Political Economy of Public Development Activities

PhD Dissertation

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2008. March

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Introduction

This dissertation analyzes public development activities from political economy point of view. The nature of individual demand for policy and the mechanism that aggregates individual political claims into policy decisions will be investigated. I will study how economic actors change their policy when exogenous effects modify the asset and cost structure of the economy. I will study how public development activities are shaped through the actors' proposals to modify policy. Monopolistic competition-based approach is used to analyze how the market share modifying effect of public interventions shapes individual demand for policy and the Nash Bargaining Concept is used to study the aggregation of these individual demands.

There are two core novelties of this approach. First, the conflict of actors does not stem from exogenous differences in preferences or from redistributive claims; rather, it is the consequence of their different position regarding the division of labor. Second, the introduced bargaining approach offers a more parsimonious and general way to conceptualize interest aggregation than other, frequently used frameworks.
The results suggest that public development activities usually contribute to the divergence of the productivity of economic sectors because both consensual development policy formation and political bargaining process strengthen bias toward policies that are promoted by the stakeholders of more developed economic sectors.

The motivation of this inquiry is to contribute to the development of policy analysis tools that decrease the transaction cost of policy making. It requires an analytical framework that describes the background of conflicts concerning policy and the costs assigned to their resolution in a comprehensive political economy framework. When can we expect the emergence of consensus in a policy process? When can we assume that individual interests will diverge; thus, policy decisions will need more time and more resources? What are the key characteristics of the process that transforms the change of economic circumstances into the modification of policies? The thesis develops a conceptual framework that offers a way to answer these questions.

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I will analyze these questions focusing on public development activities that use public resources to improve the production opportunities of economic actors. In this way I exclude public interventions that are intended to modify the allocation of disposable incomes and I also disregard political issues that are motivated by factors that are outside the economic realm. In this way public development activities are public actions that directly or indirectly influence investment, innovation or accumulation in the economy.

I look at policy as an equilibrium outcome determined by the rational strategies of economic actors. Stakeholders have rational expectations; thus, the present political equilibrium reflects both the present features of resources and technologies as well as their expected future characteristics. Exogenous shocks can modify the path of this equilibrium; therefore, these shocks induce the modification of public development activities.

Based on the above-mentioned, the core question of the research is the following: How does economic and political position (including assets and technology) shape the aggregated demand for public activities that directly or indirectly contribute either to (1) the accumulation of productive resources or to (2) the improvement of productive technologies?

The inquiry is split into two phases. First, I will study the effect of economic changes on individual policy demand, then I will focus on political demand aggregation. The first part reveals when actors agree or disagree concerning the details of policy rearrangement. The second part offers a description of how differences in political interests and political resources shape the process and outcome of policy debates.

In the first part I will use small general equilibrium settings to study the policy interest of economic actors. Conflict emerges in the models based on the assumption that different industries supply the same market with goods that are not perfect substitutes of each other. In the first two models I distinguish the basic (labor-oriented) sector, where the price of assets is fixed, from the capital sector, where factor prices are shaped by market forces. Economic actors' demand for policy increases when the labor endowment of economy rises, while this demand is reduced with technological sophistication. Moreover, we can see that the increasing intensity of competition between the sectors raises the frequency of cases when actors modify their policy expectations in different directions responding to an exogenous change. In the first setting the two sectors use sector-specific assets and they function on two

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perfectly competitive markets and the goods offered in the two markets are not perfect substitutes of each other. In the second setting I assume that the two sectors compete on one monopolistically competitive market using sector-specific assets and technologies. The second two models study the policies in an economy where sectors have the same qualitative status of economy; thus, the basic sector-sophisticated sector distinction is excluded. First, I assume that not only do sectors share the product market, but they also purchase some of their inputs from a united market and labor is the numeraire goods of the economy. In the second model I use an exogenous technical numeraire to analyze the political demand of sectors with independent inputs and unified product market. The main result of these settings is that economic actors become more supportive toward public development activities if their market share increases. On the whole, these modeling drills show that the difference of sectors' status in division of labor and their development level can result in conflicts concerning the content of policies even in cases when redistributive issues are disregarded. The introduction of monopolistic competition helps to analyze in which cases actors agree or disagree concerning the policy response to the change of economic conditions.

Part II. conceptualizes interest aggregation in a bargaining framework. I argue that the results of many political economy concepts are reproducible through a simple analysis based on the Nash Bargaining Concept (hereinafter referred to as NBC). I also review some of the main concepts of the Political Economy literature concerning policy bargaining. I define bargaining broadly, assuming that bargaining situations emerge when actors have an opportunity to create gains through cooperation and they have to agree how to share the costs and benefits of this joint enterprise. The opportunity for bargaining becomes realized if there are actors with the option and motivation to cooperate and there is a process that facilitates them to reach an agreement.

After reviewing some political economy theories and the concept of the NBC, I present a model of the Nash Bargaining with two or three participants with policy stakes, which reinforces the theory that interest, threats, influence and alliances determine participants' success to influence policy bargaining. Then I will introduce political investment in the NBC framework. First, I will study how a rational actor optimizes political investments, then I will assume that actors formulate their political investments as a best response to each other's strategy. This simple analysis provides a consistent view on the political activity of bargaining participants, which is also compatible with the arguments of the political economic literature. The analysis enforces the assumption used in Part I. that policy outcome reflects changes in

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the demand for policy. In addition, the results reveal that (1) the development and increasing return of power boost investment into politics, (2) the expansion of political investments frequently leads to the decline of welfare, (3) the differences in political influence are persistent and (4) the political inequality motivates the exit of less influential actors.

While only too restrictive assumptions could make it possible to unify the analysis of individual political demands (Part I.) and the interest aggregation process (Part II.) into one modeling framework, the assumptions used in the market structure based demand analysis and in the bargaining approach are mostly consistent with each other. Furthermore, the results of the two exercises present a consistent view on public development activities. This picture can be summarized in the following points:

- **Advantage at the advantaged** –Those policies will get more support from the economic actors that improve the situation of the more sophisticated or more developed sector. It suggests that usually the more developed industries will be favored by public programs.

- **Duality Curse** – It is hard for the actors to reach a consensus concerning public development activities in the economies with great difference in the development of economic sectors. Consequently, the ability of policies to reflect economic changes is small, and the status quo is persistent.

- **Efficient market – responsive policy trade-off** – Consensus on policies is more probable if policies cannot drastically modify the market share of economic sectors. It happens if competition – which enlarges the differences in the effect of public development activities on different asset owners - is limited. Consequently, we can assume that public policies are less responsive to economic interests when the market is more efficient.

- **Political inequality is a stable equilibrium** – Actors' rational political actions usually will not result in a convergence in political representation. Consequently, it is not simply the formation of individual policy demands that leads to sectoral bias in the public development activities, but also the process of their aggregation.

- **It can be socially harmful if public development activities become more efficient** – Higher expected payoffs of policies increase the potential return of political

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investments, which can result in a socially harmful overshooting of efforts to influence public development activities.

- **Exit is a more probable source of political collapse than the increase of resistance** – There is an increasing return to scale in political investments; consequently, groups with less influence on policies may respond to the increase of disadvantage in representation by withdrawing their contribution to the policy regime.

These results are partly based on strong assumptions concerning the structure of market interactions and the technology of political investments that warns to be cautious with their interpretation. On the other hand, the results correspond with the findings of other development economics and political economy theories as I will point out in Chapter II.1. I also argue there that the reasoning behind my results is frequently based on more general or more parsimonious assumptions than in other concepts with similar results, which also support the applicability of the offered approach.

In the following chapters I will discuss the motivation for the project and the logic behind the definition of public development activities. Then, in Part I. I will present and analyze the models that conceptualize demand for public development activities. Part II. will introduce and discuss the bargaining framework of political interest aggregation. This part also provides an extensive literature review of other political economy approaches. Finally, I conclude with presenting the key results and some potential issues for further research.

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Motivation

My main goal is to contribute to the development of a better toolkit for the analysis of public activities. I have worked for several years in the Hungarian public administration with the task of supporting analysis and methodology background for the design of policies utilizing the funds of the European Cohesion Policy. I have found that the approach used is not adequate to preparing policies successfully. The language of administration is based on the perception that the main task of government institutions and public funds is to respond to challenges and utilize strength of the country in order to promote national development. The analytical methods proposed and applied (Cost-Benefit analysis, SWOT analysis, impact assessment, ex-ante evaluation, macroeconomic modeling etc.[1]) follow this logic and also support the maximization of Social Welfare Function. At the same time, the process of policy design is purely a political, bureaucratic bargaining from the project level to the high level Commission-Government negotiations.

It would have been far more useful to apply tools that support the bargaining of stakeholders than to produce the frequently neglected analyses focusing on the right goals and proper measures. In general, I am convinced that it would be better if the analytical support of public administration accepted that public decisions are rather the equilibrium outcomes of conflicting political forces than the manifestation of social good in acts. Policy advisors and analysts should support the work of politicians and senior administrators with applicable knowledge instead of trying to continuously suggest to them what their priorities should be and how they should decide. Infrastructure should be built that enables decision makers to reach better agreements. Tools should be applied that support the bargaining of stakeholders. Procedures should be designed that offer them techniques to make deals more credible. Analyses should be done that assess the possible effect of potential measures on stakeholders as well as their probable reactions.

Economics and political economy offers good concepts to make policy support activities far more applicable. My general motivation is to work in the field of adopting the results of these disciplines into the practice of policy design. Thus, my thesis discusses political economy of public development activities from this point of view.

[1] See Tavistock Institute (2003)

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Policy-making is a bargaining process. The intention of parties involved is to reach as good terms of the contract for themselves as possible. They consider any proposals or amendments if these contribute to a state of world that makes them better off or makes the world more similar to their ideals. The general criteria to evaluate a policy and the bargaining behind it should be based on issues that are acceptable by all potential stakeholders; thus, these should be some forms of the Pareto criteria in the strong sense.[2] The value content of this approach is in its participatory approach: people who are citizens of a state must have the opportunity to represent themselves in the bargaining. Consequently, the bargain has a normative approach through the definition of participants and their rights. In this way, I propose to accept the starting point of normative public choice[3] and Gauthier's bargaining-based moral philosophy[4]. If the outcome of the bargaining could have been better from the point of view of some actors without making others worse off,[5] then the bargaining could have been better. This view is rarely applicable to compare different outcomes of bargaining because usually there are differences in outcomes: someone is better off in one case, others in the other one. However, in most of the cases parties involved probably agree on two points:

- Avoid catastrophe – If a public action (as opposed to trivial alternatives including doing nothing) straightforwardly results in a situation that is worse for all of the parties involved, we can say that this policy was bad. The main reason of this kind of disaster is that the basic condition to implement the policy has not been met. It is like setting off for a consensual destination with a leaked ship. This leak can be either physical or political. If a public program is launched without technological or material grounds, it can collapse having a harmful effect on potential beneficiaries. For instance, if transfers for some dependent groups are increased without well-grounded finance, the induced deficit will be more harmful for the beneficiary group than the off-policy scenario. If policy is launched without the support of any group with sabotage potential, the implementation will be blocked, and its realm will become a political battlefield.
- Make agreement easier – Actors involved are interested to decrease the cost of bargaining concerning public policies similarly to private contracts. Costs of discussion, codification, verification and enforcement can be extremely high in public

[2] That is, not with the possibility of potential compensation as it was frequently suggested. Potential compensation is not real compensation. See Grand (1990)
[3] For a good survey, see Mueller (1997)
[4] Gauthier (1986)
[5] Being better or worse off must also be interpreted in broad terms. If someone is envious, he would be worse off if others become richer.

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fields, it can be several times more than the value of its implication for the parties concerned. Transaction costs also include the credibility of the implementing public agency: if the commitments of public agents are risky ones, the stakeholders ask more and faster or they give less or less credibly into the bargain.

Catastrophes have beneficiaries both economically and politically. Public investments with weak benefits but extremely huge costs can maintain politically useful transfer mechanisms.[6] Collapse of certain policies or public functions opens the market for alternative suppliers and decreases competitive pressures from the benefactor of public dysfunction.[7] If the transaction costs in policy making are high, it protects the beneficiaries of the status quo, as modification in public fields becomes extremely expensive. If transaction costs are high because of lack of transparency or problems of enforceability through the law system, entry fee into the policy bargains is high; thus, only those actors seek involvement whose stakes are high. Those who are inside the closed policy clubs can benefit from this situation because their loss due to high transaction costs is smaller than the fall of benefit would be if the transaction cost mitigation opened the gates of political participation. However, the approach I propose to policy making does not seek the Pareto optimum with the actual participatory circles, but that for the bargaining with the (frequently hypothetical) normatively justified access to participation. In other words, it takes the Constitution (the subject of public actors' oath) seriously.[8] I think this normative basis fits better with the nature of democratic public administrations than a welfare maximizing background, as it fits better with the shared political interests of parties with different values; consequently, it promises the opportunity of more applicable tools for policy making.

If we accept that a successful policy process needs a good bargain and a credible implementation, the analytical support of policy design should focus on three main issues:

- *Who are the key stakeholders in an issue, what are their interests and what is their position?* The social welfare maximization works with one representative citizen.

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[6] Rent seeking theory or recent works like Robinson, Torvik (2005) and (2006) give good examples.
[7] Shelling (1971) or Dixit (2004) offers insights to show how monopolized crime can replace state in regions or sectors where state is weak, De Soto (2000) discusses how informality of property can protect actors of formal markets because economic competitiveness of informal actors is constrained (limited access to business and financial services and to transparent protection and to options to buy and sell capital goods).
[8] Of course, sometimes the goal of policy making is not to make policies but to change the structure of power in a certain field, and it sometimes happens on morally justifiable grounds. Politicians make certain public spheres battlefields and others will function as transfer channels toward the political allies. The toolkit I propose is not applicable in these situations, for these cases use the Revolutionary Politics Package TM instead.

Instead, different relevant actors are to be found, their demands for public activities are to be analyzed.

- *How does the process of decision making and implementation form different expectations into one policy package?* The institutional setting is to be analyzed in two ways: what strategies the self-oriented actors will pursue in a given situation, and - in virtue of it – what kind of rules could help them to create and keep agreements with a better payoff (mostly through decreasing the transaction costs)?
- *What are the risks of implementing an agreement, how these risks should be managed?* All policies have conditions of feasibility, such as physical conditions (like weather or geography), or money, or credible implementing agencies, or a guarantee that its losers will not block the process. The management of these risks needs assessment as well as a design of a mechanism that is able to minimize them and to indicate their presence truthfully.

I wish to contribute to this broad program with my dissertation. My thesis offers contribution to the first two of these exercises analyzing change of political interests and their effects on public decisions in the field of public development activities.

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Working Definition for Public Development Activities

Analysis of Change as a Framework to Study Development Policy

A normative concept is necessary to define what development or improvement of situation is for a community. It can give a measurement tool to assess if a change in the situation of a given community is progress or deterioration. This measure can be the sum of individual utilities[9]; the improvement for the worst-off group in the access of basic goods[10]or in having got some capabilities[11]; the rise in institutions' achievement to increase the expected utility of representative citizen[12]; the description about the processes of the society that shows if these are more just and/or more comprehensively compensate the victims of unjustifiable transactions [13]etc.

Economists frequently use Pareto improvement (nobody's utility decreased but someone's increased) or they apply the utilitarian concept symbolized with measurement tools like deadweight loss or GDP/capita growth. There are also competing concepts (e.g. Human Development Index[14]) that are based on more complex social welfare aggregation. Sometimes special measures are used to proxy level of development that focus on some core normative features (poverty rate, health adjusted life expectancy) or processes (dependency ratio, literacy, investment rate, share pf private ownership, public debt etc.) thought to be crucial for economic and social prosperity.

The Pareto concept is inconclusive in most of the cases: there are always losers and winners and the Pareto principle cannot tell anything in this case. Utilitarianism based welfare economics with or without special attention to some distributive issues (worst-off ones, basic capabilities, equality etc.) needs some strong assumptions to make benefits of winners and losses of losers comparable. For example a regime that gives more motivation for effort and innovation increases choice options of the future for some but it may decrease leisure or consumption opportunities of others for today – how to define the circumstances when effort and innovation is not too much or too little?

[9] Harsanyi (1977)
[10] see Rawls (1971)
[11] see Sen (1987)
[12] see Hare (1976)
[13] see Nozick (1974) Ch 7.
[14] See UNDP (2006) Chapter 'Human Development Indicators'

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Concept of development can be based on the declaration concerning the legitimate source to define how to measure development. Communities and societies have their concept of development: it is there in their culture, institutions (including the state). In this case we have to assume that culture or institutions truly reveal people's view on how it is better or worse for them. There are some new problems arising: why do we think that these processes are right, what to do if the resulting concept on development is not consistent. We have to judge in both cases. It is a judgment also if we think that these processes are always right and consistency is not expected from social decisions.

We can study development activities without a normative concept finding a descriptive framework that is applicable for normatively defined questions but does not use its value statements. The concept of change prevents from this normative choice but does not exclude the possibility of judgments based on values.

This approach focuses on how and why pattern and allocation of endowment and information and nature of institutions become modified.[15] In this case the analysis focuses on why and how actors induce change and how it influences the other actors. The idea of development refers to general effect: usually development is referred to actions that improve the situation for the whole community. Change must be approached from a similar perspective: We should investigate what kind of actions induces significant changes in a community and what inspires them.

I opt for this second approach because it avoids the problem but does not exclude the possibility of normative judgment.

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The Main Question: How Exogenous Shocks Modify Future Oriented Activities?

Rational actors always choose their strategy to improve their situation given their perceived options, their assumed consequences and the characteristics of their decision-making method. Consequently the study of change equals the study of strategy choice, or better to say, strategy modification[16]. Strategies change if players, their options, the rules of the game, the payoffs or the belief systems change. My dissertation will mainly focus on the effect of change in

[15] This approach is based on North (1990)

[16] it is in the definition of strategy that players have hypothetical scenarios for unfaced situations

available options and payoffs. The choice set and the payoff function of actors is shaped by endowments, by technologies, by constraints or frictions of actions, namely costs of transactions. Change of actors will be disregarded. Change in rules of the game and belief systems will be included into the analysis through the assumptions that most of the economic characteristics will be represented with their net present value, that reflects expectations concerning future amount of endowments and future costs of productions and transactions.

I narrow the focus to analyze how a community reflects to changes in external conditions in activities that modify the external conditions of the future because development – based on any concept – is always future oriented. The future characteristics of options and payoffs can be modified through modification of productive or transaction technologies and accumulation or deterioration of endowments. Innovation, investment and accumulation activities are pursued to modify the future settings. Thus, I study features of innovation, investment and accumulation activities induced by changes in technologies, endowments and transaction costs.

Change of technology refers to modification of product and cost structures. Investment and accumulation refers to increase of capital and human capital that contributes to higher production or bargaining power. Transaction costs refer to cost of institutions that facilitate interactions or to the efforts needed to move something in space or in time.

Policy and Change

Public activity can influence development in two ways: through facilitation of private actors' interaction toward change or through altering public activities that have direct effect on economic characteristics of the future.

Private actors induce deep changes when they modify their activities, agreements or partners. Companies can install new technologies, introduce new products, or revise their supply and demand structure. Individuals may change their habits concerning work, consumption, saving, investment and socializing. Civil, spiritual, political actors can modify their methods to pursue their goals, their organization and their co-operations. Public actors are involved into these amendment oriented private actions when their services facilitate or restrict these activities, and when they modify their own activities.

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- Facilitation of or restriction on private activities and interactions involves protection of civil and property rights, enforcement of contracts, regulating markets, operating of redistributive regimes and management of other public goods. The nature of these public services influences the intention and orientation of private actors for changes. If rules weaken the costs and benefits connected to changes in a certain field, private actor will be less responsive and initiative there, consequently expected magnitude of changes originating from this field will be small. On the other side if public institutions transmit or even amplify the effect of private actors' modified actions in a sphere, the status quo will be more fragile. If positive shocks are transmitted but harmful ones are weakened somewhere through public facilitation, probably there will be expansion. Similarly weaker effect of stimulating shocks and sharper consequence of potential risks will result retrenchment.
- When public actors changes the incentive schemes and expectations concerning activities of affected actor, the status quo breaks up and a new social equilibrium will take form through waves of effects and counter-effects. When public actors modify regulation, revise structure of implicit or explicit taxes and subsidies, interested parties react in two ways: they accommodate to the new incentives and they modify their expectations and pressures concerning public policies. This reaction may induce further public initiatives till the point when new equilibrium emerges: the costs and the benefits of policy change stemming from incentives defined by stakeholders and from circumstances defined by nature equalize each other.

Public development activities are pursued by public actors in order to modify the external condition in the future through policies concerning accumulation (saving and human resource development), investment and innovation. They may have indirect or direct form. In indirect case, public policies effect private actors' incentives to innovate, to invest or to accumulate (call them IIA activities). In direct case public actors pursue IIA activities themselves.

Public actors have an extensive toolkit for indirect policies: they can use enforcement to prohibit or prescribe, they can take away and give using direct and indirect taxes and transfers, they appear on markets as buyer or seller, they can organize public services, or they can communicate.

- Enforcement may increase or decrease actors' risk and profit for IIA activities e.g. through patent and copyright laws, regulation of finance sector, regulation on externalities of investments.

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- Direct and indirect redistribution motivates or discourage through co-finance and support or tax of certain sectors or types of actions.
- Demand and supply of publicly owned companies or public organization are dominant in some sectors, thus their behaviour strongly directs private partners and their IIA activity. State is the dominant buyer of defence industry, transport construction, the most influential in labour and health-care market. Public companies or organizations are frequently the biggest suppliers in some markets, for example in higher education, in health care or in infrastructure services like post or railway. Public procurements have key importance in most of the other sectors also.
- There are some public services that have high influence on IIA activities, for example public education, services for public data access, standardization, support in foreign trade negotiations etc.
- Communication of state is influential concerning expectations that govern future oriented IIA activities. If communication of public actors is credible it may shape private actions in itself. Threats on certain behaviour may dry it up, declaration of priorities can become self-fulfilling also. Public actors have influence on their credibility through keeping or not keeping commitments that determinates private actors' expectations concerning stability and reliability of any public actions including those ones concerning public development activities.

Direct public IIA activities are also influential. Negative saving is normal business for governments. Public actors' investments are tremendous in general and dominant in some sectors like roads, general education, security (both national and international). Public actors are also active in innovation activities as main organizer and financer of science.

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Analyzing Momentum of Change

Policies are outcomes of a bargain of involved stakeholders. These parties continuously represent their interests concerning public development activities; consequently this bargain is a permanent activity. It is always there although its intensity, internal structure and organization changes as the varying intentions shape it. Without exogenous shocks other then consequences of IIA, there would be a path for the equilibrium level of public development activities that is directed by the effect of past public development activities on present ones

through modification of external characteristics. It induces an equilibrium course of change. There are five main uncertainties that can break this equilibrium path:

- The conditions called external are really so. Accident shocks modify them frequently and dramatically.
- The effect of past development activities on present external conditions is not deterministic. Innovation and investment is always risky, their aggregated effect has a variation also.
- Even if change in external conditions fits to the expectation, it is not straightforward that its social and economic effect always follows the same mechanism, so consequences of their change have an uncertain element. The effects of an event depend on the circumstances. For example improvement in terms of trade can be harmful causing 'Dutch disease' or it can induce economic growth depending on the institutions and supply elasticity of nontradeable goods.[17]
- Exogenous shocks have an impact on the knowledge and belief of actors. Some event may change the evaluation of potential future losses due to pollution. This new expectation may imply actions to decrease future pollution that raises present demand for energy saving or emission reduction.
- Structure and outcome of social activities may change without exogenous shocks because of some endogenous process can reshape the game concerning structure of public development activities. For example decrease of transportation costs between two regions improve the advantage of agglomeration below a threshold level – when the autonomous decrease of costs reaches it, strong disagglomeration forces may emerge.[18] Consequently the development path is there but it always changes. In order to understand how this chain of changes shapes, we have to study how loops of it looks like: How do intentions of public and private actors following an exogenous shock reshapes public development activities.

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[17] See Sachs (1995) or Robinson at al. (2006)
[18] See Krugman (1991) or Fujita at al. (1999)

Summary

Public development activities are actions of public actors to invest, innovate and accumulate and to facilitate investment, innovation and accumulation activities of private actors. These programs respond to the changes in external conditions (endowments, technologies and transaction costs) directly and indirectly through the revised claims of private actors due to the changes. This dissertation will study public development activities asking the following question: How do the changes in endowments, technologies and transaction costs influence the volume and structure of elements in public development activities?

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Part I. - Agreement and Disagreement about Public Development Activities

Introduction

The goal of Part I. is to study how economic forces shape economic actors' interests concerning public development activities. I assume that public development activities are equilibrium outcomes of bargaining among stakeholders. This Part details how individual and economic characteristics form actors' demand for these activities and how exogenous shocks modify positions in the bargaining over policy. Issues of bargaining will be discussed Part II.

I will use models based on monopolistic competition to conceptualize demand for public development activities. Actors are identified as the owners of endowment. They are assumed to have identical utility functions. Endowment is a labor-, capital- and sector-specific capital. Profit maximizing companies are characterized by their production function; profits are zero due to the competition. There are not any strategic interactions in the economy that would distort the prices from competitive equilibrium level.

Public development activities use tax incomes to decrease production costs or to increase the amount of productive factor endowment. Public expenditure is financed by income taxes that do not raise redistributive questions: financial contribution of different economic groups is fixed, taxes are proportional to income inside these economic groups. Public policies utilize these funds to decrease production costs or to increase the size of productive factor endowments. The effectiveness of public development activities is assumed (1) to decrease with the size of intervention and (2) to be independent of the initial condition of the modified specificity – the same policy has the same effect in different settings. Actors' optimal development program is defined by the size of public spending on public development activities. Comparative statics reveal how exogenous changes of economic characteristics modify the optimal size of policies. If actors' proposals diverge concerning the direction of modification in a policy issue, we can predict that the policy will not respond to the change in economic conditions.

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In my approach exogenous shocks are evaluated identically by everyone as a consumer; however effects diverge for different groups of economic actors with stakes in different spheres of the economy.

There are two main forces that drive toward an agreement on development programs:

a. Economic forces shape actors' utility similarly as market interactions transmit the effects of exogenous changes to everyone throughout the economy. Lack or weakness of market power in the economy prevents to disclose others from beneficial changes in economic conditions and disables exclusion from the effects of harmful shocks.
b. Actors' utility functions are identical; thus, the change of prices influences their consumption possibilities in the same way. Consequently, they have identical view about the preferred change in terms of its effect on prices.

Divergence of interests emerges either because of redistributive issues or due to differences in the magnitude of policy impacts on different economic actors. I will focus on the second mechanism. Actors' income frequently depends on the market position of their sector or location. Development activities influence the market position of different firm groups differently, which leads to disagreements on development policies.

The conflicts concerning the level of individual contribution to public policies (taxes) and the exclusive support to certain economic groups (transfers) are disregarded in my study. I do not focus on the issues of direct redistribution, but rather, on the asymmetric consequences of generally beneficial policies on actors from different sectors.

The first chapter of Part I. discusses the approach I will use for analysis. I will argue that the introduction of finite but sufficiently high elasticity of substitution among goods enables us to study the politically intriguing issue of change in the demand for policies. The second and the third chapters will present the analysis of demand for public development activities. First, I will present and discuss models where the qualitative status of actors is different because some asset prices are assumed to be fix in one of the sectors, meanwhile the price of other assets is determined through market processes. Then, I introduce settings where these qualitative differences are disclosed. Sector bias in the models (Chapter I.2.) is based on the assumption that either the prices of policies move tightly together with some productive factors or that elastic supply makes prices fixed in a sector. Sector neutral approach (Chapter I.3.) assumes that factor supply is inelastic and the cost of public activities is independent of the prices of productive factors.

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Chapter I.1. Conceptualizing Analysis of Public Development Activities

This part of the dissertation studies how actors with different position in the process of economic production evaluate publicly managed economic changes, which are policies. When the owners of different factors agree on the optimal policy responses in a given situation, we may assume that there will be no serious conflicts and the society of economic actors can successfully manage the accommodation to the new situation. When they disagree on the necessary public measures as these effect their welfare differently, it becomes harder to suit policies to the changing environment. I will use small general equilibrium models and comparative statics to study how these consensuses or conflicts emerge concerning public development activities. I will show how different assumptions on the consumption behavior of actors and on the structure of economy shape the pattern of economic actors' political demand.

The Approach

I will investigate how market structure shapes political interests. Economic characteristics shape both prices and incomes. Only one of these effects works in the traditional economic approaches based on perfect competition or Cobb-Douglas utility function. The application of monopolistic competition can help us to construct settings where both prices and market shares reflect to economic changes; thus, certain policies have a universal but differentiated effect on different economic groups.

My study follows the logic that Krugman (1996) proposed when introducing the New Economic Geography. He argues that market structure based explanations can give good insights in terrains where differences are usually explained by exogenous mechanisms concerning the spatial organization of the economy. He shows how the application of this concept can explain the emergence of agglomerations endogenously without referring to exogenous geographic differences. Where pecuniary externalities are present but competition discloses profit and strategic interactions, stabile patterns of inequalities can emerge. This is due to the fact that economic processes modify the market share of economic actors, which is beneficial for some of them and harmful for others.

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Slightly modified (simpler) versions of the models applied in New Economic Geography[19] can help to study how economic interests converge or diverge endogenously in cases when people have the same utility functions and there is finite elasticity of substitution between products.

If there is a perfect competition among the sectors, they agree to disagree. If elasticity of substitution is unitary (as in case of applying Cobb-Douglas utility function), there is no rivalry, there is no conflict among the actors assuming that they can agree how to share the costs of mutually beneficial policies. If economic actors fight against each other for market share on the one hand, but they enjoy the efforts of their rivals in consumption on the other, the final outcome concerning policies is not trivial. They always agree on policies as consumers; however, they disagree as producers when public development activities influence their market prospects differently. The final outcome depends on which of these forces is more powerful. The following chapters present models to analyze these net policy effects.

My study of interests concerning public development activities focuses on the effect of market structure. I think that this approach can complement the findings of attitude- or technology-based explanations and political economy concepts of redistributive conflicts. Consequently, I will not discuss the three trivial candidates to explain differences in demand for public development activities; namely, differences in utility functions, differences in the position inside industrial networks and differences of policy efficiency in different fields. These factors have straightforward effect on policy bargaining and they are analyzed extensively in social sciences. One of the main questions in political science (including its affiliate in economics: Public Choice) is how differences in attitudes shape political preferences in different issues and in political choices. Development Economics offers an extensive armory to analyze the impact of sectors' position in the network of economic position. It is enough to mention the two best-known and honored flagships: the input-output matrix from Leontieff[20] and Hirschman's backward-forward linkage approach.[21] Rational policy choices are based on the equalization of marginal return between different policies in any public policy approach.[22]

I also disregard redistributive conflicts. It is a basic approach of political economy that actors use their political influence to pursue policies that channel the incomes of others toward

[19] New Economy Geography is a research field that analyzes spatial organization of space assuming monopolistic competition. Krugman (1991) wrote the pathbreaking paper about this approach. Fujita, Krugman, Venables (1999) and Baldwin et al. (2003) give broad overview. The models I apply are simplified versions of Martin, Roger (1994).

[20] Isard at al. (1998) gives an overview of its application in policy fields.

[21] Hirschman (1958)

[22] see Cullis (1992)

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them.[23] Interest group theories like Peltzman (1976) or Becker (1983) suggest that policies have net beneficiaries and net financers. The more influence a group has on public decisions, the bigger the expected gain or the smaller the expected loss will be from redistribution. Meltzer and Richard (1981) use a median voter-based approach to show how the extension of franchise right leads to the expansion of public activities. McGuire and Olson (1996) developed a model to argue that the rise in the relative size of the decisive group in a society decreases the volume of redistribution and increases the level of spending on public goods.

Redistribution-oriented approaches assume that the policy preferences of actors are exogenously given: they want to contribute less to public activities and strive to get more gain from them. My research focuses on a complementary aspect of policy accepting this point and the consequent results of political economy. The benefit of an economic actor from a given policy is not constant; rather, it depends on the economic conditions. The same policy to broaden the income base induces higher gains if consumption prices are lower. The same intervention to cut production costs increases sales of the beneficiary companies more if this policy leads to a more intensive improvement of the market position. I aim to study how economic characteristics influence the potential gain from policies, and thus the optimal size of policy for economic owners. Consequently, I disregard issues of redistribution assuming that its patterns are exogenously given.

Perfect Competition Assumes that All Policies are Redistributory

Actors have different position in the economy, they have earnings from assets that have different role in the production process. If the economy was fully competitive, the returns of different types of endowments would equalize: in this case the quality of economic assets could not influence the earning potential.

Let us imagine that there is a closed economy with one type of good, let it be food, and the amount of consumed food represents utility for the actors of the economy. The only factor of production is land. There are fertile lands (their amount is F) with a high level of yield (h per hectare) and there are inferior lands (in amount W) with a low level of crops (l per hectare). The products of different soils are perfect substitutes of each other. The price of food is p;

[23] For a survey, see Borck (2007)

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consequently, the income of a representative fertile land owner will be $\frac{F\ h\ p}{n_{fertile\ owners}}$, the income of an inferior land orders will be $\frac{\mathrm{W}\ l\ p}{n_{infertile\ owners}}$. The amount of food they can buy for it will be $\frac{F\ h}{n_{fertile\ owners}}$ and $\frac{\mathrm{W}\ l}{n_{infertile\ owners}}$. As one can see, the amount of food they can produce, and consequently the level of their utility, is independent both of the price level and of each other's production possibilities.

If public intervention could modify either h or l, the two groups of asset owners would disagree about the optimal level of policy. Someone will support an efficiency-enhancing policy to the level where marginal cost tax spending equals the marginal benefit of expansion of public intervention. In this case the owners of fertile lands benefit only from the improvement of h, the owners of inferior fields realize higher utility only if l becomes higher. It induces a conflict among them concerning public development activities: everyone opts for some public intervention in their land and proposes zero on the other. Because of perfect substitution and perfect competition, actors' utility is independent of each others' prospects. No one is better off if the situation of others improve.

Box 1. Defining the optimal policy level of land owners

Utility functions

$$u_h = \frac{F\ \mathrm{h}(h0,\ t_h)\ p}{n_{fertile_owners}} - t_h \qquad u_l = \frac{\mathrm{W}\ \mathrm{l}(l0,\ t_l)\ p}{n_{infertile_owners}} - t_l$$

Maximization criteria

$$\frac{\partial}{\partial t_h} u = \frac{F\left(\frac{\partial}{\partial t_h}\mathrm{h}(h0,\ t_h)\right)p}{n_{fertile_owners}} - 1 \qquad \frac{\partial}{\partial t_l} u = \frac{\mathrm{W}\left(\frac{\partial}{\partial t_l}\mathrm{h}(l0,\ t_l)\right)p}{n_{infertile_owners}} - 1$$

Implicit definition of optimal policy level

$$\frac{\partial}{\partial t_h}\mathrm{h}(h0,\ t_h) = \frac{n_{fertile_owners}}{F\ p} \qquad \frac{\partial}{\partial t_l}\mathrm{l}(l0,\ t_l) = \frac{n_{infertile_owners}}{\mathrm{W}\ p}$$

As we can see, both types of actors define their optimal level of policy independently of the other actors. In this way, the productivity increasing intervention is not a public good, but a

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publicly financed private good, and tax-based finance of fertility enhancement is a simple benefit-in-kind.

This result is generally valid. We can increase the number of asset owner groups; however, the result will not change: policy effects directly only actors who will enjoy the higher income either due to the rise in their endowments or due to the higher return of their assets. Competition will determine the income-generating effect (as well as the value) of different types of assets. The productive factors that yield the higher per unit output will be the most valuable ones, while the return on least efficient ones will be the lowest – exactly in the way Ricardo presented it in his theory about rent and value of lands. Consequently, any intervention into a perfectly competitive economy generates disagreement among net beneficiaries and net financers. In the world of perfect competition all conflicts are purely redistributive, all policies are simple transfer schemes. If a public intervention generates a higher rise of income, it will be more promoted by beneficiaries, while if it needs higher contribution to public expenses from the tax payers, it will be more opposed.

As a result, the analysis of change in demand for public development activities is neither demanding, nor promising in case of perfectly competitive markets. The rise of tax is bad, the rise of transfer is good for anyone. Production functions clearly define the role of inputs and the effect of technology coefficients; therefore, the effect of interventions to improve productive capacities is straightforward. In this setting one becomes richer if he can get more productive assets and one slips into poorness if he loses his productive capacities. This is the world to have and to have not. All conflicts focus on the allocation of income-generating capacities, thus on redistribution.

No Conflict concerning the Content of Policy if there is No Rivalry on the Markets

Conflicts concerning public development activities do not emerge if the utility effect of policy is identical for economic actors. It happens in the case of public goods. Everyone supports the public development activities if they are not excluded from the utility-enhancing effect of the policy. The only problem to be solved is to agree on contribution and to ensure enforcement, which are out of the focus of this study. Policies also have these public good features if markets transmit their positive effects throughout the economy, and the changing terms of production do not influence the market position of producers.

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These positive effects are only transmitted by market mechanisms if the cross-demand elasticity of goods is unitary. Price change in any sectors will have no effect on the nominal value of income because product of price and the sales volume is fix in this case; therefore, the consumers will share their spending on two goods independently of prices. If fish is more expensive, Robinson will buy less from Friday, but the money he will give for fish will be the same. The assumption of unitary elasticity of substitution is widespread in economics, through the frequent application of the Cobb-Douglas utility function.[24] Supplement I.1.1. presents a model based on this approach. In this case the productive features of a sector are public goods and the problem of the government to design its interventions is an optimization problem with a solution that equalizes the marginal impact of policies in different fields. In this type of economy, the only realm of conflict is the distribution of the costs of public activities among actors, and disagreement is based solely on redistributive issues.

Both perfect substitution and unitary elasticity of substitution result in all policy conflicts being redistributive ones: in the first case public intervention has effect on incomes but not on prices, in the second case income does not change, only the prices and the consumption basket of the representative consumer. Consequently, in the first case policy impacts are pure private goods and any public intervention takes the form of transfer. In the second case the effect of public intervention is a pure public good where implied rise of utility depends on income level, so the only question is how to share the costs of policy.

Finite Elasticity of Substitution can Induce Divergence in Demand for Policy

Consumers also buy positive amount of more expansive varieties in the case of imperfect substitutes. Consequently, higher level or more efficient production of any goods has an effect on the consumption opportunities of economic agents. In cases when elasticity of substitution is more than one and less than infinite, the progress in a sector has an effect on each economic actor. The net effect of an exogenous shock on utility is the total of two factors.

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[24] Price elasticity is 1 for Cobb-Douglas utility function: $u = x^a y^b$, $\frac{x}{y} = \frac{q\,a}{p\,(1-a)}$, $\frac{\partial}{\partial p} x = -\frac{q\,a\,y}{p^2\,(1-a)}$, $\frac{\left(\frac{\partial}{\partial p} x\right) p}{x} = -1$

- Income effect – the exogenous shock can modify the income of actors because the volume and price of sales that determine the return on assets applied for production changes.
- Structural effect – the exogenous shock can modify the variety and the price of goods consumed, so the consumption opportunities of the same income change.

When the productivity or asset endowment improves in a sector, the structural effect is positive for everyone; however, income effect is positive only for the actors in the sector, who realize the better terms of production. Structural changes make it possible to purchase more at the same level of income due to lower prices. The sector that can increase production or cut prices because of exogenous improvement realizes a higher income due to the rise in their market share. Whereas, this decline of price motivates to decrease prices or market share in sectors that are not direct beneficiaries of the improvement in terms of production. In this way exogenous shocks make it easier to protect or to expand market shares for direct beneficiaries, while it will become harder for others. Thus, the changes of economic characteristics modify the income-generating potential of assets applied in different sectors differently.
Consequently, conflicts emerge concerning the optimal level of policies that are beneficial for everyone. While people with identical utility functions agree to welcome and support situations when economic structure improves and offers cheaper goods or more variety, they have qualitatively different positions in the production process.

This interdependence has one more aspect. The economic structure will influence the difference in the optimal level of public development activities in the potential fields of intervention. If goods are cheaper they will have a higher share in the consumption structure of consumers because of positive and finite elasticity of substitution. Thus, if the condition to produce these goods changes, it will have a higher effect on the utility of all agents of the economy than the effect of an identical change concerning more expensive goods with smaller market share. Therefore, exogenous changes of economic characteristics induce different changes in the demand for different policies.

The same policy may have different effects on actors, so they prefer different sizes of it when economic structure changes. Exogenous shocks that influence economic conditions may modify economic actors' demand for certain policies. The same actors will accept higher taxes and more public support for a sector as a response to some structural changes, and they

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will decrease their optimal intervention size in the same policy field in other cases. For example, asset owners in agriculture benefit from the fall of industrial prices, although not as much as the capital owners of an industrial company. Consequently, they opt for a positive amount of policy to support industrial development. Of course, their proposal will opt for a smaller public program than that of someone from the industry. If some external effects expand the productive base of agriculture (for example, if farmers increase the cultivated areas), their income rises. It increases the consumption of industrial goods, which enlarges the positive effect of industrial policy for them, so they are willing to accept higher taxes for this public activity. If the costs of production and prices fall in the industry, farmers buy more for the same income, which increases alternative cost of tax, which motivates them to propose contraction of public development activities.

To model these effects I will use the framework developed by Dixit and Stiglitz (1977). This approach assumes finite elasticity of substitution and monopolistic competition to conceptualize pecuniary externalities. There are several producers or sellers of a product, but their products are a little different. There are different brands, there are different services, there is a long term cooperation in which the contracted partners' position is not the same as that of their competitors. Because of these differences, the demand curves for products of a sector are downward-sloping. When a representative firm decreases its price, it can increase its revenue acquiring a part of the buyers of other firms (assuming that increased output causes smaller cost than the increase of the revenue, because of the price cut effect). But other firms react to this with price cuts, as well, and get their clients back. Because of the price-cut mechanism and free-entrance into the sector, there will be zero profit in the equilibrium. Supplement I.1.2. presents a simple version of this setting.

I will use a two-sector version of this model. In order to keep the focus on the policy consequences of the approach, I assume that sectors have similar access to the market. I also assume that technology and level of asset endowment is exogenous for economic actors. Only exogenous shocks and public development activities can modify these characteristics.

Further research could expand the inquiry into further issues like asymmetric market access, [25]flow of assets between the different parts of the economy,[26] endogenous asset accumulation

[25] New Economic Geography distinguishes regions with transaction costs to reach the consumers. The model of Martin and Roger (1994) assumes that transaction costs are present in all regions, but if location of production and consumption is not the same, transaction costs of both location must be covered.

[26] The difference in returns of factors motivates intersectoral flows. Its dynamics and consequences are discussed in Robert-Nicoud, Sbergami (2004)

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or innovation.[27] Further work is also necessary to incorporate input factors of public development activities and supply elasticity of productive factors to construct a setting that unifies the sector-bound and the sector independent conceptualization of factor prices.

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[27] See chapter discussing the application of endogenous growth models in Baldwin (2004)

Supplement I.1.1 Cobb-Douglas Economy

This model assumes an economy with two productive assets - call them labor (L) and capital (K) - and with two goods (x and y) – one of them uses only capital for production, the other uses only labor. This full separation is introduced because some shared use of assets is indifferent from the point of view of the analysis. Companies and asset owners are price takers on perfect market. Price of labor is assumed to be unitary, price of capital adjusts to demand. Consumers (owners of productive assets) have Cobb-Dogulas utility function over the two goods (1), where 'a' represents the relative importance of labor based good (x) for the representative consumer.

The structure of production (3) can expressed from the utility function (1) and from prices of goods (p,q) using constrained optimization with the budget constrain of representative consumer (2).

(1) $u := x^a y^{(1-a)}$

(2) $inc = x\,p + y\,q$

(3) $\frac{x}{y} = \frac{q\,a}{p\,(1-a)}$

α labor is used to produce one unit of x, β unit of capital is used to produce y. The price of labor is assumed to be unitary, profits are zero due to perfect competition, thus price of x equals α. Structure of product supply (5) can be expressed utilizing the fact that the companies and the capital market are assumed to be price taker. The identity between structure of demand (3) and structure of supply determines price of capital (6).

(4) $x = \frac{L}{\alpha}$,

(5) $\frac{x}{y} = \frac{L\,\beta}{\alpha\,K}$

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(6) $q = \frac{L\,\beta\,(1-a)}{K\,a}$

Using budget constraint (2), demand structure (3) and price of capital (6) we can express the consumption of the two goods as share of representative consumer's income, and the utility of representative consumers (9). There are two types of actors in this model: the labor and the capital owners. Their incomes (10) can be expressed as the value of the whole amount of asset divided by the number of asset owners.

(7) $x = \frac{inc\,a}{\alpha}$

(8) $y = \frac{inc\,K\,a}{L\,\beta}$

(9) $u = \frac{inc\,a\left(\frac{K\,\alpha}{L\,\beta}\right)^{(1-a)}}{\alpha}$

(10) $inc_{worker} = \frac{L}{n_{worker}}$, $inc_{capital} = \frac{L\,(1-a)}{a\,n_{capital}}$

We can see that difference in actors' income and utility depends on two factor: the population of the two groups (n_{labor} , $n_{capital}$) of asset owners and the relative importance of two goods (expressed with 'a') in the consumption structure. These factors are independent of economic characteristics, consequently change in endowment level (K, L) or productivity (α , β) do not influence relative utilities.

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Supplement I.1.2. The Basic Model of Monopolistic Competition

Now income shares of goods in consumption depends on prices instead of exogenous (utility function) based determination. Monopolistic competition is assumed using a simplified classic Dixit-Stiglitz setting.[28] It assumes a representative producer, producing a good of the monopolistically competitive sector with constant elasticity of substitution among all the goods. This means that the differences among all goods produced in the monopolistic competitive market are equal. This is restriction (besides one another one: the exclusion of strategic interactions) but it is not more restrictive than those of the perfect market approach, which assumes individual adaptation of economic actors and equal - infinite - elasticity of product substitution.[29]

There are several firms, each produce a variety of the same product. Specialty of products motivates consumers to buy some of them even in case of higher prices with price elastic demand. Firms utilize this limited monopolistic feature of their outputs and choose an output that maximizes their profit. The companies compete with each other that pushes their profit to zero level, consequently price of varieties equals with the price of outputs the companies use for producing them.

Capital endowment and capital cost of production defines the number of varieties that is a key element of utility function. In this way economic characteristics influence utility directly: they define not only amount of consumable goods but number of varieties also.

Now labor and capital are not simply factors used in production of different goods. Fix cost of production needs capital. Labor is used to cover for variable costs. It represents a view of capital that is needed to install productive capacities regardless of the level of output. After this capital investment labor is used for production. This differentiation reflects to the traditional distinction between labor and capital. Capital represents the valuable assets created through accumulation (saving, learning) in order to open the opportunity to participate in enterprises. Labor represents the "physically" existing or purchased assets that are sources of efforts that make economic activities to go on.

[28] Dixit Stiglitz (1976)

[29] The question weather monopolistic or perfect competition is the most freqent in reality is not relevant in this case. The assumption of monopolistic competition is a tool for a consistent model that includes equilibrium and increasing scale of return at the same time. If we accept that these assumptions are necesarry in economic theory to explain the spatial aspect of economic processes, the validity of assumptions is out of question until there are alternative concepts.

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There is one differentiated good in economy x with several (n) varieties. Actors have CES utility function (1), with σ (σ >1) elasticity of substitution (2). Income is given as the sales of all varieties (3).

(1) $u = (n\, x^{\phi})^{\left(\frac{1}{\phi}\right)}$

(2) $\phi = \frac{\sigma - 1}{\sigma}$

(3) $In = n\, x\, p$

There are two inputs labor and capital. Each company produces one variety using α labour to produce x output and β capital as fix cost (4). Cost of labor is unitary, the return on capital is determined by market interaction. Companies are monopostically competitive, so they face finite price elasticity (σ) that directs their pricing. Companies choose their output to maximize their profit (5), (6), (7). The price-output connection is directed by demand elasticity of varieties (8). Substituting it back to (7) we can express equilibrium price of varieties (9) and the return on capital (10).

(4) $x = \alpha\, x + \beta$

(5) $\pi := \mathrm{p}(x)\, x - \alpha\, x\, w - \beta$

(6) $\frac{\partial}{\partial x}\pi = \left(\frac{\partial}{\partial x}\mathrm{p}(x)\right) x + \mathrm{p}(x) - \alpha$

(7) $\left(\frac{\left(\frac{\partial}{\partial x}\mathrm{p}(x)\right) x}{\mathrm{p}(x)} + 1\right)\mathrm{p}(x) = \alpha$

(8) $\frac{\left(\frac{\partial}{\partial x}\mathrm{p}(x)\right) x}{\mathrm{p}(x)} = -\frac{1}{\sigma}$

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(9) $p = \frac{\alpha\,\sigma}{\sigma - 1}$

(10) $r = \frac{x\,(p - \alpha)}{\beta}$

The amount of capital endowment and the capital need of a company determine the number of varieties (11). The equilibrium size of firms can be calculated equating the income of factor owners and the income of companies (11), (12), and it determines equilibrium return on capital (13).

(11) $n = \frac{K}{\beta}$

(10) $n\,x\,p = L + K\,r$

(12) $x = \frac{L\,\beta}{K\,\alpha}$

(13) $r = \frac{L}{K\,(\sigma - 1)}$

A representative consumer spends the same amount on each varieties (8). Utility function (9) and income of asset owners (10) can be calculated using the results above.

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(14) $u = \left(n \left(\frac{inc}{p\,n} \right)^{\phi} \right)^{\left(\frac{1}{\phi}\right)}$

(15) $u = \frac{inc\,(\sigma - 1)\,\beta \left(\frac{K}{\beta} \right)^{\left(\frac{1}{\phi}\right)}}{\alpha\,\sigma\,K}$, $u = \frac{inc\,(\sigma - 1) \left(\frac{K}{\beta} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha\,\sigma}$

(16) $inc_{worker} = \frac{L}{n_{worker}}$, $inc_{capital} = \frac{L}{(\sigma - 1)\, n_{capital}}$

We can see that difference in utility of labor and capital owners depends only on demand elasticity of varieties. If market elasticity is low ($\sigma < 2$), the aggregated income of capital owners will be higher than earnings of laborers. If market elasticity is sufficiently high ($2 < \sigma$) the labor owners will have a relatively higher income.

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Chapter I.2. Two sectors in Monopolistic Competition with Fixed Price in the Basic Sector

This chapter will present and discuss models assuming that products on the market are not perfect substitutes of each other. This approach enables us to construct settings where the shared desire for cheaper products to consume and the conflicts because of the income determining market share are present in the same time. As a consequence, policy responses of actors to exogenous changes sometimes correspond sometimes contradict each other.

In this chapter two sectors compete for the consumers in a monopolistically competitive market. The two sectors' positions are not the same in the economy: input prices are fixed in one of them; in the other one market forces determine returns on factors. This assumption is used to operationalize the distinction between a basic and a sophisticated sector. The prices in the basic sector are less sensible to economic characteristics because some exogenous force keeps them more stable. The price of productive factors in this basic sector has a high influence through the whole economy because of this stability that will result asymmetry in the policy responses of sectors. The next chapter will discuss other settings where this asymmetry is not present.

The first model will introduce an economy with two substitutable goods that are produced in perfectly competitive market. This chapter presents the logic of analysis in details that will be applied in the next models also. The second model will assume that there are two separate groups of companies competing in the same market. Productive factors are entirely sector specific in this case. Competition is monopolistic: profit maximizing companies function on a free entry market where goods are not perfect substitutes.

Supplement I.2.1. presents the approach used to define the consumption side of equilibrium, Supplement I.2.2 shows the second order condition and the technique used for comparative statics.

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I.2.1. Perfectly Competitive Submarkets of Two Imperfect Substitutes

Introduction

This chapter introduces the first model that enables us to analyze the emergence of conflicts concerning public development activities. Two goods are consumed in this setting, which are not perfect substitutes of each other with elasticity of substitution higher than one. This assumption results an economic equilibrium where income of actors do not move together (income share of actors is not fixed).

As we will see this possibility of divergence in incomes do not influence the general trends of utility: both sectors are better off if any of the endowment levels increase or any of the production costs fall. But agreement of evaluation is not valid for expected policy reactions in most of the cases. The qualitative differences in the mechanisms that determine income of different asset owners induces actors to propose different policy responses in case of certain exogenous change of economic characteristics.

Public development activities use income tax to finance policies that are intended to increase the factor endowments or to decrease production costs. The two sectors will be referred as labor and capital oriented ones. The only qualitative difference between the two sectors is that price of labor is assumed to be unitary, meanwhile return on capital is determined by market forces. This differentiation has asymmetric effects on policy because price of labor gives the baseline for the whole economy.

The analysis of conflicts shows that public development policy is least penetrated with conflicts when exogenous improvement of labor endowment is the dominant driver of economic development and it is full of conflicts when exogenous shocks that raise the capital endowment dominate the economy. Conflicts are frequent concerning the size of public policies to increase labor endowment on the one side, economic actors agree concerning direction of public development of capital oriented sector on the other side. Consequently, people disagree on issues with effects that would lead to agreement concerning further public activities (in the field of labor) and they agree on policies that will result later disagreement among them (concerning capital).

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The model will be presented and discussed in the first section. Public development activities will be introduced in the second part, then effect of exogenous shocks on optimal level of policies will be studied. The last section discusses which exogenous shocks generate consensus and which ones raise conflicts concerning public development activities.

The model

This model cuts market into two interlinked parts. Actors consume two types of good that are not perfect substitutes of each other. The conceptualization of these two submarkets is as simple as possible: both of them are perfectly competitive and use only one factor for production. There are two types of actors in this setting who are differentiated according to their property. Because of perfect competition profit is zero, so earnings are generated as a return on productive assets. Consequently price of goods, endowment level and production costs determine the income of the two groups of owners, whose utility functions are identical. Differences in income - and later in interests concerning public development activities – are entirely consequences of position in the economy.

Two factors determine individual utility: beside the income of actors the structural features shapes individual welfare. Utility is the product of these two factors.

The two sectors will be labeled as 'labor' and capital'. The two sectors have only one – but important – qualitative difference. Price of labor is assumed to be unitary, price of capital is determined by the economic equilibrium. Consequently price of labor is the baseline and it is not influenced by any economic shocks. Capital sector is far more influenced by the economic forces, returns are formed by each features of economy in this case.

As we will see, the two types of actors evaluate exogenous changes similarly: they welcome improvement of endowment levels and fall of production costs – both concerning their own sector and the other one. But important differences appear in the detailed analysis: meanwhile labor owners' utility is shaped mostly through structural effects, capital owners feel the effect of external shocks also on their income directly. This difference will be the key driver behind the variance in their political behavior.

It is important to see what the differences between the two sectors are because income and policy demand of stakeholders of different sectors frequently diverge. If this divergence were symmetric, the qualitative differences between the two sectors would not be important

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because the choice of numeraire would not influence the results. But divergence and asymmetry together needs some explanatory notes.

In this model one of the productive assets is assumed to have unitary (fixed) price. This assumption has two important aspects:

- This price is not influenced by domestic market forces

  There are different approaches to interpret the basic sector, the 'fix point' of the economy. The price in a sector and in its dominant production factor can be treated as fix if some characteristics of utility function, physical conditions, exogenous forces or technological features maintain their stability in an economy.

  - Inelastic demand – The price of certain, primary goods with inelastic demand like food, accommodation, energy can be accepted like a real numeraire because demand for others goods depends on how big share of income remains for them.
  - Exogenous pricing – If a market is competitive and open, the prices can be taken as exogenous because local actors (either entrepreneurs or politicians) have no power to influence the prices given by international market. Competitiveness is an important factor because if either local or foreign supply is concentrated enough, producers can successfully utilize their market power through cartels or political actions. In this case profit maximization will be based on characteristics of demand that makes pricing endogenous to the characteristics of the economy. Usually easily transportable, not capital intensive goods like crops or textile are typical examples.
  - Basic inputs – If there are certain inputs that are hardly substitutable (that means inelastic demand) and penetrate the whole economy it is reasonable to treat the prices of these inputs as baseline prices in an economy. Unskilled labor, land, key raw materials or basic services are examples for it.

- Price of public activities moves together with this price

  As we will see each policy is characterized with its size that is measured in the amount of money spent on it. Unit of currency is the same that the unit of endowment in the basic sector. From this perspective basic sectors are those ones that use similar productive factors to the public sectors.

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These criteria offer a good basis to distinguish the basic and the accommodating sector of the economy. The labor oriented vs. capital oriented distinction is the most trivial choice. Unskilled labor can be taken as exogenous, meanwhile capital (either as human capital or as capital good or as assets for investment) is the result of an economic accumulation process.[30] The distinction of human resource oriented services and land oriented agriculture vs. capital intensive industry fits to the conditions discussed above, so it can be used to interpret the sectoral conceptualization of this model also.
Based on these arguments, I will refer to the two sectors as labor and capital oriented ones, keeping in mind that the results offer interpretation to the policy debates in an industry vs. other sectors framework also.

In the basic sector a company uses α labor to produce one unit of a output, in the other sector β capital is used for it. The amount of labor is L, the level of capital endowment is K in the economy. The total output of labor sector is x1, the output of capital sector is x2.

1. $x1 = \frac{L}{\alpha}, \quad x2 = \frac{K}{\beta}$

2. $\frac{x1}{x2} = \frac{L\,\beta}{\alpha\,K}$

Perfect competition enforces companies to produce at zero profit in both sectors. It means that companies use all of their incomes to pay for the productive factors that they use. Price of labor is assumed to be unitary, consequently the price of labor oriented good is equal with the amount of labor that is necessary to produce one unit of it.

3. $p1 = \alpha$

Economic forces that equate the consumption and production of goods in the economy determine the price of capital.

[30] Reference how others use it

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The Dixit-Stiglitz CES utility function[31] is used to conceptualize consumption The two products of economy are substitutable for consumes with σ elasticity of substitution, it means that if price of labor oriented good increases with 1 percent, its consumption will decrease with σ times 1 percent. The two goods are not perfect substitutes, so $1 < \sigma$, $\sigma < \infty$. For sake of simplicity in representation I will use ϕ instead of σ, ($\phi = \frac{\sigma - 1}{\sigma}$, $\sigma = \frac{1}{1 - \phi}$).

The condition of imperfect substitution is $0 < \phi$, $\phi < 1$.

The utility maximization of representative consumer beside her income constraints defines the correspondence between price and consumption shares (4), (for details see Supplement I.2.1.).

4. $$\frac{x1}{x2} = \left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$$

The utility functions of all consumers are identical, so the behavior of representative consumer describes the behavior of different owners. The income level of actors does not influence their consumption structure (income elasticity is unitary for all goods). Consequently, the consumption structure of representative consumer is identical to the consumption structure of the whole economy.

In equilibrium supply and demand of goods equates (5). If this equilibrium would not be met, either demand would be higher than supply that would motivate consumers to offer higher price or supply would be higher than demand that would motivate producers to cut their prices.

5. $$\frac{L\,\beta}{\alpha\,K} = \left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$$

This equilibrium determines the price of capital oriented good (6). As we can see, this price decreases with K and increases with α, β, and L. α defines the price of the baseline good, so if it increases the price level of the whole economy goes up. If $\frac{K}{\beta}$ increases, the amount of capital intensive good increases on the market and consumers absorb this higher volume only

[31] Dixit, Stiglitz (1977)

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at a lower price level. Similarly, if L goes up the supply of labor good increases that motivates relative price increase of capital good.

6. $$p2 = \alpha \left(\frac{L\,\beta}{\alpha\,K} \right)^{(1-\phi)}$$

Because of zero profit condition the income of sector 2 finances the return (r) on capital (7).

7. $$r = \frac{p2}{\beta}, \quad r = \frac{\alpha \left(\frac{L\,\beta}{\alpha\,K} \right)^{(1-\phi)}}{\beta}$$

Using these results utility function and income of representative capital and labor owner can be expressed. G (9) refers to the general price index of the economy as it is discussed in Supplement I.2.1.

8. $$u = \frac{Inc}{G}$$

9. $$G = \alpha \left(1 + \left(\frac{\alpha\,K}{L\,\beta} \right)^{\phi} \right)^{\left(\frac{\phi-1}{\phi} \right)}$$

As we can see utility function (10) is the ratio of income (Inc) and G. (Reciprocal of G will be referred as structural factor of utility.) Structural factor is identical for the two types of the actors. It increases with rise of K and decline of β, because it makes products of capital sector cheaper and it decreases with L because it raises the price of capital good. Price of labor oriented good decreases and price of capital good increases if α falls. Altogether the first effect is more powerful, thus value of structural factor decreases with α.

10. $$u = \frac{Inc \left(1 + \left(\frac{\alpha\,K}{L\,\beta} \right)^{\phi} \right)^{\left(\frac{1-\phi}{\phi} \right)}}{\alpha}$$

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The income of actors is determined by the return and volume of their productive assets. Price of labor is unitary, consequently income of representative labor owner is the amount of labor that belongs to her (11). Return of capital (7), amount of capital and number of capital owners defines the equilibrium level of representative capital owners' income (12). The share of individual from the asset pool is labeled by l and k for labor and capital respectively.

11. $$inc_{worker} = \frac{L\, l}{n_{labor}}$$

12. $$inc_{capital} = \frac{\alpha \left(\frac{L\, \beta}{\alpha\, K} \right)^{(1-\phi)} K\, k}{\beta\, n_{capital}} = \frac{k\, L \left(\frac{\alpha\, K}{L\, \beta} \right)^{\phi}}{n_{capital}}$$

Discussion of the Model

Statement 1. Labor and Capital owners evaluate similarly the change of economic characteristics in general. Utility of economic actors increases if

- K or L rises
- α or β falls.

Proof – The first order derivatives of the utility function are positive for labor and capital owners. See Appendix I.1.

Consequently, the capital and labor owners have a shared view about what are the blessing and what are the harmful changes. This agreement is based (1) on the market mechanisms that transmits the effect of exogenous shocks and (2) on the identical utility functions of the actors that makes the society homogenous in consumption attitudes.

Looking into details we can see that the mechanisms for actors are different behind this shared evaluation of economic effects. Structural features are identical for all economic actors, but income effect of exogenous changes is different for capital and labor owners.

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Statement 2. - Both labor and capital owners' incomes increase if L rises (although in different pace). Labor owners' income is insensitive to other economic characteristics. Meanwhile capital owners' income increases with α and K and decreases with β.

Proof - The first order derivatives of the income function gives these results. See Appendix I.2.

Table 1. and Table 2. present the composition of exogenous effects to income and structural effects.

Table 1. Effect of economic characteristics on Labor owners' utility

	Positive Structural Effect	Negative Structural Effect
Positive Income effect		L
No Income Effect	K, $\frac{1}{\alpha}$, $\frac{1}{\beta}$	α, β

Income of labor owners is sensible only to labor endowment. Their utility changes mostly through the structural part of the utility function: it increases with K and with the fall of α and β. Rise of L has a negative structural effect but it is dominated by the income effect. Labor owners feel directly in their pockets if they have more assets to sell on the market, other effects they perceive through the change in price of consumed goods.

Table 2. Effect of economic characteristics on Capital owners' utility

	Positive Structural Effect	Negative Structural Effect
Positive Income effect	K, $\frac{1}{\beta}$	L, α
Negative Income Effect	$\frac{1}{\alpha}$	β

Capital owners' income is directly influenced by economic characteristics. Their earnings rise if endowment level of any sector increases or if production costs in their sector falls or if the production cost of the concurrent sector increases. Structural changes are positive for them

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when K increases or production cost of any sector decreases, and it is negative if level of L goes up. In case of L the positive income effect dominates, but in case of decline of α the positive structural effect is stronger.

These differences in the effect mechanism of economic characteristics on the utility of actors are the cradle of conflicts on some fields of public development activities.

Introduction of Policy

Public development activities use tax revenues to modify the characteristics of the economy. Income tax is assumed to finance the policies that increase endowment levels or mitigate production costs with decreasing marginal utility.

Taxation is conceptualized as simply and as generally as possible: economic actors pay a given amount of tax after a given amount of income. The goal of this dissertation is to study demand for public development activities disregarding the effects of income redistribution. I assume that contribution to public spending is fixed between the two asset-owner groups and it is income proportional inside them.

Capital owners' total tax payment is $\frac{n_{capital}\, t}{N}$, labor owners pay $\frac{n_{worker}\, t}{N}$ ($N = n_{capital} + n_{worker}$). $n_{capital}$ and n_{worker} are the number of taxed items in the two asset groups. These variables are assumed to be fully exogenous, the only assumption concerning number of taxed items is that this is fixed. The ratio of number of tax units expresses the contribution share of the groups. It is assumed that there is an agreement concerning this share that is out of the realm of policy debates on public development activities. It means that inter-sectoral redistribution patterns are taken as given.

An asset owner pays the tax after the number of taxed items possessed by him. The income generation effect of taxed items is equal. Thus everyone contributes to public development activities in a given share of his income.

Utility is a linear function of net income. There is no decreasing marginal utility of earnings and no deadweight loss due to taxation. There are three reasons for this choice. At first representation of nonlinear income effects on utility would cause technical complications. At

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second, disincentive effect of taxation spreads on different assets and the productivity of their economic application that would need a satisfactory theory to get conceptualized. At third, now public spending is used for asset and productivity enhancing investments, thus it is not trivial why taxation should discourage economic activities.

The connection between the total spending on a public development activity and individual contribution level is simply calculable in this setting. An individual pays t_{ind} from a taxed unit of her income that finances public policy using $t = N\, t_{ind}$ to modify economic conditions.

Equation 13. presents the utility function assuming income tax rewriting equation 10.

13. $u = (\mathrm{f}(t) - t_{ind})\ \mathrm{g}(t)$

14. $f_{worker} = \dfrac{L\, l}{n_{labor}}$, $f_{capital} = \dfrac{k\, L \left(\dfrac{\alpha\, K}{L\, \beta} \right)^{\phi}}{n_{capital}}$, $g = \dfrac{\left(1 + \left(\dfrac{\alpha\, K}{L\, \beta} \right)^{\phi} \right)^{\left(\frac{1-\phi}{\phi} \right)}}{\alpha}$

Function f refers to the income part of the utility function, g refers to the structural part, similarly to previous cases.

The modeling framework is chosen to be stationary. For sake of simplicity everything is expressed as net present value. This approach makes interpretation even broader: policies are expressed with net present value, thus they conceptualize the preferred flow of policies as a reflection to the expected path of change in endowments and cost structure. In this way policy is interpreted as the tool that modifies the path of economy.

Economic characteristics are interpreted in net present value also, consequently they represent not only the real level of endowments and cost coefficients but the expectations concerning their value also.

Actors' optimal policy disregards strategic considerations: optimal policy expresses what would be their best response to the prevailing conditions.

Policies are conceptualized in a general way, there are three assumptions concerning them:

- Decreasing marginal utility – Public interventions are assumed to use less efficiently an additional unit of tax if the intervention is bigger.

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- Effect of policy is independent from initial condition of modified characteristics – An endowment level increasing policy has the same real effect, disregarding whether the off policy amount of endowment is high or low. Similarly, the mitigation of production costs gives the same result from the same amount of public money in each cases also. This assumption is introduced because of two main reasons. At first, I want to avoid results that are based on differences in policy efficiency because it would require a theory that gives a good account under what circumstances and why are policies more efficient in some cases then in others. At second the intention of this project is to study how features outside of the public sector influences policies and it motivates to minimize assumptions concerning public activities.
- Price of policy is fixed – I assume that there is a direct correspondence between amount of public fund spent on a policy and its effect. This seemingly innocent assumption means that changes in prices do not influence the cost-efficiency characteristics of policy. The main benefit of this condition is practical: introducing price index for public interventions would need additional theoretical assumptions and it would cause technical problems that would make the mathematical analysis untreatably complicated. The main cost of this assumption that it links policy directly to the basic, labor sector: price is assumed to be fixed there, so taking price of policy fixed also implies that price of labor sector and price of policies move together. To formulate it more sharply: this approach assumes that public development activities are directly or indirectly labor oriented ones.
- Optimal policy exists – Public development activities that are supported by different social groups are feasible only if it increases their utility. It requires them to satisfy a minimum efficiency requirement: the benefit of policies must be higher then the utility loss induced by taxation. Their may exist policies that are harmful for one or more social groups but it is sure that these ones will not enjoy support from stakeholders with negative payoff.[32] This study focuses on policy interest of social groups, thus it is necessarily assumed that policies that increases utility for the two groups of owners exist. There is one more technical condition for the existence of optimal policies: the optimal spending on them is smaller then the full income of economic actors. This condition is easy to defend from practical point of view. It technically means that

[32] Political Economy literature offers many theories why socially harmful policies exist (olson as a classic, robinson on white elepahants, peltzman on regulation). This issue is discussed in Part II..

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decrease of marginal utility is fast enough to reach the utility maximization size of policy in an affordable zone.[33]

These assumptions enable us to conceptualize policies in a broad term that will be helpful to interpret the policies in general terms also. Tax income can be utilized in four different fields of public development activity:

- To increase labor endowment (L) – Interpretation of L depends on the interpretation of the two sectors as it was discussed above. I argued to apply the model to labor oriented sectors or the activity of human resources, consequently increase of L refers to development of productive factors in this sector. Basic education and health care are the most trivial examples because these public activities directly contribute to the enrichment of labor assets in an economy. Households can be assumed as actors of the setting, in this case policies that enables families to increase their labor supply can be linked to this policy variable. Policies to increase labor activity e.g. through modification of incentive schemes or improvement of childcare belongs to this category. Utilizing the expected present value nature of the approach, policies that support the increase of population through higher fertility rate can be interpreted in this framework also.[34]
- To increase capital endowment (K) – Value of assets in the capital sector refers to the amount of fixed assets, or to the value of capital goods. In a broader interpretation everything that is result of accumulation belongs to this policy, including value of human capital that embodies special technical knowledge. It is hard to interpret the distinction between the price and volume of capital assets. Capital endowment may have many different forms (some of them exists only virtually), they are interpretable as a unified group only through their value that is the product of its amount and price in the model. Some price index (based on contribution to GDP or on general rate of return (interest rate minus risk premium) can be used to separate price and volume of capital. There are several policies that increase these assets like state aids, market regulations, public activities that supports or discourages saving or investment.

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[33] More technically it means that Second Order Condition is satisfied and optimal tax level is smaller than income.

[34] Number of actor is assumed to be fixed throughout the analysis, so migration policies are not treated in this model. It would be necessary through distinction of owners' assets and external assets. The previous ones would appear both in income and structural part of the utility function, the latter category would not influence income directly only through the prices and the economic structure.

- To decrease production cost in labor sector (α) – The production cost of labor sector refers to the labor force need per output in its purest form. It can be approximated with cost of production in labor oriented sectors. Less labor is necessary to produce the same output if production becomes more efficient in the labor sector because of some technological improvements. If labor market becomes more flexible, less unit of labor is to buy for the same task also.
- To decrease production cost in capital sector (β) – Production costs of capital sector refer to capital efficiency in closest term. In broader sense costs of transportation and costs of transactions belongs to this category. In this sense cost of communication and contracting (including bargaining, agreement, verification and enforcement) belong to this category. Public activities that support the efficiency of capital utilization are the key concerns of this policy field. Some examples: the cut of administrative and transaction costs, improvement of transport policies, development of corporate law, coordination activities like standardization. Taxes that levied on capital to finance policies outside the realm of studied public interventions and public activities that influences risks or expectations with effect on the net present value of necessary capital influence β also.

Clear-cut classification of public development activities into these four categories is not possible, because these are seriously interdependent. Fall of costs motivate producers to increase their demand for a certain asset that raises its price, hence supply. Higher level of endowments may decrease its price that decreases pressures to keep costs low. A more sophisticated model would be able to treat these effects but they are disregarded in this case. This approach is intended to study how a loop of chain in policy changes looks like, more sophisticated approaches to give account for longer term development paths – some string of chain – is beyond the scope of this project.

Next section will discuss what mechanisms shape the political interest of economic groups and how exogenous economic changes influence sectoral positions in different policy fields.

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Effect of Exogenous Changes on Policy

The introduced model and the policy conceptualization enable us to investigate how exogenous shocks modify the two sectors' interest in different policy fields. There are two main arguments that support this approach instead of analysis of explicit policy levels. The first argument is practical: analysis of optimal policy levels would be far more complicated. The second argument is more general: to study the nature of changes is more important than to study the details of policies if we accept that institutions are path dependent.

The analysis of optimal policy levels would require far more detailed assumptions about the function of these policies. It would be hard to accept any explicit function form to describe policies because efficiency of public services is not a pure technological question: the input-output relations of a policy depend on the relative power of interested parties and the institutional setting that structures their bargaining. Only beneficiaries of policy are represented in this setting because an approach that would include other actors (policy agencies, politicians, suppliers of policy) and issues of bargaining would be too complicated and would use too many assumptions. Thus I focus only on the beneficiary side now, other factors of policy formation will be discussed later. This strategy motivated to conceptualize policy field in general terms and to design the analysis to follow a comparative statics strategy.

It is frequently appropriate to assume temporary policies as a consequence of historical phenomena: as a result of a series of past changes instead of the adequate reaction to the temporary interest and power of the influential parties.[35] Accepting this view, not the size and structure of policies is to be studied but the nature of process that formulates them. If hysteresis is accepted, not temporary features of policy but the forces that shapes their direction should be in the focus of analysis.

Based on these arguments I will investigate, how exogenous shocks modify the expected policy of the two actors. If they agree in the direction of desired change we can propose that policies will change in this consensually proposed way. If the owners of different type of assets do not agree, the direction of change is not straightforward. If the influence of the two groups is balanced, status quo prevails. If one of them is more powerful in an issue the direction of policy modification will follow their interests.

[35] North (1990)

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The results of analysis can be summarized in the following statements. Proofs based on comparative statics are presented in Appendix I.

Statement 3. The optimal size of labor endowment enhancing policies for labor owners rises if exogenous effects improve technologies in labor sector (α goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of capital sector improves (β goes down).

Statement 4. The optimal size of capital endowment enhancing policies for labor owners rises, if exogenous effects increase labor endowment (L goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of labor sector improves (α goes down).

Statement 5. The optimal size of labor technology improving policies for labor owners rises, if exogenous effects increase labor endowment (L goes up) or improve technologies in labor sector (α goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of capital sector improves (β goes down).

Statement 6. The optimal size of capital technology improving policies for labor owners rises, if exogenous effects increase labor or capital endowment (L or K goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when technology of labor sector improves (α goes down).

Statement 7. The optimal size of labor endowment enhancing policies for capital owners rises, if exogenous effects increase capital endowment (K goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when labor endowment increases (L goes up) or technology of labor sector improves (α goes down).

Statement 8. The optimal size of labor technology enhancing policies for capital owners rises, if exogenous effects increase capital or labor endowment (K or L goes up) or improve technologies in capital sector (β goes down).

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Statement 9. The optimal size of capital endowment enhancing policies for capital owners rises, if exogenous effects increase labor endowment (L goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of labor sector improves (α goes down).

Statement 10. The optimal size of capital technology enhancing policies for capital owners rises, if exogenous effects increase labor or capital endowment (L or K goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when technology of labor sector improves (α goes down).

Table 4. and Table 5. sum up the results of analysis. The rows of the tables show how exogenous change of economic characteristics effect the optimal size of policy named in the first column of the tables; + means that exogenous shock motivates expansion, - indicates that change motivates to propose contraction of policy.

Table 4. - Optimal Policy of asset owners' in labor sector

	When			
	L	K	α	β
	Rises		Falls	
Labor owners' proposed direction to modify the size of public development activities				
To increase labor endowment	**?**	-	+	-
To increase capital endowment	+	-	-	+
To improve technology in labor sector	+	-	+	-
To improve technology in capital sector	+	+	-	+

Labor owners support the expansion of any policies when the amount of their endowments increases.[36] In these cases their income increases, so the improvement of economic sector becomes more valuable for them.

Rise of K enlarges the utility decreasing effect of taxes, thus labor owners propose the contraction of all policies except technology improvement in capital sector. The impact of

[36] There is one exception: if labor enhancing policy is not efficient enough, rise of endowment level will dismotivate owners to propose further policy expansion.

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public intervention to mitigate the production cost in the capital sector is magnified by this shock, thus direct positive effect of expansion of this field is stronger than the indirect negative effect that dominates in case of other policies.

If technology of labor sector improves, the labor owners propose to increase spending on policies concerning labor sector and to decrease public activities in capital sector. This shock increases the value of structural part in the utility function. It motivates higher spending on L. For the other three policy fields there is a positive structural effect and a negative effect through the magnified negative effect of income tax. In case of reduction of α the positive effect dominates, in case of policies to develop capital sector the negative effects are stronger. When production costs of capital sector falls, the positive structural effects of policies in capital sector are more powerful than indirect negative effects through enlarged negative impact of taxation. Lower β decreases the aggregated impact of labor sector oriented policies, thus labor owners will suggest reduction of public activity in this fields.

Table 5. - Optimal Policy of asset owners' in capital sector

	When			
	L	K	α	β
	Rises		Falls	
Capital owners' proposed direction to modify the size of public development activities				
To increase labor endowment	-	+	-	+
To increase capital endowment	+	-	-	+
To improve technology in labor sector	+	+	**?**	+
To improve technology in capital sector	+	+	-	+

Capital owners' income is more sensitive to economic changes and they are more supportive to expand public development activities as a response to positive exogenous shocks.

If L increases, capital owners realize an increase of their income and a decreasing relative importance of structural factors in their utility that motivates expansion of policies except further increase of labor endowment. As L increases the income enhancing impact of labor

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endowment promoting policies grows slower than their structure deteriorating effect. Thus, in field the reduction is proposed.

Capital owners support higher spending in all policy fields when the amount of their productive assets (K) increases - except the public policies to increase capital endowment: the direct effect of higher income and better economic structure dominates in these policy fields against higher negative tax effects.

When production cost of labor sector declines, the negative effect of decreasing income and enlarging negative tax effect are more powerful than structural benefits.[37]

Improvement of technology in capital sector motivates actors of the sector to propose expansion in each policy field because both income prospects and structural effects improve.

Reasoning behind the Results

As we could see all economic characteristics has an effect on economic structure. Consequently all exogenous changes and each policy interventions modify the structural part of the utility function. Income effect is always present for capital owners, labor owners' income is effected only if L changes. Based on it, there are three possible scenarios concerning effect of economic changes on optimal level of policy:

I. Policy and economic changes influence only structural features
II. Economic change has an influence both on income and economic structure, policy modifies only structural part
III. Policy and external effects influence both income and economic structure

I. Only structural effects

Function f represents the income of an actor, g(c,t) reflects to the structural part of the utility function.

15. $u := (f - t)\, g(c, t)$

Optimal level of public intervention can be given by unconstrained optimization, optimal tax level can be explicitly expressed from this equation.

[37] If production cost decreasing policies are effective enough, this intervention can be an exception because above treshold improvement of structural factors may outweight the negative tax and income effects.

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16. $\frac{\partial}{\partial t} u = -\mathrm{g}(c, t) + (f - t)\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right) = 0$

The effect of development policy is positive on economic because $0 < \frac{\partial}{\partial t}\mathrm{g}(c, t)$ (Supplement I.2.2. shows why it is a sufficient condition.)

17. $t = \frac{-\mathrm{g}(c, t) + \left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right) f}{\frac{\partial}{\partial t}\mathrm{g}(c, t)}$

Now lets' look at how change of an economic characteristic - labeled with c - effects the optimal tax level.

18. $\frac{\partial}{\partial c} t = \frac{-\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)\left(\frac{\partial}{\partial c}\mathrm{g}(c, t)\right) + \left(\frac{\partial^2}{\partial t\, \partial c}\mathrm{g}(c, t)\right)\mathrm{g}(c, t)}{\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)^2}$

As we can see the exogenous change influences the optimal tax level in two channels in this case. At first, increase of c decreases the optimal tax level, because the improvement of economic structure enlarges the utility loss of taxation. For example if the value of structural part of the utility function increases with 10 percent, the overall effect of unitary increase in tax level increases with 10 percent also, because multiplication of income and structural part gives the utility function. At second, the change of economic characteristic modifies the effect of policy on structural features. For example, if K increases due to some external effects, the same policy to decrease β will have more intensive positive effect on the structural part of the utility function because of their multiplicative relation. If this increase of overall policy efficiency is higher than the tax cost enlarging effect of structural improvement, the optimal tax level will rise. Both effects may have the opposite sign. For example rise of β reduces the utility enhancing effect of economic structure, so decreases the overall negative effect of taxes on the one side and decreases structural improvement effect of policies to raise the level of K.

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II. Exogenous effect modifies income also

In the second scenario economic change has an influence both on income and economic structure.

19. $u := (\mathrm{f}(c) - t)\,\mathrm{g}(c, t)$

Unconstrained optimization helps to express optimal level of t in this case also.

20. $\frac{\partial}{\partial t} u = -\mathrm{g}(c, t) + (\mathrm{f}(c) - t)\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right) = 0$

21. $t = \frac{-\mathrm{g}(c, t) + \left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)\mathrm{f}(c)}{\frac{\partial}{\partial t}\mathrm{g}(c, t)}$

The effect of exogenous change (c) is threefold in this case. The two effects discussed above are valid here also: on the one side the improvement of economic structure increases utility loss of income decreasing taxation, on the other side external shock modifies the overall effect of public intervention on the economic structure. The third effect beside these is consequence of external shocks' influence on the income level: higher income enforces the positive effect of structural improvements.

22. $\frac{\partial}{\partial c} t = \frac{-\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)\left(\frac{\partial}{\partial c}\mathrm{g}(c, t)\right) + \left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)^2\left(\frac{\partial}{\partial c}\mathrm{f}(c)\right) + \left(\frac{\partial^2}{\partial t\,\partial c}\mathrm{g}(c, t)\right)\mathrm{g}(c, t)}{\left(\frac{\partial}{\partial t}\mathrm{g}(c, t)\right)^2}$

For example a sudden (e.g. technological invention) induced fall of α

- improves the structure of economy, so increases the value of money, thus utility loss of income taxes
- increases the economic structure improving effect of technological policies to decrease β

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- decreases the income of capital owners, so reduces the utility improving effect of positive structural changes for them.

III. Policy and exogenous shocks attach both income and structure

Policy and external effects influence both income and economic structure in the most complicated case.

23. $u := (\mathrm{f}(c, t) - t)\, \mathrm{g}(c, t)$

Expressing the effect of external change on the optimal size of policy, we can see that there are far more mechanisms that shape the optimal policy level.

24. $$\frac{\partial}{\partial c} t = \left(\left(-\mathrm{g}(c, t) \left(\frac{\partial}{\partial t} \mathrm{f}(c, t) \right) + \mathrm{g}(c, t) \right) \left(\frac{\partial^2}{\partial t\, \partial c} \mathrm{g}(c, t) \right) + \left(\frac{\partial}{\partial t} \mathrm{g}(c, t) \right) \left(\left(\frac{\partial}{\partial t} \mathrm{g}(c, t) \right) \left(\frac{\partial}{\partial c} \mathrm{f}(c, t) \right) + \left(\frac{\partial}{\partial c} \mathrm{g}(c, t) \right) \left(\frac{\partial}{\partial t} \mathrm{f}(c, t) \right) + \mathrm{g}(c, t) \left(\frac{\partial^2}{\partial t\, \partial c} \mathrm{f}(c, t) \right) - \left(\frac{\partial}{\partial c} \mathrm{g}(c, t) \right) \right) \right) \Big/ \left(\frac{\partial}{\partial t} \mathrm{g}(c, t) \right)^2$$

Exogenous change of an economic characteristic influences the optimal size of public development policy in eight ways now. Let's look at these paths through the case, how change of asset endowment in labor sector (L) influences the optimal policy of capital owners concerning policies to develop their endowment level (K).

- Increase of L raises income of actors that strengthens the utility increasing effect of policy to improve economic structure.
- Increase of L augments the effect of the policy to raise the income of representative actor directly.
- Income increase through Effect 2 contributes to Effect 1 to enhance the utility impact of economic structure.
- Increase of L leads directly to a less utility enhancing economic structure and it decreases the negative effect of income tax.
- This structural deterioration decreases the utility improving effect of increasing income.

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- Rise of L decreases the structure-improving effect of policy to increase level of K that directly weakens efficiency of public intervention.
- This lower efficiency leads to lower value of structural part of the utility function that decreases the welfare loss of income tax.
- Because the exogenous shock decreases the structure improving effect of policy, the effect to strengthen positive effect of rising income is weaker also.

The aggregate value of these effects is positive in this case, so higher level of L motivates capital owners to propose more expanded policies to increase level of K.

Consequences for Development Policy

Comparing policy proposals of labor and capital owners we can see when they agree in the direction of desired modification of public development activities and when they have conflict concerning policies. Table 6. shows the aggregated results of actors' proposed policy reaction to exogenous shocks.

Table 6.

	When			
	L	K	α	β
	Rises		Falls	
Capital and Labor owners' proposed agree				
To increase labor endowment	**?/-**	**Pro C**	**Pro C**	**Pro C**
To increase capital endowment	+	-	-	+
To improve technology in labor sector	+	**Pro C**	**+/?**	**Pro C**
To improve technology in capital sector	+	+	-	+

Sign + or – indicates that both income groups upgrade or downgrade the optimal size of a public activity as a response to a change of economic characteristics. Pro C shows that there is a disagreement and the capital owners upgrade their policy demand if the value of an economic characteristic grows. If reaction of a labor group is not straightforward and the other

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one supposes contraction of policy ?/- is used in the table, label +/? means that labor group increases demand for public activities meanwhile reaction of capital group is not evident.

One important warning is necessary before the interpretation of the result. The table shows the agreement or disagreement about the direction of change. It is possible that the group who originally proposed higher level of public intervention reflects exogenous shock with a proposal to decrease policy and the originally more minimalist groups proposes expansion. In this case opposite direction means optimal levels getting closer to each other: in this case social tensions decrease concerning the optimal level of policy, the equilibrium level of public activity will be closer to the ideal option of all actors. It is also possible that more interventionist proposes increase of spending and originally less keen supporters of a given public development activity calls for further cut of spending on it in this case political positions will get further from each other and relation of groups becomes more hostile. But the policy relevant consequence of conflict concerning the proposed direction of policy modification is the same both in case of detente and rise of tension: the public response to the external change of condition will be smaller in volume. In the first case the agreement among actors becomes stronger that the original level of policy was right. In the second case motivation to change will rise in both sides but the disagreement on its size enlarges also.

If labor endowment (L) increases in the economy, economic actors agree to increase spending on policies disregarding the further rise of labor assets. It suggests than an economy where amount of available labor increases we can predict peace and expansion in the field of development oriented public activities.

In the case of increasing productivity of labor (when α falls) actors agree that spending on the development of capital sector is to be cut. Labor owners propose expansion of technological development of labor sector that is accepted by capital owners also if this policy is sufficiently efficient. There is no agreement concerning policy to increase labor endowment. Labor owners reduce policy demand for these activities if α falls, meanwhile capital owners opt for higher level of public development activities in this case.

Groups' agreement contributes to develop capital sector if its production cost (β) falls. They disagree concerning development of labor sector in this case: labor owners reduce support, capital owners accepts more an increase public spending in this case.

If level of capital endowments (K) rise the actors agree concerning policies toward capital: there is a consensus to cut spending on development of assets and expand public activities to

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improve capital productivity. Capital owners opt for expansion, labor owners seek contraction in policies to improve characteristics of the labor sector.

Economic groups always agree about direction of change in the field of production cost mitigation in the capital sector. They increase their demand for policy in all cases except the exogenous technological development.

The two parties also agree about policy responses concerning public activities to increase the asset level of capital sector. Everyone proposes expansion if L increases or β decreases, and they all reduce the expected level of intervention, if K increases or α decreases.

Efficiency enhancement of labor sector is welcomed by both groups if labor endowment increases, and there is a chance of agreement if α falls. Development of capital sector induces conflict in this policy field because it motivates capital owners to increase policy demand, meanwhile labor owners would reduce public activity.

Disagreement is almost full to increase asset level in the labor sector. There is a slight chance to agree on spending cuts in case of increasing L if the efficiency of public intervention is low. In other cases actors disagree. Rise of K or fall of β motivates capital owners to spend more and labor owners to spend less on this policy. Labor owners propose expansion, capital owners call for contraction compared to their earlier policy demand if α falls.

If we assume that both sectors will dominate policy decisions concerning their own sector, positive shocks would mostly lead to the reduction of policy to improve labor endowment. The size of public activities to decrease production cost in labor sector would decrease if labor sector develops and it would decline if features of capital sector improve.

If labor sector would dominate policy decisions only fall of production cost in the labor sector would lead to public activity enlargement generally, and fall of β would motivate expansion of policies concerning the capital sector. Other positive external changes would reduce public intervention.

If capital sector dominates, development inducing shocks motivate further expansion of policies except improvement of capital endowment if K increases and the public activities to develop capital sector if α falls.

These results imply the following conclusions:

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1. If there are conflicts concerning the direction of policy modification, capital owners propose policy expansion in all cases when interest of actors is clearly recognizable.
2. Actors agree more frequently about the optimal direction of policy changes if exogenous development of labor sector gives the dominant impetus for economic progress.
3. Conflicts are more frequent if exogenous improvements in the capital sector are the main drivers of development. Policies concerning development of capital sector are fully consensual, meanwhile public development activities to improve labor sector are more prone to conflicts.

Development of technology in the capital sector has an advantage compared to other policies because its expansion is supported most frequently (in case of three types of shocks from four) and it is the only policy that reinforces itself.

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I.2.2. One Market and Two Company Groups in Monopolistic Competition

In the previous model I presented and studied a model with two interlinked perfectly competitive submarkets. Now the setting is modified and I assume that there is one product market where all companies compete with each other. There are two groups of companies that use group specific assets for production and group specific technology.
This modification has two main advantages that compensate the additional technical complexity. At first, now labor and capital is conceptualized in a more realistic way. Capital finances fix cost of production in this setting, labor covers variable costs. It makes clearer the conceptualization of sector and asset based differentiation of interest. At second, now the difference of interests is purely based on productive issues, because there is no separation of submarkets in this case.

There are no real asset-type based conflicts in this model because income share of labor and capital in sectors depend on the utility function. Thus, I will focus on the sectoral specificities. We will see that conflicts are more frequent now than in the previous case because sectors compete not only in prices but also in diversity of variety. The basic sector will be against the development of the more sophisticated one and its' progress will motivate reduction of public development activities for them in general. The more sophisticated sector will upgrade its political demands when labor endowment in basic sector increases or when they can see positive changes in their own sector. In other cases they will decrease the expected level of intervention in all policy fields.

The presentation will be similar to the previous chapter. At first I describe and discuss the model. Then I introduce public development activities, finally I discuss how economic actors reflect to different economic changes.

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The Model

The setting of the previous model is modified in two ways. At first, now I assume that labor is used to cover the variable costs of production. At second now there is only one united market and only sector specificity of assets and technology makes the difference between the companies of the two sectors.

This distinction of labor and capital is frequently applied in the literature. It assumes that volume of labor (and other assets representing effort) correlates with the output level of a company, meanwhile accumulated assets – in form of knowledge, entrepreneurship, innovation, machines, buildings etc – are necessary to create the opportunity of production.

The united nature of the market means that firms of the same sector compete for sales with each other with the same intensity as two producers from different sectors. This approach can be interpreted in two different ways:

- We can perceive the model as a framework to analyze conflicts inside a sector.[38] There can be cleavages inside one industry along many different dimensions. Now I will mention the four most important ones:
  (1) Companies can differ in their political representation. They may belong to different industrial societies that enables the policy implementation to target public activities separately to the two groups on the one side and separates the lobbying activity of the two subgroups on the other side.
  (2) The firms of the two groups may apply different technologies. This kind of industrial cleavage is frequent: small entrepreneurs vs. big companies; companies with traditional labor oriented technology vs. modern capital intensive ones; competing technologies (e.g. trains and trucks, oil and coal) or technological standards (like different operational systems).
  (3) The two groups can be distinguished along difference in access of productive factors. For example there are companies with good access to financial markets meanwhile others are not, there can be difference in the access to essential infrastructures or inputs.
  (4) The two groups can represent one sector with companies in two different locations.
- We can assume that the two industrial groups represent the whole economy that is characterized with a fully unified market. In this approach not only restaurants compete with restaurants or shoemakers compete with shoemakers, but they compete

[38] The model should be slightly modified to accept fully this interpretation. Consumption of other actors outside the concerned sector should be incorporated into the production side and consumption of sectoral owners' from goods not produced by them industry should be built in also. Put it in the other way, this interpetation needs to assume that share of others' consumption from sectoral output is equal with the share of external goods in the consumption bundle of sectoral actors. This approach is frequently used in New Economic Geography see Krugman, Fujita, ? Spatial Economics

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with each other with the same intensity also. In this way the two sectors represent two main branches of economy like services and industries that offer goods that are substitutes for each other also.

The applicability of the first approach is based on the assumption that the actors and characteristics outside of the analyzed sector have an absolutely symmetric influence on the two groups. The second way of interpretation assumes that elasticity of substitution is constant among each goods in the economy. Both alternatives seems to be restrictive but any of them gives a more realistic account of economies than the traditional (Cobb-Douglas utility function) based representations because now income share of sectors is not fixed, external economic forces do exist, differentiation of labor and capital is based on their role of production.[39] These advantages open the way also to study emergence of conflicts concerning public development activities.

The two main sectors apply different assets for production in this case: both labor and capital are sector specific. Specificity means that work or capital owners can contribute to production only in one sector, their assets are not applicable in the other one. This distinction is easily interpretable in case of capital. Accumulation takes form in a specialized way: knowledge, entrepreneurial skills and capital goods are efficient if they are specialized. This specialization is irreversible that makes capital sector specific. Now I assume that this irreversibility is strong enough and there are no economic processes that equalize capital returns in different sectors through amortization and expected return based orientation of investments. Sector specificity is interpretable only with these frictions in the capital market.

This logic is valid for sector specific labor also if we assume that factors behind variable costs are sector specific. Labor is characterized with basic, sector specific skills and the change of this basic skill set is prohibitively costly compared to its possible returns.[40] Human capital investment or company specific training can emanate specificity of labor. It is also possible that more basic drivers like sector specific motivation or abilities differentiate labor. Strong migration movements suggest that sector specificity of labor is not a generally acceptable assumption; the next chapter will present a model without this assumption.

This story of asset specificity because of high costs to move from one type of activity into other one can be based on economic arguments:

[39] Like in Martin, Rogers (1994a) and (1994b)
[40] See Gallup at al. (1999)

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- Discount rate of actors can be too low to invest into other sectors, mostly in cases when differences in returns are volatile that makes expected present value of these activities low.
- Expected return can be asymmetric for economic agents because of accumulation of sector specific knowledge: value of options is higher and cost of risks is lower if these are more calculable. Thus, after primary choice of sector, the capital and labor owners perceive a cumulative advantage of returns in their sector, even in cases when exogenous observations show high return differences.

There are cases when sector specificity is caused by not purely economic factors.

- Specialization can be self-enforcing through transaction cost mechanisms. Costs of contracting and contract enforcement make it profitable to apply devices that enable partners to mitigate them. Reputation mechanisms are based on the logic that good track record leads to trust, thus to lower cost of transactions because it either proofs the goodwill of the actor or because the potential loss due to malevolent behavior increases with the rise of trustiness.[41] The number of business partners usually increases with time that decreases the transaction costs through a higher threat potential against unfair behavior because the more denser networks enable to spread the information about it more efficiently.[42] These and other mechanisms have clear economic value that increases the sector specificity of an entrepreneur or an employee.
- It is possible that two groups of companies are present on a market with totally different business techniques: for example flexible small entrepreneurs with good local knowledge and reputation have an advantage to accommodate to local specificities, meanwhile big enterprises has cost advantage through scale efficiency, better access to finance market and more conscious marketing and innovation activities. The success of the two competing groups is based on different competences that differentiate their assets and because of the nature of the market none of them can push the other group out of the market that maintains its dual structure.[43]

There are cases also when main reasons of sector specificity are outside of the economic realm. It is frequent that location, race or gender strongly influences someone's prospects in different economic activities. Family background or social environment highly shapes

[41] see Grief 2005.
[42] see Grief 2005.
[43] See Banerjee and Duflo (2005)

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abilities to become successful in formal or in informal economy. There are assets that are nontradeable like reputation of family or detailed knowledge about technology or local market that can be transferred only through close social ties. There are religious or cultural norms that motivate people to get involved into or to avoid certain economic activities.[44]
Either or economic or on other bases, sector specificity of labor or capital is a frequent phenomenon. The model presented above enables us to study, how it leads to agreement or conflict concerning public development activities.

And now we can look at the technical details of the model. Monopolistic competition is assumed using a simplified classic Dixit-Stiglitz setting.[45] There is a constant elasticity of substitution among all the goods, assuming that the differences among all goods produced in the monopolistic competitive market are equal.
There are several firms functioning in the two groups of companies, each produce a variety of the same product. Specialty of products motivates consumers to buy some of them even in case of higher prices with price elastic demand. Firms utilize this limited monopolistic feature of their outputs and choose an output that maximizes their profit. The companies compete with each other that push their profit to zero level, consequently price of varieties equals with the price of outputs the companies use for producing them.
Capital endowment and capital cost of production defines the number of varieties that is a key element of utility function. In this way economic characteristics influence utility directly: they define not only amount of consumable goods but number of varieties also.

All companies produce a different variety and maximize their profits with regard to elasticity of substitution - σ (in the equations I will use σ and $\phi = \frac{\sigma - 1}{\sigma}$, $1 < \sigma$). Technologies are different in the two groups of companies: companies in group 1 uses $\alpha 1$ labor for production (as variable cost) and $\beta 1$ capital to set up the productive facilities (as fix cost), similarly group2 uses $\alpha 2$ labor and $\beta 2$ capital. The labor and capital markets are also separated among sectors: both groups use group specific labor (L1 and L2) and group specific capital (K1 and K2). Consequently there will be four different representative actors: the owners of labor and the owners of capital in the two sectors. The wage (return on labor) is assumed to be unitary in sector 1, the economic equilibrium determines wage in the other sector.

[44] See Grief (1993)
[45] See Dixit-Stiglitz (1977)

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Number of companies (n1, n2) depends on capital endowment and firm level capital requirement in both sectors. It is assumed that all economic assets are used in economic equilibrium, thus the amount of capital and the capital need to produce one variety determine together the number of firms in a sector.

1. $n1 = \frac{K1}{\beta 1}$

2. $n2 = \frac{K2}{\beta 2}$

Level of output is technologically given also. Number of firms, variable cost ($\alpha 1$ and $\alpha 2$) and available amount of labor determines output level of a company. The rate of labor endowment and the labor need of one product give the total output of a sector. We have to divide it with the number of producers in a sector to get the output from a single variety (the production level of one firm).

3. $x1s = \frac{L1\ \beta 1}{\alpha 1\ K1}$

4. $x2s = \frac{L2\ \beta 2}{\alpha 2\ K2}$

Prices are set up in order to maximize profit at σ elasticity of demand, as we saw it in earlier cases. Companies utilize the monopolistic feature of their product that is why they set a price above their marginal cost (that is $\alpha 1$ in sector 1. and $\alpha 2\, w$ in sector 2.). Price of labor is unitary in sector 1., and it equals w in the other group.

There are two inputs labor and capital. Each company in the basic sector produces one variety using $\alpha 1$ labour to produce x1 output and $\beta 1$ capital as fix cost (5). Cost of labor is unitary, the return on capital is determined by market interaction. Because of monopostic competition companies face finite price elasticity (σ) that directs their pricing. Companies choose their

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output to maximize their profit (6), (7), (8). The price-output connection is directed by demand elasticity of varieties (9). Substituting it back to (8) we can express equilibrium price of varieties (9) and the return on capital (10).

5. $x1 = \alpha\, x1 + \beta 1$

6. $\pi = \mathrm{p1}(x1)\, x1 - \alpha 1\, x\, w1 - \beta$

7. $\frac{\partial}{\partial x1}\pi = \left(\frac{\partial}{\partial x1}\mathrm{p1}(x1)\right) x + \mathrm{p1}(x1) - \alpha 1$

8. $\left(\frac{\frac{\partial}{\partial x1}\mathrm{p1}(x1)}{\mathrm{p1}(x1)} + 1\right)\mathrm{p1}(x1) = \alpha$

9. $\frac{\frac{\partial}{\partial x1}\mathrm{p1}(x1)}{\mathrm{p1}(x1)} = -\frac{1}{\sigma}$

10. $p1 = \frac{\alpha 1\, \sigma}{\sigma - 1}$

The price in sector 2. is to be calculated similarly. The only difference is that now unit labor cost is not unitary but w.

11. $p2 = \frac{\alpha 2\, w\, \sigma}{\sigma - 1}$

The demand side defines the correspondence between output level of firms and prices similarly to previous cases (see Supplement I.2.1 for details).

12. $\frac{x1}{x2} = \left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$

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Substituting companies' price choice into this condition we can determine the equilibrium level of wage in sector 2. Equation 8. is the keystone of the model, because this is where supply of goods and demand for them is equated. If wages were lower than this level, the prices of sector would induce a demand higher than the equilibrium level. It motivates increase of production that leads to higher wages because labor supply is inelastic. These pressures work till the equalization of supply and demand of productive assets at the equilibrium wage level w.

13. $$\frac{x1}{x2} = \left(\frac{\alpha 2\, w}{\alpha 1} \right)^{\left(\frac{1}{1-\phi} \right)}$$

Substituting result of equation 3. and equation 4. we get an explicit expression for wage in sector 2. As we can see, assets and technology exogenously determines supply. Wage in sector 1. is unitary, so economic equilibrium emerges through the process that determines level of wages in sector two.

14. $$\left(\frac{\alpha 2\, w}{\alpha 1} \right)^{\left(\frac{1}{1-\phi} \right)} = \frac{L1\ \beta 1\ \alpha 2\ K2}{\alpha 1\ K1\ L2\ \beta 2}$$

15. $$w = \left(\frac{L1\ \beta 1\ K2}{K1\ L2\ \beta 2} \right)^{(1-\phi)} \left(\frac{\alpha 1}{\alpha 2} \right)^{\phi}$$

Companies have no profit because of free entry into the market, so they use all of their incomes to cover the costs of productive factors. Thus, capital returns are the incomes on unitary capital left after covering the costs of production.

16. $$r1 = \frac{x1\ (p1 - \alpha 1)}{\beta 1}, \quad r2 = \frac{x2\ (p2 - \alpha 2\, w)}{\beta 2}$$

Substituting equation 5. and 6. into equation 11. we can explicitly express the return of capital in both sectors.

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17. $$r1 = \frac{L1}{K1\,(\sigma - 1)}$$

18. $$r2 = \frac{\left(\frac{L1\,\beta 1}{K1\,\beta 2}\right)^{(1-\phi)} \left(\frac{L2\,\alpha 1}{K2\,\alpha 2}\right)^{\phi}}{\sigma - 1}$$

So we could express return on productive factors and output level of firms. The final step is to write up the utility function based on these results. Logic presented in Supplement I.2.1 is used to make this step simple. This framework gives utility (15) as the ratio of general price index (G – equation 14.) and income of actors.

19. $$G = \left(n1\,p1^{\left(\frac{\phi}{\phi - 1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi - 1}\right)} \right)^{\left(\frac{\phi - 1}{\phi}\right)}$$

20. $$u = \frac{inc\,(\sigma - 1)}{\alpha 1\,\sigma \left(\frac{K1 \left(1 + \left(\frac{K2\,\beta 1}{\beta 2\,K1} \right)^{(1-\phi)} \left(\frac{L2\,\alpha 1}{\alpha 2\,L1} \right)^{\phi} \right)}{\beta 1} \right)^{\left(\frac{\phi - 1}{\phi}\right)}}$$

$$u = \frac{(\sigma - 1)\,inc \left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1\,\sigma}$$

21. $$st = \left(\frac{L2}{\alpha 2} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} \left(\frac{K2}{\beta 2} \right)^{\left(\frac{1}{\sigma}\right)}$$

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Wage of labor and return on capital defines income after one unit of assets similarly to previous cases: Total income of a productive factor (the amount of it produced by the rate of return) is multiplied with the number of asset units possessed by owners.

22. $$inc_{work1} = \frac{L1}{n_{worker1}}$$

23. $$inc_{work2} = \frac{L2\left(\frac{L1\ \beta 1\ K2}{K1\ L2\ \beta 2}\right)^{(1-\phi)}\left(\frac{\alpha 1}{\alpha 2}\right)^{\phi}}{n_{worker2}}, \quad inc_{worker2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}}{n_{worker2}}$$

24. $$inc_{capital1} = \frac{L1}{(\sigma-1)\,n_{capital1}}$$

25. $$inc_{capital2} = \frac{L2\left(\frac{L1\ \beta 1\ K2}{K1\ L2\ \beta 2}\right)^{(1-\phi)}\left(\frac{\alpha 1}{\alpha 2}\right)^{\phi}}{(\sigma-1)\,n_{capital2}}, \quad inc_{capital2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}}{n_{capital2}\,(\sigma-1)}$$

Discussion of the Model

At first I will discuss these results, then I will look at the detailed effect of economic characteristics on the utility of representative actors following the logic of analysis presented in the previous chapter.

As we can see, there is no qualitative difference between the utility function of capital and labor owners in any of the sectors in this setting. Their shares from the income of the sector are determined by the elasticity of substitution as we could see earlier. This inherent characteristic of the utility function - that expresses the consumers' desire for diversity – directs the monopolistic nature of the market. Return on capital depends on this effect: capital owners income is the surplus above marginal costs from sales and it depends on how much extra price the buyers pay because of some unique characteristics of a variety. This willingness to pay depends on preferences, thus the division of incomes between labor and

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capital owners depends purely on characteristics that are exogenous. This concordance of asset owners is natural consequence of the fact that the two type of actors possess factors that are complementary for them to generate income: none of them has an option to utilize their assets without the others and market forces do not influence their shares from this common enterprise. Of course these conditions may cause fierce distributive conflicts among them but these types of conflicts are outside the scope of this dissertation. From economic point of view the capital and labor owners are strong alliances because their reaction to any kind of change of economic conditions corresponds with each other perfectly. Because of this full accordance the further analysis will focus only on the difference and similarity of the representative actor of the two sectors.

Statement 1. Asset owners in the two sectors evaluate similarly the change of economic characteristics in general. Utility of economic actors increases if

- K1 or L1 or st rises
- $\alpha 1$, $\beta 1$, $\alpha 2$ or $\beta 2$ falls.

Proof – First order derivatives of utility function gives the result as it is presented in Appendix II.1.

The economic actors reflect similarly to exogenous shocks because of identical utility function and the role of market processes to spread impacts of exogenous changes similarly to the previous case. All actors' welfare increases if the labor endowment or labor productivity increases in any sectors. When labor endowment of sector 1 increases, labor owners in sector 1 enjoys the fruits of their higher income base, their capital owner partners enjoy the rise of income because of higher level of sales. Stakeholders of production in sector 2 realizes an increase of demand from actors of sector 1 that enables them to increase their prices that results higher earnings for them also. Fall of $\alpha 1$ results a general decrease of price level in the economy that increases the purchasing power of all actors. Higher endowment level or labor productivity of sector 2. increases capacity there that leads to higher income for producers, and the consumers from the other sector enjoys the fall of prices induced by the rise of supply.

Economic agents also agree concerning the evaluation of changes in the level of capital assets and the fix cost of production. If capital level increases or variety installation cost decreases in a sector, consumers enjoy the increasing variety of goods offered.

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Although the general reaction of sectors is identical, the detailed mechanism behind the impact of changing economic circumstances are not the same in the two sectors - mainly because the price of labor, thus price of products made in sector 1. are assumed to be unitary similarly to previous case. Due to this choice of unit, the owners of sector 1. do not enjoy the positive income effects of increasing variety of their products as it happens in sector 2. The policy responses of actors will be influenced by this asymmetry. As we discussed earlier, some exogenous stabilization effect can give this 'fix point' nature of labor in sector 1. The two more feasible explanations for this exogeneity are the following ones:

- Sector 1. uses mostly unskilled labor where purely demographic features determine labor supply and goods shape the price of labor mostly that can be perceived really basic ones like food. Thus, sector 1 represents the traditional, low skill based sectors like agriculture, textile, basic services, meanwhile sector 2 represents the sectors with more skill based industry and services with higher value added.[46]
- The labor force in sector 1. is used by one another sector that determinates its price. For example the same labor pool is used by sectors where price, consequently wage is determined by international market.[47]

Statement 2. - Both labor and capital owners' incomes increase if L1 rises (although in different pace). Income of actors in sector 2 is insensitive to other economic characteristics. Their income increases with $\alpha 1$, $\beta 1$, L2 and K2 and decreases with K1, $\alpha 2$, $\beta 2$.

Proof – First order derivatives of sectoral incomes give the result. See Appendix II.2.

Table 1. presents the effect of economic characteristics on the utility of actors in sector 1. As we can see, the only economic characteristic with positive income effect is the labor endowment of the sector, but increasing labor endowment has a negative effect on economic structure (because it induces rise of prices in sector 2.). Other variables do not have effect on income of actors in sector 1. and they have a positive effect on economic structure. Fall of production costs in any sectors and rise of labor endowment in sector 2. reduce prices, more capital or lower fix costs increase diversity of supply.

[46] Concerning differentiation of traditional and modern sector see Banerjee and Duflo (2005)
[47] The crucial role of biggest export sector is emphasized by Shafer (1994)

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Table 1. Effect of economic characteristics on utility of actors in Sector 1.

	Positive Structural Effect	Negative Structural Effect
Positive Income effect		L1
No Income Effect	$\frac{1}{\alpha 1}$, K1, $\frac{1}{\beta 1}$, L2, K2, $\frac{1}{\alpha 2}$, $\frac{1}{\beta 2}$	$\alpha 1$, $\beta 1$, $\alpha 2$, $\beta 2$

The structural part of the utility function is identical for the agents of the two sectors, but the income effects differ. The earning of asset owners in sector 2. increases when they have more assets or they need less of these to produce the same amount of goods. They also enjoy higher earnings if L1 rises because it induces higher demand, hence higher price for their products. When sector 1. realizes fall in costs of production, they will have a relative price advantage that has a negative effect on income in sector 2. Improved capital endowment in sector 1. directs demand toward sector 1. also, because it induces higher variety of products. It also enforces actors of sector 2. to mitigate their prices, that reduces their income too.

Table 2. Effect of economic characteristics on utility of actors in Sector 2.

	Positive Structural Effect	Negative Structural Effect
Positive Income effect	L2, K2, $\frac{1}{\alpha 2}$, $\frac{1}{\beta 2}$	L1, $\alpha 1$, $\beta 1$,
Negative Income Effect	$\frac{1}{\alpha 1}$, K1, $\frac{1}{\beta 1}$	$\alpha 2$, $\beta 2$

As we could see in the previous subchapter differences in policy reaction are consequences of these differences in the impact of economic characteristics on income relevant part of the utility function

Introduction of Policy

The conceptualization of public interventions follows the approach introduced and discussed in the previous chapter. Income is taxed and this public revenue is used to finance modification of an economic characteristic into a direction that increases utility of economic actors (22).

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26. $u = (\mathrm{f}(t) - t_{ind})\, \mathrm{g}(t)$

Two representative actors will represent the two sectors. As I argued earlier, it is not worthwhile to distinguish the capital and labor owners inside a sector because their utility function have no other difference than their share from sectoral earnings that depends on the characteristics on the utility function of consumers that is taken exogenous in this setting.

27. $f_{sector1} = \frac{L1}{n_1}$, $f_{sector2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}}{n_2}$, $st = \left(\frac{L2}{\alpha 2}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{K2}{\beta 2}\right)^{\left(\frac{1}{\sigma}\right)}$

28. $g = \frac{\left(\frac{K1\left(1 + \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{\alpha 1}$

In this model the background of variables is slightly different compared to the previous case. Sector 1. is interpreted as the basic sector using productive inputs with exogenously (naturally, demographically, internationally) determined prices and sector 2. is the sector using more sophisticated inputs for production.

These inputs of production are L1 and L2. They represent not only labor but also other factors that are used in proportion with the level of output, like raw materials or energy. Thus, not only public programs that enhances labor endowment (like education, incentives for labor market participation, health care) increases the value of these variables but public activities that increase the amount of available raw materials of production also (e.g. public support to mining or energy production).

The direct cost of production ($\alpha 1$, $\alpha 2$) refers to technology and transaction costs of firms' everyday activity. The labor and raw material oriented sector 1. produces cheaper if they need less worker or energy to produce the same amount of output or transportation costs decrease. The sectors become more efficient if they cut their costs through better technologies or the

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number and cost of necessary transactions like contracting and enforcement, marketing, public procedures falls.

K1 and K2 represents the resources, $\beta 1$ and $\beta 2$ refers to the costs that are necessary to start the production of a new variety in the relevant sector. A new variety qualitatively differs from the other ones. The most straightforward interpretation of fix cost is the necessary investment to install the capacities to produce through buying land or buildings and machines. We have to be cautious with this approach because fix cost refers to purely output independent inputs of economic activity. If agricultural output is in close relation with the size of cultivated land, if industrial output moves together with the number of machines, then these assets belongs to L1 and L2 in the model. It is better to interpret fix cost related variables as conceptualization of entrepreneurial skills and efforts.[48]

Different varieties in both sectors can be interpreted as submarkets with several companies. In this approach creation of a new variety may refer to the innovation of a new type of product. In this case K represents the special resources used by a pathfinder and her income is the extra profit created before the followers arrive and makes the market competitive. Design of a variety can be the creation of a previously missing market, where fix cost (K) represents the cost to build the new market and variable cost (L) is the cost of companies entering this market. The cost of market creation may refer to the administrative costs of enabling transactions in this market for example the foundation of stock markets or the development of techniques that makes it feasible to buy via Internet. K1 or K2 represents the resources used by the 'market creator' who gets income through some services or fees paid by producers or consumers of the market.

Policies to raise K1 or K2 support the accumulation of knowledge and skills and funding resources that are necessary to create qualitatively new products in a sector. Higher education, innovation policies, maintenance of stability that channels creative energies from permanent accommodation into invention belongs to this category beside availability of investment funds. Public activities to decrease $\beta 1$ or $\beta 2$ decreases the cost of creating a new variety through decreasing the transaction costs to start something new. These costs can be mitigated also through the reduction of risks with more transparent and predictable market environment. Development of venture capital markets may reduce risks and decrease direct costs via lower

[48] See Martin and Rogers (1994a)

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interest rates also. Regulation or separated public treatment of sector relevant innovative resources can help the differentiation of sector relevant policy variables.

Effect of Exogenous Changes on Policy

Because of the differences in the details of the utility functions discussed above, the representatives of sector 1. and sector 2. will not always agree on the optimal reaction in the field of public development activities when exogenous effects change the characteristics of their economy. The logic of analysis is fully identical with the approach of the previous chapter. Comparative statics method is used to calculate the direction of change in the optimal spending level on different policies.

Statement 3. The optimal size of policies increasing labor endowment in sector 1. for actors in sector 1. rises if exogenous effects increase capital endowment in sector one (K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

Statement 4. The optimal size of policies that increase capital endowment in sector 1. rises for actors in sector 1. if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when capital endowment of sector 1 increases (K1 goes up) or sector 2 develops (st goes up).

Statement 5. The optimal size of policies that increase labor productivity in sector 1. rises for actors in sector 1. if exogenous effects increase labor or capital endowment in sector 1. (L1 or K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

Statement 6. The optimal size of policies that increase capital productivity in sector 1. rises for actors in sector 1 if exogenous effects increase labor or capital endowment in sector 1. (L1 or K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

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Statement 7. The optimal size of policies that increase the level of endowments or improve prodctivity in sector 2. rises for actors in sector 1 if exogenous effects increase labor endowment in sector 1. (L1 up). Optimal size of this policy decreases when capital endowment in sector 1. raises (K1 goes up), technology of sector 1. improves ($\beta 1$ or $\alpha 1$ goes down) or sector 2 develops (st goes up).

Statement 8. The optimal size of policies that increase the level of labor endowment in sector 1. rises for actors in sector 2 if exogenous effects improve situation of sector 2. (st goes up). Optimal size of this policy decreases when situation of sector 1.becomes better (L1 or K1 goes up, $\beta 1$ or $\alpha 1$ goes down) .

Statement 9. The optimal size of policies that increase the level of capital endowment in sector 1. rises for actors in sector 2 if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when situation of sector 1.becomes better (K1 goes up, $\beta 1$ or $\alpha 1$ goes down) .

Statement 10. The optimal size of policies that imporve labor technology in sector 1. rises for actors in sector 2 if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or capital productivity of sector 1.becomes better (K1 goes up, $\beta 1$ goes down) .

Statement 11. The optimal size of policies that improve capital technology in sector 1. rises for actors in sector 2. if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or labor productivity of sector 1.becomes better (K1 goes up, $\alpha 1$ goes down) .

Statement 12. The optimal size of policies that develop sector 2. rises for actors in sector 2. if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or productivity of sector 1.becomes better (K1 goes up, $\alpha 1$, $\beta 1$ goes down) .
The proof of these statements is presented in Appendix II.3-II.12.

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Table 4. and Table 5. summarize the results of this analysis. As in the previous subchapter. The rows of the tables show how exogenous change of economic characteristics effect the optimal size of policy named in the first column of the tables; + means that exogenous shock motivates expansion, - indicates that change motivates to propose contraction of policy.

Table 4. Optimal Policy of actors in Sector 1.

	When				
	L1	K1	St	$\alpha 1$	$\beta 1$
	Rises			Falls	
Actors in sector 1. propose to modify the size of public development activities					
To increase labor endowment in sector 1.	**?**	+	-	+	+
To increase capital endowment in sector 1.	+	-	-	+	+
To increase endowment level or improve productivity in sector 2.	+	-	-	-	-
To improve productivity of labor in sector 1.	+	+	-	+	+
To improve productivity of capital in sector 1.	+	+	-	+	+

Policy preferences of actors in sector 1. are clear in this case:

1. The optimal size of public activities to develop their sectors increases for them if they realize progress of their sector Expect the case when rise of capital level in sector 1. motivates to propose lower level of public activity in this field.[49]
2. The development of sector 2. motivates them to propose lover level of public development activities.
3. Any economic progress except the raise of labor endowment in sector 1. motivates them to propose contraction of policies to develop sector 2.

These three general effects suggest that actors in sector 1. are not simply self regarding (they want more public spending on their own development when their economic prospects are better) but they are also hostile to the other sector: improvement of their own economic conditions motivate them to propose lower public spending on the development of sector 2. The only case when this hostility does not work is when higher labor endowment enables sector 1. to increase the output of its varieties. On the other side development of sector 2. has

[49] The assumption of independence between the ex ante policy value of a variable and the modifying effect of policy is responsible for this effect: the increasing capital level reduces the relative impact of this policy. Observing the utility function, we can see that K1 and $\beta 1$ appears always together because the effect of capital depends on the cost of its application. Because of this connected role when K1 increases, then relative impact of policy to decrease K1 increases. Consequently when K1 rises it becomes more promising to decrease the cost of its application relative to its further enhancement.

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a negative effect on policy attitudes of sector 1.: they would like to see contraction of all public development activities in this case.

Table 5. Optimal Policy of actors in Sector 2.

	When				
	L1	K1	St	$\alpha 1$	$\beta 1$
	Rises			Falls	
Actors in sector 1. propose to modify the size of public development activities					
To increase labor endowment in sector 1.	-	-	+	-	-
To increase capital endowment in sector 1.	+	-	+	-	-
To increase endowment level or improve productivity in sector 2.	+	-	+	-	-
To improve productivity of labor in sector 1.	+	-	+	**?**	-
To improve productivity of capital in sector 1.	+	-	+	-	**?**

The economic position of sector 2. makes its stakeholders more munificent in the field of public development activities.

- They increase their demand for public development activities in general when characteristics of sector 2. improve or when level of labor endowment in sector 1. becomes higher. The only exception is that the optimal size of public activity to increase L1 decreases when L1 rises.
- They cut their preferred tax level in all policies if technology in sector 1. becomes more efficient or this sector becomes more rich in capital. Better technological conditions may induce them to propose higher spending on their further improvement if public intervention is efficient enough in these fields.

The main reason of this more encompassing approach is that income of actors in sector 2. increases with L1 and st. It enlarges the positive effect of policies that improves the structural factors of utility, including the progress in sector 1.

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Table 6. Agreements and disagreements concerning public development activities

	When				
	L1	K1	St	$\alpha 1$	$\beta 1$
	Rises			Falls	
Actors in sector 1. propose to modify the size of public development activities					
To increase labor endowment in sector 1.	**Pro1/-**	**Pro1**	**Pro2**	**Pro1**	**Pro1**
To increase capital endowment in sector 1.	**+**	**-**	**Pro2**	**Pro1**	**Pro1**
To increase endowment level or improve productivity in sector 2.	**+**	**-**	**Pro2**	**-**	**-**
To improve productivity of labor in sector 1.	**+**	**Pro1**	**Pro2**	**Pro1/+**	**Pro1**
To improve productivity of capital in sector 1.	**+**	**Pro1**	**Pro2**	**Pro1**	**Pro1/+**

Table 6. summarizes the comparison of desired policy responses in case of different exogenous economic changes. If actors of both sectors agree concerning the proposed direction of policy modification, we can assume that the size of policy will change in the consensually desired way. If there is a discrepancy between actors intention concerning the right policy response, the exogenous shocks may have a smaller effect on the level of intervention.[50] Similarly to the previous chapter + and – indicates that the actors of the two sector agree about expansion or contraction in a certain policy field as a response to an exogenous shock. Pro1 means that optimal size of policy increases for agents of sector1 and decreases for asset owners in sector 2, Pro2 signs the opposite. Pro1/- and Pro1/+ mean that we do not know which of the indicated results is in effect. The comparison of policy responses gives the following main results:

- Only rise of labor endowment in sector 1. implies broad agreement about the preferred direction of policy change: economic actors agree about the expansion of all policies (except further rise of L1).
- Results show consensus in the policy to develop sector 2. when condition of sector 1. changes. Economic actors agree to cut spending when K1 increases or production costs ($\alpha 1$, $\beta 1$) fall and they support each other to expand public activity to rise L1.
- Representatives of the two sectors agree to cut programs to increase capital endowment in sector 1. when exogenous shocks imply its rise. There is a chance to agree in the field of technologies of sector 1. also. If public intervention is efficient

[50] As we discussed in the previous chapter disagreement in the direction of the optimal change can mean not only that tensions will increase concerning a public development activity, it is also possible that the positions will get closer to each other. Proposal of actors with reverse direction have the same outcome in both cases: the chance or the size of the policy change is small.

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enough in this field actors of sector 2. join to their colleges and increase the size of their optimal policy.

- In all other cases everyone upgrades the size of optimal policies if their sector develops.
- If both sectors dominates decisions concerning the development of their own sector, expansion of a policy is expected when the related characteristics of the relevant sector improves and contraction is probable when the other sector enjoys progress. There are two exception: sector 1. does not support rise of public spending to increase K1 when it raises exogenously and sector 2. does not loose motivation to support rise of public programs when L1 increases.
- If agents of sector 1. were powerful enough to govern decisions concerning public development activities, they would respond to all progress of their sector with expanded policies to develop themselves and to cut spending on the development of the other sector, and they would propose general reduction of public development activities when situation of sector 2. becomes better. The program of this sector is the following: ”Government should support me and disregard others when I am on a development path. If situation of other sector improves or mine becomes worse state should decrease its activity.”
- If actors of sector 2. were the decisive ones they would expand development policy in all field if L1 or st increases and they would contract public activities generally when capital level or technology parameters of sector 2 improves. Their political program is the following: “Government must invest in all fields of development when human endowment of the basic sector increases or our sectors develop. In other cases state must withdraw from public development activities”.
- This results fits to the concepts of ‘poverty trap’ and conditional convergence. An economy opts for higher level of public development activities when it is better endowed with productive assets in the basic sector, so if these productive bases are weak, economic agents will opt for lower level of public intervention. Higher level of capital assets or development of more sophisticated sector rise divergence between sectors in the direction of rearrangement of optimal level public development activities that results lower responsibility to economic opportunities that can be interpreted as a political component of conditional convergence. Moreover progress in any fields except labor endowment of basic sectors motivate contraction of public support for the

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development of the more sophisticated sector that may decrease the development potential of more advanced economies also.

Comparison of the Two Models

The second sector is more sensible to the development of basic sector both in the second model based on monopolistic competition and in the previous model with perfectly competitive. There was consensus concerning the development of productive factor (labor) of the basic sector too. Economic sectors mostly agree concerning the development of sector 2. when condition of sector 1 changes in both cases also.
The main difference between the results of the two settings is that in the case of perfectly competitive sub-markets the basic (in the previous model labor) sector mostly agreed to propose more spending on the development of sector 2 when it developed, now – in case of one united market with monopolistic competition – actors of sector 1. are not supportive in this field. In the previous model the two sectors competed only in price: both of them produced only one type of good and the cheaper one could get a higher market share. Now the two company groups compete not only in price (scale) but also in number of varieties their sector offers (scope).

The next chapter will present two models without qualitative differences of the two sectors. The first one assumes that the two sectors of economy share not only the product market but they hire the labor from the same market also. The second one is a close relative of this model but numeraire will be outside of the two analyzed sectors in that case. As we will see, these assumptions will diminish the asymmetries and changes the nature of conflicts between the two sectors.

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Supplement I.2.1. – General description of consumption side in monopolistic competition models

Now let's assume an economy with more goods that are not perfect substitutes of each other. This substitution effect is conceptualized with CES utility function.

Now there are varieties in the economy and the elasticity of substitution is σ between them. I will assume in each model that varieties have two separate groups. The two groups represent companies with different technologies, location or identity in the models.

Number of varieties is n1 in the first group and n2 in the second one (in the first model with perfectly competitive submarkets n1=1, n2=1). The representative actor consumes x1 from the varieties belonging to the first group, and x2 is consumed from the goods of the second group.

1. $\phi = \frac{\sigma - 1}{\sigma}, \quad \sigma = \frac{1}{1 - \phi}$

2. $u = (n1\, x1^{\phi} + n2\, x2^{\phi})^{\left(\frac{1}{\phi}\right)}$

Price of goods is p1 in the first group, p2 in the second group. The total spending of representative actor is In.

3. $In = n1\, p1\, x1 + n2\, p2\, x2$

The consumption share of goods can be expressed using constrained optimization with Lagrange method. Variable Inc refers to the income of the representative actor. The constraint that directs the solution is that consumption and income must be equal. This approach discloses the temporary transfer of money. It can be interpreted in two ways:

(1) Monetary products are parts of the utility function: people always maximize their utility in the given condition, even if they buy or sell future opportunities. Insurances, borrowing, lending can be symbolized by goods.

(2) The second option develops the previous approach further: utility function represents the net present value of all consumption decisions. All economic variables: endowments, technological characteristics, incomes, consumption shares, policies are represented in this

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way. Consequently what our model describes is a static representation of the economic path expected by the representative economic actor.

4. $Lag = (n1\ x1^{\phi} + n2\ x2^{\phi})^{\left(\frac{1}{\phi}\right)} - \mu\ (n1\ p1\ x1 + n2\ p2\ x2 - Inc)$

We get the consumption share of two goods expressing μ from $\frac{\partial}{\partial x1} Lag$ and $\frac{\partial}{\partial x2} Lag$ and equating them.

5. $x1 = x2 \left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$

The optimal level of x1 as a function of utility, prices and number of varieties in the two groups can be expressed using this result.

6. $x1 = \frac{u\ p1^{\left(\frac{1}{\phi - 1}\right)}}{\left(n1\ p1^{\left(\frac{\phi}{\phi - 1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi - 1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$

7. $x2 = \frac{u\ p2^{\left(\frac{1}{\phi - 1}\right)}}{\left(n1\ p1^{\left(\frac{\phi}{\phi - 1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi - 1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$

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The income as a function of utility, prices and number of varieties can be expressed using this result.

8. $$In = \frac{u\left(n1\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)}{\left(n1\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$$

Let's introduce G, the price index of economy based on this result. In this way we can simply express the connection between income and utility. Because spending equals income, this representation expresses individual utility as a function of income and economic characteristics.

9. $$G = \left(n1\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{\phi-1}{\phi}\right)}$$

10. $$u = \frac{In}{G}$$

11. $$u = \frac{Inc}{G}$$

This framework shows how economic features shape utility. These results will be used for all of the CES models that give insights about different qualitative aspects of economic structure in order to present various ways of this equilibrium process between supply and demand.

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Supplement I.2.2. – Comparative Statics Analysis of Public Development Activities

The optimal level of tax for characteristics that influence income level of actors can be analyzed using the general utility function

1. $u := \theta\,(\mathrm{f}(t) - t)\,\mathrm{g}(t)$, $\theta = \dfrac{k}{n_{capital}}$ or $\theta = \dfrac{l}{n_{worker}}$

θ expresses the share of income and public contribution of individual actor in his asset owner group.

We get a condition for optimal level of public development activity with unconstrained optimization

2. $\dfrac{\partial}{\partial t} u = 0$

3. $\dfrac{\left(1 - \left(\dfrac{\partial}{\partial t}\mathrm{f}(t)\right)\right)\mathrm{g}(t)}{(\mathrm{f}(t) - t)\left(\dfrac{\partial}{\partial t}\mathrm{g}(t)\right)} = 1$

The analysis of Second Order Condition shows that FOC gives an optimum only if the efficiency decline of public intervention is sufficiently fast.

4. $soc1 := \theta\left(\dfrac{\partial^2}{\partial t^2}\mathrm{f}(t)\right)\mathrm{g}(t) + 2\,\theta\left(\left(\dfrac{\partial}{\partial t}\mathrm{f}(t)\right) - 1\right)\left(\dfrac{\partial}{\partial t}\mathrm{g}(t)\right) + \theta\,(\mathrm{f}(t) - t)\left(\dfrac{\partial^2}{\partial t^2}\mathrm{g}(t)\right)$

5. $\dfrac{\partial^2}{\partial t^2}\mathrm{f}(t) < \dfrac{(-\mathrm{f}(t) + t)^2\left(\dfrac{\partial^2}{\partial t^2}\mathrm{g}(t)\right) - 2\,\mathrm{g}(t)\left(\left(\dfrac{\partial}{\partial t}\mathrm{f}(t)\right) - 1\right)^2}{(-\mathrm{f}(t) + t)\,\mathrm{g}(t)}$

Th First Order Condition will be used for comparative statics analysis based on Implicit function Theorem as in previous cases.

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6. $$G := \frac{\left(1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t)\right)\right) \mathrm{g}(t)}{(\mathrm{f}(t) - t)\left(\frac{\partial}{\partial t} \mathrm{g}(t)\right)}$$

7. $$\frac{\partial}{\partial x} t = -\frac{\frac{\partial}{\partial x} G}{\frac{\partial}{\partial t} G}$$

At first let's look at $\frac{\partial}{\partial t} G$!

8. $$\frac{\partial}{\partial t} G = -\frac{\left(\frac{\partial^2}{\partial t^2} \mathrm{f}(t)\right) \mathrm{g}(t)}{(\mathrm{f}(t) - t)\left(\frac{\partial}{\partial t} \mathrm{g}(t)\right)} + \frac{1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t)\right)}{\mathrm{f}(t) - t} - \frac{\left(1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t)\right)\right) \mathrm{g}(t)\left(\left(\frac{\partial}{\partial t} \mathrm{f}(t)\right) - 1\right)}{(\mathrm{f}(t) - t)^2\left(\frac{\partial}{\partial t} \mathrm{g}(t)\right)}$$
$$- \frac{\left(1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t)\right)\right) \mathrm{g}(t)\left(\frac{\partial^2}{\partial t^2} \mathrm{g}(t)\right)}{(\mathrm{f}(t) - t)\left(\frac{\partial}{\partial t} \mathrm{g}(t)\right)^2}$$

Using the first order condition it can be simplified in to the following form:

9. $$\frac{\partial}{\partial t} G = \frac{-(-\mathrm{f}(t) + t)^2\left(\frac{\partial^2}{\partial t^2} \mathrm{g}(t)\right) + \mathrm{g}(t)\left((-\mathrm{f}(t) + t)\left(\frac{\partial^2}{\partial t^2} \mathrm{f}(t)\right) + 2\left(\left(\frac{\partial}{\partial t} \mathrm{f}(t)\right) - 1\right)^2\right)}{\left(\left(\frac{\partial}{\partial t} \mathrm{f}(t)\right) - 1\right)(-\mathrm{f}(t) + t)\,\mathrm{g}(t)}$$

10. $$\frac{\partial}{\partial t} G = \frac{dGta}{\left(\frac{\partial}{\partial t} \mathrm{f}(t)\right) - 1}$$

11. $$dGta = \frac{-(-\mathrm{f}(t) + t)^2\left(\frac{\partial^2}{\partial t^2} \mathrm{g}(t)\right) + \mathrm{g}(t)\left((-\mathrm{f}(t) + t)\left(\frac{\partial^2}{\partial t^2} \mathrm{f}(t)\right) + 2\left(\left(\frac{\partial}{\partial t} \mathrm{f}(t)\right) - 1\right)^2\right)}{(-\mathrm{f}(t) + t)\,\mathrm{g}(t)}$$

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$dGta < 0$ if SOC is satisfied:

Consequently

12. $\frac{\partial}{\partial t} G < 0$ if $0 < \left(\frac{\partial}{\partial t} \mathrm{f}(t) \right) - 1$

13. $0 < \frac{\partial}{\partial t} G$ if $\frac{\partial}{\partial t} \mathrm{f}(t) < 1$

It is hard to check this condition but using result of FOC we get a more convenient condition

14. $G := \frac{\left(1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t) \right) \right) \mathrm{g}(t)}{(\mathrm{f}(t) - t) \left(\frac{\partial}{\partial t} \mathrm{g}(t) \right)}$ gives that $0 < 1 - \left(\frac{\partial}{\partial t} \mathrm{f}(t) \right)$ if $0 < \frac{\partial}{\partial t} \mathrm{g}(t)$

Thus

15. $\frac{\partial}{\partial t} G < 0$ if $0 < \frac{\partial}{\partial t} \mathrm{g}(t)$

16. $0 < \frac{\partial}{\partial t} G$ if $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$

To find the sign of $\frac{\partial}{\partial x} G$ I will use the conditions that comes from

17. $1 = \frac{\left(1 - \left(\frac{\partial}{\partial t} \mathrm{f}(x, t) \right) \right) \mathrm{g}(x, t)}{(\mathrm{f}(x, t) - t) \left(\frac{\partial}{\partial t} \mathrm{g}(x, t) \right)}$

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It usually gives a condition for the first derivative of the policy variable like $\frac{\partial}{\partial t}\mathrm{L}(t)$ or $\frac{\partial}{\partial t}\beta(t)$ directly. It also helps the analysis when

$$18.\ t = \frac{-\mathrm{g}(x,\,t) + \mathrm{g}(x,\,t)\left(\frac{\partial}{\partial t}\mathrm{f}(x,\,t)\right) + \left(\frac{\partial}{\partial t}\mathrm{g}(x,\,t)\right)\mathrm{f}(x,\,t)}{\frac{\partial}{\partial t}\mathrm{g}(x,\,t)}$$

An expression for optimal tax level is substituted. The condition t>0 also frequently helps the analysis. These two conditions and the substitution of t into $\frac{\partial}{\partial x}G$ are usually satisfactory to calculate its sign.

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Chapter I.3. - Monopolistic Competition in a Two Sector Economy with Qualitatively Identical Economic Status

The qualitative difference between the two sectors based on the assumption that price of labor is fixed in one of the sectors and market forces shape it in the other one was the basis for many results in the previous chapter. As I argued there, this numeraire choice reflects the real economic processes to a certain extent, because some asset prices are more sensible to exogenous shocks than others. Now I will present models without this asymmetric responsiveness of asset prices, to see how demand for public development activities reflects economic changes when only the sector specific assets are different in the two parts of the economy and the two sectors reflect similarly in similar situations.

The results are symmetric now, consequently less exciting then in the previous chapter, but the assumptions behind them are far more general. There are two sectors with sector specific assets in a world of monopolistic competition and policies with decreasing marginal utility. As we will see, the introduction of sectoral symmetry will have one more merit: the key characteristics of the general equilibrium (utility function and income of asset owners) have a far more simple expression than in the previous chapter. It makes policy analysis simpler also and promises more opportunities for further applications.

In the first setting I will assume that the two sectors use the same labor pool beside different sector specific capitals. In the second model I will assume that the numeraire good of the economy is exogenous from the perspective of the analysis.

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I.3.1. Two company groups on the same product and labor markets

Now I assume that companies are interlinked not only in the product market, but in the labor market also. In previous cases it was assumed that all goods are sector specific. Now a non-sector specific asset will be introduced. I assume that companies use the same type of output for production (that is labeled labor), and they differ only in the type of capital that is used to install productive capacities. The economic model applied now is modified only in one way compared to the previous one: now economic adjustment happens not through the compensation of productive factors (labor) but through the amount of them used by different sectors. This modification has several merits. The asymmetry between sectors disappears and we can analyze the interaction of three groups (labor owners and owners of specific capital used in the two sectors) that increases the applicability. From technical point of view the representation of utility functions will be far simpler than in the previous two cases.

Results of analysis show that there is no exogenous shock that would induce consensual modification of public development activities. There will be no issue where capital owners of the two sectors agree.

At first I present the model, then I discuss its implications for public development activities.

The Model

Two groups of companies compete on the same market and they use sector specific capital and the same type of labor for production. Each company produces a separate variety, their monopolistic competition shapes the prices.

Capital refers to sector specific resource applications. Its owners are locked into the companies, thus their returns fluctuate with output and price prospect of companies: If firms are better off they can earn more, if their sales shrink they can get less. Capital need of a company is independent of its output, it reflects to the fix cost of operations. Labor owners sell their assets to the companies, and their efforts are in linear connection with the output of firms. Thus 'labor' represents all productive suppliers of companies who offer their services, goods in a market price that is independent of the companies' success or failure.

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The two groups use different sector specific capitals, the first one needs $\beta 1$ unit of K1, the second sector needs $\beta 2$ unit of K2 to set up production. Both groups use the same labor pool, $\alpha 1$ unit of labor is necessary to produce one unit of output in the first group, $\alpha 2$ labor is used for unitary production in the second group. The two groups of companies face the same markets both in input and output side. Prices of goods governed by the same elasticity of substitution (σ) for all of them, and they have to pay the same price of productive inputs represented by labor.

Ratio of output levels of the two company groups depends on their prices and elasticity of substitution $1 < \sigma$ ($\phi = \frac{\sigma - 1}{\sigma}$, $\phi < 1$). For details of description concerning the consumption side see Supplement I.2.1.

1. $$\frac{x1}{x2} = \left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$$

The price level of the economy is determined by prices, elasticity and number of varieties (n1, n2) in the two groups.

2. $$G = \left(n1\, p1^{\left(\frac{\phi}{\phi - 1}\right)} + n2\, p2^{\left(\frac{\phi}{\phi - 1}\right)}\right)^{\left(\frac{\phi - 1}{\phi}\right)}$$

Capital is used to cover fix cost of production, thus share of all available capital and fix cost of one factory defines number of factories in the two groups.

3. $$n1 = \frac{K1}{\beta 1}, \quad n2 = \frac{K2}{\beta 2}$$

There is monopolistic competition so finite elasticity of substitution (σ) directs the profit maximizing behavior of companies. Profits are zero because there is no entry barrier. Price of labor is assumed to be unitary, price of sector specific capitals is defined by the zero profit condition as we could see in I.2.2.

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4. $p1 = \frac{\alpha 1\, \sigma}{\sigma - 1}$, $p2 = \frac{\alpha 2\, \sigma}{\sigma - 1}$

Prices determine the demand of different goods as we could see it in the previous cases.

5. $\frac{x1}{x2} = \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(\frac{1}{1-\phi}\right)}$

The only difference compared to the previous model is that market equilibrating forces works now through the adjustment of variety level of outputs and not through wage levels. Labor is used by both groups, their share depends on the number of companies, the per unit labor need of production and output.

6. $n1\, x1\, \alpha 1 + n2\, x2\, \alpha 2 = L$

Elasticity of substitution and cost of production determines prices in both sectors (4.) and these prices direct the relative demand for different varieties (5.). At equilibrium output level of companies the supply and demand for a certain good is equal. Equations (7-9.) shows the logic how equation of supply and demand gives an explicit formula for outputs. Substituting (7) into (1) we get equation (8). Expressing x1 from it we get the result (9).

7. $x2 = \frac{L - n1\, x1\, \alpha 1}{n2\, \alpha 2}$

8. $\frac{x1\, n2\, \alpha 2}{-n1\, x1\, \alpha 1 + L} = \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(\frac{1}{1-\phi}\right)}$

9. $x1 = \frac{L}{n1\, \alpha 1 + n2 \left(\frac{p1}{p2}\right)^{\left(\frac{1}{1-\phi}\right)} \alpha 2}$

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Following this logic we can explicitly express the level of outputs in the other sector also. Using these results with equation (3.) and (4.) we can express the equilibrium output of firms for both company groups.

$$10.\quad x1 = \frac{L\,\beta 2\left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\beta 1}{\beta 1\,K2\,\alpha 2 + \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\beta 2\,K1\,\alpha 1}$$

$$11.\quad x2 = \frac{\beta 1\,L\,\beta 2}{\beta 1\,K2\,\alpha 2 + \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\beta 2\,K1\,\alpha 1}$$

Knowing prices, costs and output level we can calculate the capital returns. As in previous cases, capital return equals the net income (that remains for the capital owners after covering variable costs) per capital used by the company.

$$12.\quad r1 = \frac{x1\,(p1-\alpha 1)}{\beta 1},\ r2 = \frac{x2\,(p2-\alpha 2)}{\beta 2}$$

$$13.\quad r1 = \frac{L\,\beta 2\left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\alpha 1}{\left(\beta 1\,K2\,\alpha 2 + \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\beta 2\,K1\,\alpha 1\right)(\sigma-1)}$$

$$14.\quad r2 = \frac{\beta 1\,L\,\alpha 2}{\left(\beta 1\,K2\,\alpha 2 + \left(\frac{\alpha 2}{\alpha 1}\right)^{\left(-\frac{1}{\phi-1}\right)}\beta 2\,K1\,\alpha 1\right)(\sigma-1)}$$

Using these results utility and incomes can be expressed

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15. $$G = \frac{\left(\frac{K1\ \alpha 1^{\left(\frac{\phi}{\phi - 1}\right)}}{\beta 1} + \frac{K2\ \alpha 2^{\left(\frac{\phi}{\phi - 1}\right)}}{\beta 2} \right)^{\left(\frac{\phi - 1}{\phi}\right)}}{\sigma - 1}^{\sigma}$$

16. $$u = \frac{inc^{\sigma}}{\left(\frac{K1\ \alpha 1^{\left(\frac{\phi}{\phi - 1}\right)}}{\beta 1} + \frac{K2\ \alpha 2^{\left(\frac{\phi}{\phi - 1}\right)}}{\beta 2} \right)^{\left(\frac{\phi - 1}{\phi}\right)}}^{(\sigma - 1)}$$

17. $$inc_{worker} = \frac{L}{n_{worker}}$$

18. $$inc_{capital1} = \frac{K1\ \beta 2\ L}{\left(\beta 1\ K2 \left(\frac{\alpha 2}{\alpha 1} \right)^{\left(\frac{\phi}{\phi - 1}\right)} + K1\ \beta 2 \right) (\sigma - 1)\ n_{capital1}}$$

19. $$inc_{capital2} = \frac{\beta 1\ K2\ L}{\left(\beta 1\ K2 + \left(\frac{\alpha 2}{\alpha 1} \right)^{\left(\frac{\phi}{1 - \phi}\right)} \beta 2\ K1 \right) (\sigma - 1)\ n_{capital2}}$$

I introduce two variables to express the key functions in a more dense and transparent way. Variable ‘a’ expresses the situation of sector 1. , ‘b’ expresses the overall condition of sector 2.. The value of ‘a’ or ‘b’ is higher if the relevant sector has more capital or it needs less investment to introduce a new variety or less effort for production, so when it is more developed or it has higher market share.

20. $$a = \frac{K1}{\beta 1\ \alpha 1^{(\sigma - 1)}}\ ,\ b = \frac{K2}{\beta 2\ \alpha 2^{(\sigma - 1)}}$$

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The rewritten form of utility function using these abbreviations clearly shows, that utility of consumers increase if any of the two sectors becomes more developed. Because both industries use the same type of labor, there is no difference in their role in the utility of consumers – unlike in the previous settings.

$$21.\quad u = \frac{inc\,\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\sigma-1}$$

Income of workers depends on their endowment level.

$$22.\quad inc_{worker} = \frac{L}{n_{worker}}$$

Income of capital owners is strongly determined by labor pool also because more workers means higher level of production, higher sales, thus higher capital returns. Representative owners in both sectors realize higher income if their relative position compared to the other industry improves. In this case they can increase the number of their varieties that results higher demand for their products.

$$23.\quad inc_{capital1} = \frac{L}{\left(\frac{b}{a}+1\right)(\sigma-1)\,n_{capital1}}$$

$$24.\quad inc_{capital2} = \frac{L}{\left(\frac{a}{b}+1\right)(\sigma-1)\,n_{capital1}}$$

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Discussion of the Model

In this model the general consensus concerning the evaluation of economic events is not valid.

Statement 1. Labor owners utility increases when labor endowment increases or any of the sectors develops. Utility of capital owners increases if labor endowment increases or their sector develops and their utility decreases if the other sector develops.

Proof - First order derivatives of utility functions gives the result. See Appendix III.1.

Labor owners' welfare increases if their endowment level increases or prospects of any of the two sectors improve. Capital owners agree that rise of labor endowment is a good thing but their utility decreases when condition in the other sector improves. In previous models sectors competed only for the consumers: actors of a certain sector experienced some relative loss of market position when the other sector increased efficiency or variety but the improved consumption opportunities could compensate them. In the previous model labor and capital owners in a sector shared the benefits or costs of relative advantage or disadvantage in productive efficiency or diversity of variety. Now capital owners suffer or gain alone due to their better or worse market position, because price of productive factors is independent of the capital endowment and technological characteristics of economic sectors.

Labor owners' income is independent of sectoral characteristics, they enjoy the development of industries through the improvement of structural factors of the economy. Fall of production costs makes goods cheaper, rise of capital level or decline of fix costs to launch a new variety increases variety.

These positive structural effects are dominated by income factor for capital owners. They can earn more if economy increases in general because of enrichment of productive assets (L) because the return on capital is proportional to the volume of sales. If they can cut prices (because of lower production costs - $\alpha 1$ or $\alpha 2$) or they can increase the number of varieties offered by their industry (because of higher level of capital - K1 or K2 - or reduction of fix costs - $\beta 1$ or $\beta 2$), they can sell and earn more. Thus relative position becomes crucial for them: increasing consumer opportunities because of development in other sectors cannot compensate the loss of income induced by relative worsening of their market opportunities.

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Table 1. Income effect of economic characteristics

	Labor owners	capital owners in sector 1	capital owners in sector 2
Positive Income Effect	L	L, a	L, b
No income effect	a, b		
Negative income effect		b	a

Public Development Activities

The interpretation and conceptualization of public development activities is similar to the previous cases. Labor represents all the factors used for production, capital represents the assets that are necessary to establish producing facilities. There are three differences compared to the previous model in the terrain of policies:

- At first, the two sectors are perfectly symmetric in this model. In the earlier setting we had to fix the price of productive inputs in on of the sectors. It resulted qualitative differences in the utility function of actors and consequently in their policy reactions. Now we do not need to distinguish labor-oriented and capital or basic and sophisticated sector. Now the two company groups differ only in two ways: (1) they have different asset levels and technological characteristics; (2) they belong to different industrial communities, thus different collective actions.[51] The two groups can represent different sectors (like in previous case), companies with different size (large firms vs. small and medium enterprises), ownership background (domestic vs. multinational, traditional vs. modern), or location (companies of two towns or regions).
- At second, now price of policy is not bounded to one of the sectors. Increasing tax incomes relates to higher policy impact as we could see earlier but now the exogenously fixed price of policy that supports this assumption do not imply sectoral bias. Price of policy is fix as price of productive assets in the economy.
- At third, now actors propose policies with contradictory content: sectors would initiate public measures that increase prices or decrease capital level in the other group.

[51] We can even assume that the two company groups are technologically identical but they fight against each other to get selective support from government policies.

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Conflicts emerge not simply the optimal size of policies but there is lack of agreement about the basic meaning of them.

Because of these conflicts, if everyone has a natural advantage on the policy fields that target the development of characteristics that have direct (non market mediated) effect on their income, we enter a world where policies not only simply over- or undersized because of some bias in policy relevant influences but policies will emerge that are harmful for some other actors by their very nature. What is perceived as public good by one sector, that is public bad for the other one. Thus this approach is close to the perfect market situation discussed in chapter I.1. and it fits well to the standard approaches like Olson's redistributory coalition concept, Becker's interest group competition, Peltzman's policy for campaign contribution approach[52]: in this case public intervention in economic sectors have losers and winners.

The following statements present the effect of exogenous economic changes on the policy proposals of economic actors. The results concerning optimal policy of actors in sector 2. are logical transformations of statements concerning optimal policy for actors in sector 1. These statements are results of comparative statics, for details see Appendix III.

Statement 2. The optimal size of policy to increase labor endowment is independent of the economic characteristics for labor owners.

Statement 3. The optimal size of policies to develop economic sectors rises for labor owners if labor endowment increases. Labor owners do not modify the optimal size of these policies when sectoral characteristics change.

Statement 4. The size of optimal policy to increases labor endowment decreases for actors of sector 1. if exogenous shock improves the situation any of the economic sectors. The optimal size of this policy is not modified if labor endowment changes.

Statement 5. The size of optimal policy to develop sector 1. increases for actors of this sector if exogenous shocks increase labor endowment (L goes up) and size of optimal policy decreases if actors experience development of their own sector (a goes up). The development

[52] See Part II. for details.

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of the other sector (b goes up) motivates to propose policy expansion if actors' sector is sufficiently developed ($\frac{(\sigma-1)\,b}{\sigma-3} < a(t)$) and policy contraction is demanded if the other sector is sufficiently developed ($a(t) < \frac{(\sigma-1)\,b}{\sigma-2}$).

Statement 6. The size of optimal policy to develop sector 2. increases for actors in sector 1. if exogenous shocks increase labor endowment (L goes up) and the size of the policy decreases if sector 2. becomes more developed (b goes up). Development of sector 1. (rise of a) motivates actors to propose policy contraction if sector 1. is more developed than sector 2. (a>b) and to promote policy expansion if a is sufficiently less developed ($a < \frac{b(t)\,(\sigma-2)}{\sigma-1}$).

The following tables present the analysis of comparative statics concerning public development activities. As earlier, sign '–' shows that the optimal size of a given policy decreases for an actor and '+' indicates that the representative actor of one of the groups upgrade her desired level of public intervention.

Table 2. Labor owners' policy responses to exogenous economic shocks

Optimal Policy of Labor owners'	When		
	L	a	b
	Rises		
To increase amount of productive assets	**0**	**0**	**0**
To develop sector 1.	+	-	-
To develop sector 2.	+	-	-

Table 2. presents the response of labor owners to the exogenous shocks. Labor endowment defines their income and situation of the two sectors determine the structural factor of their utility. The optimal policy to improve labor endowment for them is independent of economic characteristics. At optimal level of policy the marginal income gain of public activity equals the marginal cost of tax that finances it, so this process is not influenced by condition of sectors. Higher income enlarges the importance of structural development, so rise of L motivates labor owners to propose expansion of public activities that improve the situation of

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any of the two sectors. When terms of production become better, labor owners reduce their optimal size of policy in the field of sectoral development because the intensified utility decreasing impact of taxation (through the increasing importance of economic structure) dominates possible gain of further expansion. Labor owners support public development activities when their endowment level increases and they become less enthusiastic about these policies when technology or capital assets improve.

Table 3. Capital owners policy responses to exogenous economic shocks in sector 1.

Optimal Policy of Capital owners' in Sector 1.	When		
	L	a	b
	Rises		
To increase labor endowment	**0**	+	-
To develop sector 1.	+	-	-/+*
To *decrease* development of sector 2.	+	+/-**	-

* it is negative if $a < \frac{(\sigma - 1)\, b}{\sigma - 2}$, it is positive if $\frac{(\sigma - 1)\, b}{\sigma - 3} < a$

** it is positive if $a < \frac{b\,(\sigma - 2)}{\sigma - 1}$, it is negative if $b < a$

Table 3. presents the policy responses of capital owners in the sector 1.. The reaction of the two groups is symmetrical: so table to show policy responses of sector could be created exchanging label 'a' and 'b' in Table 3.

Capital owners in sector 1. propose three types of policy: raise of labor endowment (L), improvement of condition in their own sector (a) and *deterioration* of conditions in the other sector (b). Capital owners support the expansion of policy to increase labor endowment when their situation becomes better and they reduce the size of the optimal level of public intervention in this field when the progress happens in the other sector. Because of symmetry it induces that the more developed sector (that has higher capital endowment and/or lower installation and production costs) will be more enthusiastic promoter of labor sector,

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consequently this one is the natural alliance for labor owners. Reaction of actors in sector 2. to exogenous shocks follows the same logic.

Sectoral representatives will initiate higher public spending to improve their capital endowment or technology if the amount of productive assets (L) is higher or the other sector becomes more developed and their company group is sufficiently developed compared to the other one. When some exogenous shock helps them through enhancement of their terms of production, they will opt for lower level of industrial development. They have the same reaction if the other sector prospers and they are less developed compared to them.
They become more eager concerning the destructive policy against the other sector if economic stakes increase because of higher overall production (increase of L) or when they are prosperous and relatively less developed. Their hostility decreases when the other sector increases (that makes them more sensitive to structural improvements because of lower income) or when they are sufficiently developed and develops further.

Table 5. Comparison of actors' policy reactions

The aggregated reaction of actors	When		
	L	A	B
	Rises		
To increase labor endowment	All actors agree to do nothing	L owners opt for no change K1 owners for expansion, K2 owners for contraction	L owners opt for no change K1 owners for contraction, K2 owners for expansion
To develop sector 1.	L and K1 owners support expansion, K2 owners would expand deterioration	L and K1 owners opt for reduction, K2 owners become less hostile	L owners opt for reduction, K1 owners opt expansion, K2 owners becomes less hostile
To develop sector 2.	L and K2 owners support expansion, K1 owners would expand deterioration	L and K2 owners opt for reduction, K1 owners become less hostile	L owners opt for reduction, K1 owners becomes less hostile, K2 owners opt expansion,

Table 5. summarizes the comparison of different actors' policy responses. The table is based on the assumption that sector 1. is sufficiently more developed than sector 2. to be decisive. As we can see, there is only one case when all actors have the same reaction to exogenous

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changes: rise of labor endowment motivates everyone to do nothing on the field of policies to increase amount of productive assets. So actors accept the status quo.

Options converge also concerning development of sectors when the situation in the more developed sector (a) becomes better. Labor owners and the direct beneficiaries of public development activities downgrade the optimal size of intervention, meanwhile the other sector becomes less eager to use the state for deterioration. So when the more developed sector becomes better off, the probable result is a peaceful public withdrawal.

When the prospects of the less developed sector (b) improves, the industry that would be the beneficiary of a policy opts for its expansion and the motivation of the other sector to turn back development becomes weaker. It could lead to the expansion of policy but labor owners oppose it.

In the field of enrichment of productive assets (L), its owners will opt for the status quo, the sector that experiences prosperous exogenous shock will opt for expansion, the other one for reduction.

If we assume that when two sectors opt for the same direction of change (decreasing hostility will be interpreted as a positive move), their coalition dominates the decision concerning expansion or reduction of a certain policy, we can predict enlargement of development policy in the following cases:

- Development of any of the two sectors when L increases – in this case the beneficiary industry gets the support of L owners that may be enough to compensate the growing hostility of the other sector
- Development of any of the two sectors when b increases - now the beneficiary sector proposes expansion, the other sector becomes less hostile but L owners opt for reduction of policy. Consequently the expansion is less probable in this case.

Based on similar logic, decline of public activities to develop the two sectors is probable when the situation of the more developed sector becomes better.

If we define a stricter criteria and we assume that change can happen only if the more developed sector is member of the majority of real beneficiaries, we may forecast increasing public development activity in the more developed sector when amount of productive assets (L) increases and reduction of this activity when the situation of beneficiary sector (a) improves. The first effect resembles to the poverty trap results of previous models, the second one seems to be a reincarnation of conditional convergence finding of previous analysis.

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Summing up, now there is not any case where the three types of actors agree about the direction of change. Real policy modification as a reaction to the change of economic characteristics has a high chance only in two fields. In case of public support for development of the sector in better situation expansion is the probable result of increasing amount of productive assets, reduction of public activities is expected when the beneficiary sector becomes better off. The policies to improve the situation of less developed sector (b) are probably reduced also if the other sector (a) prospers. In other cases the main conclusion is that change of interests due to exogenous shocks do not imply modification of policies.

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I.3.2. Monopolistic competition of two sectors with exogenous numeraire

This model is a modified version of the one presented in I.2.2. Now the asymmetry of sectors will be avoided in a different way, assuming that price of sector specific labors react to market condition in both sectors, similarly to capital.

The Model

In order to exclude fix price of productive asset in any one of the two sectors I assume that there is a third type of good that has only a technical role: this is the numeraire good. As in previous cases n1, n2 is the number of varieties in the two sectors, x1, and x2 is the amount of these varieties. As we could see earlier, $1 < \sigma$ ($\phi = \frac{\sigma - 1}{\sigma}$, $\phi < 1$)represents the elasticity of substitution between any two goods in the economy.

1. $u = (x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)}$

The budget constrain of the representative consumer is 'In'. Price of goods is p1 and p2 in sector 1. and sector 2.

2. $In = x0\,\phi + n1\,p1\,x1 + n2\,p2\,x2$

This numeriare good is x0, for sake of later simplicity I assume that $x0\,\phi$ is consumed from it at unitary price. I assume that this amount gives such a small part of the consumption that it has no effect either on utility or on income. Its key function is this disregardiblity because it enables us to treat the asset prices in both of the analyzed sectors in a way that makes the price of endowments reflective to economic conditions.

The solution of utility maximization for the budget constraint gives the correspondence between price and output of varieties in the two sectors. For details see Supplement I.3.1

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3. $x1 = \left(\frac{1}{p1\ \phi} \right)^{\left(\frac{1}{1-\phi} \right)}$, $x1 = \left(\frac{1\ \sigma}{p1\ (\sigma - 1)} \right)^{\sigma}$

4. $x2 = \left(\frac{1}{p2\ \phi} \right)^{\left(\frac{1}{1-\phi} \right)}$, $x2 = \left(\frac{1\ \sigma}{p2\ (\sigma - 1)} \right)^{\sigma}$

Now look at the production side. The level of sector specific capital endowments (K1, K2) and the fix costs of production ($\beta 1$, $\beta 2$) determine the number of varieties (n1 and n2).

5. $n1 = \frac{K1}{\beta 1}$, $n2 = \frac{K2}{\beta 2}$

The companies define their prices to maximize their profit as it was discussed in earlier: firms utilize the elasticity of substitution that determines the deviation from marginal cost. Marginal cost is constant because of linearity in production function, one unit of output needs $\alpha 1$ or $\alpha 2$ unit of labor at price w1, w2.

6. $p1 = \frac{\alpha 1\ w1\ \sigma}{\sigma - 1}$, $p2 = \frac{\alpha 2\ w2\ \sigma}{\sigma - 1}$

The output of firms is defined by endowments and technologies because in equilibrium all assets are fully utilized.

7. $x1 = \frac{L1\ \beta 1}{\alpha 1\ K1}$, $x2 = \frac{L2\ \beta 2}{\alpha 2\ K2}$

In equilibrium supply and demand of goods is equal and this equilibrium determines wage level in both sectors.

8. $\frac{L1\ \beta 1}{\alpha 1\ K1} = \left(\frac{1}{\alpha 1\ w1} \right)^{\sigma}$, $\frac{L2\ \beta 2}{\alpha 2\ K2} = \left(\frac{1}{\alpha 2\ w2} \right)^{\sigma}$

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9. $w1 := \left(\frac{K1}{L1\ \beta 1\ \alpha 1^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)}$, $w2 := \left(\frac{K2}{L2\ \beta 2\ \alpha 2^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)}$

Return on capital depends on the firms input above marginal cost.

10. $r = \frac{x\,(p - \alpha\, w)}{\beta}$

Substituting the variables into this equation we get the earning on unit of capital.

11. $r1 := \frac{L1 \left(\frac{K1}{L1\ \beta 1\ \alpha 1^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)}}{K1\ (\sigma - 1)}$, $r2 := \frac{L2 \left(\frac{K2}{L2\ \beta 2\ \alpha 2^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)}}{K2\ (\sigma - 1)}$

Based on these results the utility function can be expressed as function of economic characteristics. See Supplement I.3.1 concerning details to define the utility function.

12. $u := \frac{inc}{\left(\frac{\sigma}{\sigma - 1} \right)^{(-\sigma + 1)} \left(\left(\frac{K1 \left(\frac{L1}{\alpha 1} \right)^{(\sigma - 1)}}{\beta 1} \right)^{\left(\frac{1}{\sigma}\right)} + \left(\frac{K2 \left(\frac{L2}{\alpha 2} \right)^{(\sigma - 1)}}{\beta 2} \right)^{\left(\frac{1}{\sigma}\right)} \right)^{\left(\frac{1}{-\sigma + 1}\right)}}$

As we could see in previous cases the difference in income of capital owners and labor owners depends only on elasticity of substitution. The incomes are symmetric in the two sectors, there is not any qualitative difference between the two company groups. The two company groups are just two separate segment of economy.

13. $inc_{work1} = \frac{\left(\frac{K1}{L1\ \beta 1\ \alpha 1^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)} L1}{n_{worker1}}$, $inc_{capital1} = \frac{L1 \left(\frac{K1}{L1\ \beta 1\ \alpha 1^{(\sigma - 1)}} \right)^{\left(\frac{1}{\sigma}\right)}}{(\sigma - 1)\ n_{capital1}}$

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14. $$inc_{work2} = \frac{\left(\frac{K2}{L2\ \beta 2\ \alpha 2^{(\sigma-1)}}\right)^{\left(\frac{1}{\sigma}\right)} L2}{n_{worker2}},\ inc_{capital2} = \frac{L2\left(\frac{K2}{L2\ \beta 2\ \alpha 2^{(\sigma-1)}}\right)^{\left(\frac{1}{\sigma}\right)}}{(\sigma-1)\ n_{capital2}}$$

The results can be expressed in a far more simple way.

15. $$a = \left(\frac{K1\left(\frac{L1}{\alpha 1}\right)^{(\sigma-1)}}{\beta 1}\right)^{\left(\frac{1}{\sigma}\right)},\ b = \left(\frac{K2\left(\frac{L2}{\alpha 2}\right)^{(\sigma-1)}}{\beta 2}\right)^{\left(\frac{1}{\sigma}\right)}$$

16. $$u = \frac{inc\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\left(\frac{\sigma}{\sigma-1}\right)^{(-\sigma+1)}}$$

17. $$inc_{work1} = \frac{a}{n_{worker}},\ inc_{capital1} = \frac{a}{n_{capital1}\,(\sigma-1)}$$

18. $$inc_{work2} = \frac{b}{n_{worker2}},\ inc_{capital2} = \frac{b}{n_{capital2}\,(\sigma-1)}$$

Results of Policy Analysis

Public development activities are analyzed applying this summarized version. In this way I distinguish two types of policies: development of sector 1. and development of sector 2. So policies are defined broadly, development of sector 1. represents interventions to raise of capital or labor endowments or to cut either in production or in fix costs. Assumptions concerning policies are the same like before: we assume that policies are financed form income tax, they are feasible their optimal size is bigger then zero and smaller than the income level, all policies work with decreasing marginal efficiency, the direct effect of public intervention is independent from the initial condition of the targeted policy field. As earlier I treat capital and labor owners of a sector together, because the policy effects are not qualitatively different for them.

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The following statement presents the reaction of actors to exogenous economic changes. Their proof is presented in Appendix IV

Statement 1. Optimal development policy (either to develop sector 1, sector 2 or both of them) increases for actors in sector 1. if exogenous shocks improve the situation of their sector (a goes up). They contract optimal size of policy if the other sector develops (b goes up.). The optimal size of this policy increases with general economic development (similar rise of a and b) if sector 2. is sufficiently more developed than sector 1. ($a(x, t) < b(x) + 2t$).

Table 1. summarizes the results of comparative statics for actors in sector 1.

Table 1. Policy reaction of actors in sector 1.

	Situation of sector 1.	Situation of sector 2.	Situation of both sector
Policy	Improves		
To develop sector 1.	+	-	+/-*
To develop sector 2.	+	-	+/-*
To develop both sectors	+	-	+/-*

* it is positive if a<b+2*t – t represents the tax spending on the policy

The results show that agents in a sector increase the size of their optimal policy when their situation becomes relatively better: they upgrade their political demand if assets increase or costs fall in their sector and they diminish their demand for public development activities if the other sector becomes more rich in assets or more efficient. When sector 1. develops, its actors feel it both in higher incomes and better economic structure, that is the driver of increasing support of policies. In case of progress in sector 2. owners of sector 1. earn the same income and their utility increases through better economic structure (cheaper goods). But this effect increases the opportunity cost of taxes that is why size of optimal policy decreases.

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If both sector develops with the same pace, optimal size of policies will be increased if sector 1. is less developed than sector 2. or if it is more advanced, but the difference is small enough. If assets or technology make sector 1. sufficiently more productive they will reduce support for policies. It is important to note that the indices of level of development in sectors (a and b) are more sensitive to productive assets and production cost (L and alpha) than to capital level and fix cost – the more competitive the market is (the higher elasticity of substitution is), higher this bias becomes.

Statement 2. Actors in sector 1. decrease their optimal size of policy to develop sector 2. if sector 3. develops (c increases).

Proof – Comparative statics is used. For details see Appendix IV.

It demonstrates that the real motivation behind contraction of support to develop other sectors based on increasing alternative cost of public policy. When other sectors increase, the purchasing value of the same income increases that motivates to opt for lower level of public development activities.

Now the status of two sectors is identical, so political reaction of actors in sector 2. are the same: they opt for more spending on public development activites when their situation becomes relatively better.

Table 2. presents the comparison of political reactions. I assume that sector 1. is the more developed one, so a>b.

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Table 2. Comparison of policy responses to exogenous shocks

	Situation of sector 1.	Situation of sector 2.	Situation of both sector
Policy	Improves		
To develop sector 1.	Pro1	Pro2	+/Pro2
To develop sector 2.	Pro1	Pro2	+/Pro2

Everyone opts for higher level of public development activities when exogenous shocks improve their market position. Consequently, winners of economic changes are the more

enthusiastic supporters of development policy. If the development level of the two economic sectors is close to each other (a<b+2t, b<a+2t) the general improvement of economic situation will motivate economic agents to increase their support for development activities also. If development difference of sectors is considerably high, the more advanced one will decrease its support for policies.

Statement 3. If elasticity of substitution is higher then two ($2 < \sigma$) any economic actor propose higher spending on public activity to develop his sector than the intervention level proposed by actors from the other sector.

Proof – See Appendix IV.

This result helps us to interpret the political reactions more deeply. Actors of Sector 1.opt for higher level of intervention in their sector then agents of sector 1. and vica versa. Consequently when the economy experiences an exogenous shock that has a positive effect on sector 1., actors policy proposals will diverge in case of policies in sector 1. and converge for interventions in sector 2.
As we could see positive shock motivates its direct beneficiaries to increase optimal size of public development activities in general, and others contract their policy expectations. Thus the booming sector rises its ex ante higher proposal for development of itself meanwhile the other sector downgrades the ex ante lower level of optimal intervention.

The initial demand for public development activities that improve the situation of the other company groups was lower in the booming sector, so when its owners upgrade and the agents of the other (beneficiary) sector decreases political demand, the difference between the two policy proposals will decrease.
When both sector develops with similar speed but the bigger one proposes reduction of public policy we can see similar effect: the difference in the optimal size of development policy will decrease concerning public interventions in the more development sector and proposals will diverge concerning policies in the less developed one.

Based on these we can summarize the results:

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- All actors increase their policy demand in all fields when their market share is sufficiently balanced and both of them develop. In this case the equilibrium level of policy probably increases for each public development activity.
- When development differences are high between the sectors or only one of them enjoys positive effect of the progress, there will not be any policy fields where actors agree to increase their policy demand.
- When one sector develops and the other stagnates, their policy proposals converge, so stability of status quo increases in the public development issues concerning the stagnating sector.
- In case of general prosperity with great difference in sector' size the status quo will become more stable concerning public activities in the more developed sector.
- Consequently, the conflicts concerning public development activities increase either in the boosting sector in case of asymmetric development or in the less developed sector when the whole economy prospers.

As we could see in the previous model also, the introduction of symmetry between sectors makes rise of universal support for any kind of public development activities disappear. In previous chapter the 'basic sector' defined the price level of the economy. Now the price level depends on an insignificant numeraire, so the policy looses its role to effect on the general root of prices in the economy. An economic actor becomes more supportive for any kind of public development activity if she realizes process in her home sector. Development of other sectors motivates to reduce size of government interventions. Conflicts concerning public development activities heat up either in the field of the boosting sector or around policies supporting the less developed one. Political fights are more probable in these fields.

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Summary

The two settings describe differently the market equilibrium and uses different ways to conceptualize the price level of the economy. The firs model assumed that the two company groups compete both on product and labor markets and the price of productive assets used by both of them defines the baseline for prices. In the second model we modified the approach of the previous chapter and assumed that the productive assets of the two sectors are entirely separated and price level is totally exogenous.

We could see that the elimination of basic sector, sophisticated sector differentiation leads to a policy field with far more conflicts: the number of cases when actors agree about the direction of policy response is far more smaller than in the previous chapter. The only consensus in the setting with united labor market is to do nothing when labor endowment rises. In the other setting we could find one consensual field when general economic development motivates everyone to upgrade policy expectations in a relatively balanced economy.

The hostility of sectors is more powerful in the first model. The labor market linkage motivates companies to opt for policies that deteriorate the situation of other sector. If competition for labor is not present actors welcome the development of the other sector, they disagree only in the size of public intervention. This result suggests that application of the same resource pool may increase hostility of sectors.

The implications of the two settings are opposite concerning some policy effects also. In case of united labor market owners decrease their optimal size of some or all policies when they realize positive shock effects and development of the other sector motivates them to increase demand for public development of their sector when they work in the more developed sector of the economy. In the other setting everyone becomes more supportive for policy when they realize progress of their own sectors and contracts policy proposals when others are the lucky ones. Change of income is far more sensible to the progress of a sector when productive assets are separated because in the other case the united labor market factor returns are more interdependent.

Increasing endowment of the shared asset pool or the development of the smaller sector may induce proposal for the expansion of policy in the first model. The general progress of economy is similar to the enrichment of shared pool and it has similar policy effects also. But the separated productive asset setting suggests policy expansion when the more developed sector boosts contrary to the other model.

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The partly contradicting results of the two settings suggest that the competition on input and output markets have different effect on companies‘ policy responses. Further work is necessary to reveal the nature of this variation. But these models reveals some clear patterns of economic agents’ policy responses to exogenous shocks and the assumptions behind the different settings are well defined enough to check them empirically.

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Supplement I.3.1. - Definition of Price Index and Utility Function with Exogenous Numeraire Good

The utility function

n1,n2 - number of varieties in the two sectors

x1, x2 - amount of varieties in the two sectors

x0 - the numeraire good

1. $u = (x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)}$

The budget constrain

p1, p2 - price of varieties in the two sectors

2. $In := x0\,\phi^2 + n1\,p1\,x1 + n2\,p2\,x2$

The connection between prices and consumption level is calculated using Lagrange method

3. $Lag := (x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)} - \mu\,(x0\,\phi + n1\,p1\,x1 + n2\,p2\,x2 - Inc)$

4. $dx0 := \frac{(x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)}\,\phi}{x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi}} - \mu\,\phi$

5. $dx1 := \frac{(x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)}\,n1\,x1^{\phi}}{x1\,(x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})} - \mu\,n1\,p1$

6. $dx2 := \frac{(x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})^{\left(\frac{1}{\phi}\right)}\,n2\,x2^{\phi}}{x2\,(x0\,\phi^2 + n1\,x1^{\phi} + n2\,x2^{\phi})} - \mu\,n2\,p2$

Solving the system of these equations for μ we get the following result:

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7. $x1 = \left(\frac{1}{p1\,\phi}\right)^{\left(\frac{1}{1-\phi}\right)}$, $x2 = \left(\frac{1}{p2\,\phi}\right)^{\left(\frac{1}{1-\phi}\right)}$, $x1 = x2\left(\frac{p2}{p1}\right)^{\left(\frac{1}{1-\phi}\right)}$

Based on these results, the utility function and the price index will be defined in the way we applied eralier also. First correspondence of utility and consumption of varieties is expressed.

8. $u = x1\left(\frac{x0\,\phi^2}{x1} + n1 + n2\left(\left(\frac{p2}{p1}\right)^{\left(\frac{1}{\phi-1}\right)}\right)^{\phi}\right)^{\left(\frac{1}{\phi}\right)}$

9. $x01 = \frac{x0\,\phi^2}{x1}$

10. $u = x1\,p1^{\left(\frac{1}{1-\phi}\right)}\left((x01+n1)\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{1}{\phi}\right)}$

11. $x1 := \frac{u\,p1^{\left(\frac{1}{\phi-1}\right)}}{\left((x01+n1)\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$

12. $x2 := \frac{u\,p2^{\left(\frac{1}{\phi-1}\right)}}{\left((x01+n1)\,p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\,p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$

I substitute these results into the budget constrain

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13. $$In = x0 + \frac{u\left(n1\ p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi-1}\right)}\right)}{\left(x0 + n1\ p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{1}{\phi}\right)}}$$

Now comes the trick: I erase x0, assuming that its value is sufficiently close to zero.

14. $$In = u\left(n1\ p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{\phi-1}{\phi}\right)}$$

Based on this trick, the results are the familiar ones:

15. $$G = \left(n1\ p1^{\left(\frac{\phi}{\phi-1}\right)} + n2\ p2^{\left(\frac{\phi}{\phi-1}\right)}\right)^{\left(\frac{\phi-1}{\phi}\right)}$$

16. $$u = \frac{In}{G}$$

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Interpretation of the results

The four models present different conceptualizations of the idea that the policy consequences of exogenous economic shocks have more exciting features than permanent conflicts or full agreement concerning public development activities.

As we could see, demand for policy reflects economic changes. The presented models show that economic actors' policy demands change with economic characteristics. Sometimes actors revise their political demand in a similar way, in which case we can predict change in the size of policy. In other cases actors modify their policy claims in different directions, which suggests a less intensive policy readjustment. The models demonstrate that the assumption of finite elasticity of substitution enables us to study how economic changes modify actors' stakes in different fields of public development activities.

Different settings concerning market structure yield different results. The presented models describe different ways concerning change of demand for policy. It is partly a negative result: the analysis could not reveal generally valid outcomes in this field. There is a positive interpretation, as well: the models demonstrate that the market structure of economy and the differences in the sectors' reaction to economic changes (in supply elasticity of basic economic factors) have real political effect. Different economic structures result in different conflicts or agreements of economic actors concerning public development activities.

The key differences in the results were the consequences of the numeraire choice. If there is a sector where prices do not react to economic changes, the prospect of this sector has more effect on policy demand. When basic and secondary sectors can be distinguished, we can find consensus concerning the development of the second sector in general, and concerning most of the policies when exogenous shocks change the endowment level of the basic sector. When there is no qualitative difference in the adjustment process of sectors, there is no general consensus concerning policies.

The analysis demonstrates that economic position does not determine the policy demand of actors straightforwardly. The strength of market forces that transmit effects of exogenous shocks among economic actors is not always the same, which also induces different changes in policy demand. The presented models are rudimentary, further research is necessary to reveal when and why economic actors agree or disagree on the size of public development activities. These more sophisticated approaches should entail a more detailed analysis of

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market structure assuming different elasticity of substitution inside and between sectors. Introduction of supply elasticity of labor and capital is necessary to replace a numeraire-based simplified differentiation in the price adjustment of productive factors, as well.

The substantive results of models are not univocal; nevertheless, there are some outcomes that are supported by each approach. As we could see (1) policy is biased toward more developed sectors, (2) economic duality reduces policy responsiveness and (3) there is a trade-off between political responsiveness and market efficiency.

This section offers only some interpretative examples to discuss the results of modeling. A well-organized settlement of results in the political economy and development economy literature is beyond the scope of this project and a thorough empirical test is left for further study, as well.

First, I shortly recapitulate the substantive results of the different approaches. Then, I will shortly discuss the general conclusions of the modeling.

Results Recapitulated

The models presented in Chapter I.2. introduce a basic (labor-oriented) sector and a more sophisticated (capital-oriented) one. The qualitative difference is based on the numeraire choice in the models: the price of labor was assumed to be exogenously given and the market forces determined the price of capital.

We distinguished competition inside and between sectors in the first case (Ch. 1.2.1.), and competition had the same intensity between any two firms regardless of their sectoral background in the second case (Ch 1.2.2). In the first case we can distinguish two perfectly competitive but interconnected markets. For example, there are two purely price-driven markets, such as groceries and fast-food restaurants and the consumers spend some less in groceries and more in fast-food restaurants if the goods in latter ones become cheaper. In the second case there is a unified market of foods: all groceries and restaurants have their special features and each of them competes against all other places where people can get something to eat.

As we could see in all these cases, the actors of economy evaluated policy interventions in the same way as consumers, but their reactions were diverse as the owners of productive factors. The relative strength of these two effects on individual evaluation determined the direction of

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proposed policy rearrangement in case of exogenous economic shocks. The results of the two approaches (separate submarkets in Chapter 1.2.1. and one unified market with different types of producers in Chapter 1.2.2.) do not show serious differences, the comparative statics had similar outcomes in both cases. It suggests that it is not a crucial issue in terms of political economy of the public development activities whether a market is unified or it is split into separate submarkets.

The comparative statics analysis of these settings showed that

1. Capital owners are more pro state than labor owners;
2. Development happens with less conflict if improvement of labor is its main driver;
3. Economic actors agree to launch development programs that increase conflicts and disagree to spend on public activities that would increase concordance;
4. Public development activity increases with progress of the basic sector.

Let us assume that groceries comprise the more basic sector, while fast-food restaurants belong to the more sophisticated one, and public development activities are focused on improving the efficiency or enriching the assets of a certain type of vendor capacity. In this case results mean that (1) fast-food restaurant owners are more supportive of public development activities; (2) public development policy goes on with fewer conflicts if economic progress favors groceries; (3) the consequence of policies that enjoys initial support of both type of vendors may result in changes that will create conflicts; (4) if groceries develop, the public development activities on food selling market will probably expand.

The third modeling approach (Chapter I.3.1.) assumes a unified labor market and two different types of producers with a producer type specific capital. The two sectors compete on one united product market, the capital prices are shaped by market forces. Now not only do producers compete for consumers with their products, but there is also a competition for labor on a perfectly competitive market. The same employee can work either in a supermarket or in a fast-food restaurant, but different management skills and facilities are applied in the two types of food vendors.

There were not any cases when the three types of actors (labor and two types of sector-specific capital owners) could agree on the direction of policy rearrangement. It demonstrates that policy adjustment is less certain, and thus less responsive, if market forces are powerful. In these cases political status quo is steady: if someone can break through, it is the more developed sector because its prospects have greater impact on the perspectives of labor

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owners. These results suggest that competition and policy can hardly work effectively together, so there is a market-polity trade-off.
If competition is intense, the "united" employees of food retail, grocery owners and fast-food restaurant owners will not agree on the direction of policy. If groceries have a higher market share, their owners can acquire the support of the workers that can be sufficient to achieve pro-grocery policies.

The model in Chapter I.3.2. used an exogenous numeraire to sort out difference in the economic status of sectors (that was present in Chapter I.2.) and to switch off the conflict-generating effects of united labor market in I.3.1. In this case groceries and fast-food restaurants use subsector specific labor, not only subsector specific management and facilities. They compete on the same market and the market forces shape the prices of their products similarly; as a result, there is no basic and more sophisticated sector in this case.
In this case agreement on public development policies is widespread if the economy is balanced both in terms of development level and development prospect of sectors. Results show that policy conflicts are more frequent in economies where one sector is dominant or it enjoys far better growth prospects. If due to external factors economic progress penetrates the whole economy, those policy fields are more consensual, which are beneficial to the more developed sector.
It means that if market share and market prospects of groceries on the one hand and fast-food restaurants on the other hand are similar, they can agree on development policy issues. If the market shares of the two type of suppliers are not sufficiently close to equal or it seems that fast-food restaurants have better chances to expand or to increase their efficiency, public development will not enjoy consensual support. If the demand or technology of the whole food sector enjoys positive external shocks (i.e. spending on food grows or price of agricultural products fall), the structure of consensually supported mix of public development activities will become more biased toward the type of food sold with higher market share.

Further research is necessary to reveal, which of the above-summarized settings have the most appropriate assumptions. It could be misleading to interpret the models separately. Nevertheless, there are results that are supported by the different approaches univocally; thus, these are not sensitive to the differences of the approaches. These general results expose that (1) public development policy is biased toward the more advantaged sector, (2) large sectoral

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development differences can block rearrangement of public development policies and (3) there is a trade-off between efficiency of market forces and responsiveness of policy.

Advantage at the advantaged

Usually the more developed industries will be favored by public programs. In the first settings (in Chapter I.2.) the capital sector enjoys the development policy advantage, in the last setting (I.3.2.) better technology or more abundant sector-specific resources are the bases of sectoral advantage. This result - public development activities are biased toward these sectors - is not based on the bargaining power bias of these sectors because the change in public development activities needed the univocal support of economic actors in the models. It means that the size of a certain policy - like human resource development or public spending on technology improvement – changes only if all asset owners support this rearrangement.

Each actor benefits from the policy as a consumer; however, the condition of production improves only for direct beneficiaries. Based on the modeling results, let us assume that an exogenous change – technology improvement in machinery based on a new invention – motivates economic actors to increase spending on certain public development activities: policies to encourage further technological development or to support start-up firms in the machinery sector. In this case asset owners of machinery (sector-specific entrepreneurs and workers, owners of fixed assets) receive higher returns because of better production possibilities. Other productive agents do not get benefit from this improvement, but they also enjoy the increasing variety and/or the lower prices resulting from the improved technology as consumers. To sum up, technology improvement increased the suppliers' and the consumers' surplus of machinery products, which increased the productivity, and hence the demand for the public development activity. The technology development induced policy expansion that is beneficial for everyone, but the distribution of this gain is biased toward the owners and workers of the machinery sector.

If machinery sector is more developed than the textile industry, the models predict that exogenous economic shocks will motivate all actors to support the enhancement of development activities in machinery. This development advantage can be based either on more flexible accommodation of price and output to economic circumstances (as it happens in Chapter 1.2.) or on higher output due to more efficient utilization or higher volume of sector

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specific resources (as it is conceptualized in Chapter 1.3.2.). Policies to improve terms of production in the more developed sector enjoy support more frequently as the same amount of additional development effort has a more penetrating effect on the whole economy due to more flexibility or the higher output. Consequently, more often the more developed machinery sector will get support from the public development policies instead of the textile industry.

Accepting this framework, we can predict that public assistance will be biased toward the more developed sector, which results in a better utilization compared to balanced development policy, but at the same time the state contributes to the backwardness of the sector lagging behind, too.

The dominant role of the leading sector in the political economy of public development activities is a generally accepted idea. The political economic analysis of South America's relative backwardness frequently refers to the political role of past or present dominant sectors.[53] Shafer (1994) claims that the characteristics of the main export (leading) sector in a country strongly influence its development prospects for the future. In his approach the features of the leading sector lead to certain patterns of the state, which results in different abilities to manage the reconstruction of the economy in case of crises.

It is important to emphasize that this result is based on a different mechanism than most of the interest-group, rent-seeking or regulation capture explanations suggest (discussed in details in the literature review chapter of Part II.): 'the advantage of the advantaged' is not based on their better political position in this analysis. The public development activities beneficial to the more developed sector enjoy consensual support more frequently in this approach either because these are more supportive toward basic sectors (in models of Chapter I.2.) or because of their more encompassing position due to the higher share in consumption (in models of Chapter I.3.). This mechanism is more similar to the logic of Aghion and Shanckermann (2004) where the increasing economic role of low-cost companies makes it politically feasible to launch competition-enhancing policies in an economy with imperfect competition.

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[53] See, for example Engelmann and Sokoloff (2000), Acemoglu, Johnson and Robinson (2004), Gavis, Hausmann and Ricardo (1998)

Duality Curse

Modeling results suggest that conflicts concerning public development activities are less frequent if the basic (less-developed) economic sectors have better prospects or the economic position of economic sectors is more balanced. In the models of Chapter I.2. development of the capital sector induced conflicts, in Chapter I.3.2. economic actors could agree on public development activities if the market shares of the sectors were relatively balanced or the economic changes modified the position of each sectors similarly. Thus, if the situation or the prospects of the more sophisticated, more developed sector are better, disagreement will emerge.

Consequently, if there is a stronger duality in the economy, more conflicts regarding policies emerge. Not only do conflicts generate socially unproductive political investments (as it is discussed in Chapter II.1.), but they also make policy less responsive to changing circumstances.[54] Thus, dual economic structure postpones the implementation of policies that would be necessary to keep an economy on a competitive track in international perspective: the more dual an economy is, the less competent its development policy will be.

This result fits in well with the findings of the literature on trade-off between inequality and growth, especially in the case of poor countries.[55] The results also resemble the arguments of literature on dual economies: if there are economic sectors with significant efficiency differences, the economy will grow slower because the growth opportunities of the traditional sector cannot be utilized.[56]

Although the results are similar, the mechanism I found behind the negative effect of dualism is different from the above-mentioned macroeconomic explanations and it also differs from the political reasons discussed in Chapter II.1. The logic revealed by the models simply suggests that agreement concerning the optimal modification of public development activities is frequently missing because of the great differences in the situation of economic sectors. It is hard to modify policies because of this divergence of interests; thus, a dual economy can hardly utilize its polity to support economic development. Neither suboptimal equilibria, nor unproductive political activities, but the serious limitedness of public response is the core of the duality curse in the applied conceptualization of public development activities.

[54] Rodrik, Dani (1996) provides an extensive overview of theories concerning the delay of policy responses because of conflicting interests.
[55] See Barro (1999), Perrson and Tabellini (1994)
[56] See Banerje and Duflo (2005)

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Efficient market – responsive policy trade-off

Modeling results show that the ability to agree on public development activities decreases if the market becomes more powerful. If comparing models in Chapter I.2.2. and I.3.1., we can see that the introduction of competitive input markets ruins any kind of consensus in the development policy. It suggests that there is a trade-off between policy responsiveness and the power of market forces.

The mechanism of this trade-off is based on the contradicting forces of individuals' evaluation of policies as a consumer and as a producer. If someone's income is fixed, increasing variety or fall of prices improves consumption opportunities and raises welfare. On the other hand, public development activities have different effects on different economic sectors: market share increases for one of them and decreases for the other. Thus, the income per capita will become higher for asset owners in the expanding sector and it will fall in the sector with shrinking sales.

If public development activities induce major market restructuring, the positive effect of increasing opportunities for consumers cannot compensate for the negative effect of asset owners' consequent income decline in the worse off sector. In this case actors will disagree on the adjustment of the public development activities. However, if the separation of the input sources or the loyalty of consumers to a certain type of goods protects the consumers sufficiently, the development policies will not lead to dangerous deterioration of market share; therefore, the fruits of development for consumers will become dominant.

If the available input pool and/or the rate of spending in grocery and fast-food restaurants could not change, the two retailing subsectors had no reason to be hostile; thus, policies with biased effect could attain support due to consumers' expected benefits. Actors can agree on public development activities if they are not dangerous rivals on the market.

The argument that policies are feasible when stakeholders agree to support them due to low level of competition resembles some traditional approaches. The standard welfare economics approach emphasizes that public intervention is an option when market failures are present and significant.[57] The above-discussed result can be interpreted as a descriptive version of this normative statement: public intervention is feasible if market failures are present and significant. In our case the productivity disadvantage of certain producers do not have

[57] See Stiglitz (1988)

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catastrophic effects on market share due to either the lack of input markets or the finite elasticity of substitution – which are the typical phenomena of market failures.

This policy-market trade-off result also resembles to a political economy tradition. Stigler's seminal analysis on economic regulation[58] emphasizes that interest group activity is less effective, consequently less frequent, if new entrants can deteriorate the incumbents' rents. If entry barriers – like fidelity of consumers or exclusive access to productive inputs in our case – are effective, political activity is more profitable; thus, the probability of public intervention increases. Becker (1983) argues that interest group activities are more successful if the deadweight loss of policy is smaller compared to the amount transferred by a given policy. Relative deadweight loss is smaller if the supply or demand elasticity is low, thus in these cases public intervention is more probable. The discussed result of my analysis is also based on low elasticities: the limits of market power are based either on consumer fidelity or lack of input markets that make supply more inelastic. The core difference between this political economy approach and the logic behind my analysis is that the main driver of policies is political influence in the mentioned interest group approaches, while the beneficial effect of policies on consumers generates support for public development activities in my approach.

As we could see, the three results – i.e. the advantage of the more developed sector, the obstacles of policy adjustment in case of economic duality and the trade-off between responsiveness of market and policy – are compatible with several economic and political economy theories. The key novelty of my approach is that it investigates the effect and opportunity of consensual public interventions in order to improve production opportunities based on a market power based setting driven by the assumption of monopolistic competition. In this way I could disclose redistribution-oriented policies and I could analyze public development activities in a framework where market forces and market rigidities are present at the same time. This exercise provides only part of the framework to analyze public development activities. The simplification on political decisions assuming that consensual reaction of economic actors will shape public development activities is too restrictive. More detailed descriptions of political interactions are necessary to have a full understanding of the issue, which will be carried out in the next part of the dissertation.

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[58] Stigler (1971)

Part II. Bargaining Over Policy

Introduction

This part of my dissertation offers a framework to discuss how stakeholders induce changes in policies. Part I. studied how economic changes modify economic actors' claims on policies, now I will study how they can pursue these claims as political actors. I conceptualize policy process as a bargaining. As Part I. promoted the Dixit-Stiglitz formulization of monopolistic competition to reveal forces behind policy demand, Part II. argues for the application of the Nash Bargaining Concept to study its effect on final policy outcome. However, the argument behind the toolkit promotion is different now. In the previous part I argued that monopolistic competition-based approach can offer new arguments for a relatively neglected area. Now I claim that the results of a rich and prosperous research field can be summed up using the Nash Bargaining Concept: we can get robust results in a simple way that are compatible with the points of political economy literature using this approach.
In addition to the result that this analysis confirms the assumption used in the previous chapter; namely, that policy reflects the change in demand of affected actors, I will also study how change in political positions influence policy outcomes. I will discuss how position in bargaining, the alternatives of policy and the efficiency of political investments shape the policy process.

The application of political economy principles needs a consistent system of general statements concerning the core aspects of policy process. The nature of political economy research frequently resists this claim because adequate modeling needs precise assumptions concerning the framework and the sequence of interactions among involved actors. Now I will review a part of this literature presenting that there are several general results that are broadly accepted by different political economy approaches. Then I show that a simple bargaining approach can reproduce these findings.

Policy is an outcome of bargaining among interested stakeholders because no policy can function without some support of its beneficiaries and some compensation for its benefactors.

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The analysis of policy process is always intended to show how interaction of actors with different interests, resources and ideas results in a public action.

I will study how actors' policy demand and political influence shape deals concerning the size of mutually beneficial policies. I will not distinguish public and private actors. Although the state has a crucial role in the design and implementation of policies, no public actor can be successful without reference to the political demand of private actors, as stakeholders have several tools to influence policy outcomes. Powerful actors can frequently ruin policies or overthrow its initiators. They can also offer substantial support to the public decision or decision maker. Thus, public actors have to make a deal with private actors concerning policies; thus, they are participants in the policy bargaining.

The literature review focuses on (1) how features of bargaining shape outcomes; (2) what motivates actors for political investments; (3) what the background and consequence of political inequality is. I organize the presentation of relevant literature around seven statements:

1. Bargaining reflects demand for policy, so when actors modify their intention concerning public issues, the content or the structure of policies will change.
2. Position determines success; thus, if someone has some advantage in the political decision process, he will get a higher payoff.
3. An ally is always helpful; consequently, actors try to manipulate the circle of participants in policy debates.
4. Development and increasing return of power boost investment into politics.
5. Political investments decrease welfare.
6. Political inequality is a status quo because differences in bargaining power are based on the characteristics of actors that are stable.
7. Political inequality motivates improvement of exit option.

The second chapter will present a Nash Bargaining-based approach to study the design and the outcome of policies. I will introduce political investment in this framework. I will study how a rational actor optimizes political investments, then I will assume that actors formulate their political investments as a best response to each other's strategy. This simple analysis gives a consistent view on the political activity of participants and on the outcome of bargaining, which is compatible with the principles of the political economic literature.

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The main contribution of my analysis is that I point out that the results of many different political economy concepts are reproducible through a simple model based on the Nash Bargaining Concept (NBC). This point has two important consequences. Firstly, it gives support to the argument that the economic analysis of a political phenomena is not an inherently eclectic exercise[59]. Secondly,[60] it suggests that the NBC can be useful to analyze public policies and it can be the basis of tools to support policy design process.

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[59] Contributions to Political Economy usually describe stories of political interactions. These works intend to analyze different situations; consequently, the assumptions concerning the actors of the models and the assumptions about the rules of the game show a high diversity. But the results of these models present a high level of consistency and they suggest that the mosaic of different concepts outlines a clear formation. I argue that NBC seems to be a promising approach to find some main lines of this structure.

[60] This second conclusion is more important from the point of view of my motivation.

Chapter II.1. Forces behind Outcome, Participation and Efforts in Policy Bargaining – Literature Review

Introduction

I will focus on three topics of the economic literature that discusses the emergence and main characteristics of public decisions, which I call the political economy literature.

1. How do actors' intentions, political position and involvement into public bargaining influence the outcome of policies?
2. What circumstances determine actors' actions to improve their payoff and what are the aggregated consequences of these political investments?
3. What are the causes and consequences of unequal political influences?

The political economy literature is enormous and diverse; thus, my review will be unavoidably selective. New Institutional Economics, Public Choice and the contemporary political economy literature concerning development issues are given more emphasis in my work (although it does not mean that these fields would be perfectly covered).

1. The dominant approach of political economy is that a model or a more general framework describes a story that gives good insights into a phenomenon in a transparent way based on explicit assumptions. I will provide brief summaries of several stories related to the questions above in a structure that is based on some general ideas of the literature.

Bargaining Reflects Demand for Policy

If democratic institutions functioned perfectly, the policies would be shaped dominantly by the political demand of individuals.[61] But political systems are not always democratic and there are inherent problems that weaken the demand transmission of democratic institutions. Rational ignorance of voters pushes politicians to respond to voters' expectations in symbolic

[61] This approach is reflected in political economy applications with the assumption of probabilistic voting. This approach assumes that voting behavior can be described with a probabilistic function for all individuals, and policy proposal of candidates can modify these probabilities. Consequently, if someone's political demand becomes more intensive in an issue, he will respond to policy offers in this field with a bigger modification in probability of support. Politicians maximize expected value of votes; thus, they rationally reflect to policy demand in this setting. For a detailed discussion, see Mueller (2003) Chapter 12.

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issues instead of policies.[62] Voting systems tend to disregard both the intensity of political preferences and the political demand of groups that are not decisive at elections[63]. Moreover, political decisions are more or less influenced by other forces than the demand of voters. Interest groups can find their ways to pursue decision makers who have some motivation to respond to the political demand of people even in dictatorships.

The models of interest groups represent policy demand similarly to market behavior: higher level of demand means that someone would pay more for the same political output. This approach appeared in Stigler's classic article titled "Theory of Economic Regulation"[64]: he conceptualized policy design as a trade between politicians and interest groups. Peltzman[65] formalized Stigler's point assuming that an interest group offers campaign contribution to a vote-maximizing politician for the support of certain policies. In his model the policy will be bigger if it has a smaller negative effect on voters' probable support or if the interest group offers higher financial support. In this way, political demand matters. The main message of interest group theories is that rational politicians reflect the expectation of economic interests about public decisions.[66]

Olson and McGuire (1996) offer an alternative mechanism to connect policy demand and policy response. They assume that the state is motivated to maximize its income similarly to

[62] The theory of voting paradox shows that the expected net benefit of casting a vote is negative if we assume instrumental rationality. (Fejehorn &Fiorina (1974)) The act of political participation must have a positive value for the voters in itself. If it is true, voters' choice is more connected to the maximization of utility from their action then from its outcome. The application of expressive rationality based on this approach leads to the conclusion that symbols and emotions are more influential in voting behavior than individual interests. (Rabinowitz & Macdonald (1989))

[63] The political models of democracy usually follow the tradition of Downs (1954) and assume that the median voter's political preferences determine policy outcomes. Because of its simplicity, median voter theorem is frequently used in political economic applications.

[64] Stigler (1971)

[65] Peltzman (1976)

[66] Becker (1983) gives the most simple and more explicit conceptualization of this approach. He assumes that policy is the equilibrium of pressures expressed by different groups. A group has more influence if it spends more on it, if the costs of the organization are smaller, if the group has bigger electoral power and the negative effect of pursued policies is smaller for other groups. Several sophisticated models have followed Stigler's, Becker's and Peltzman's work. These developments usually described a multistage game, where interest groups and politicians define their best response strategies with respect to each other and to voting behavior. The contribution option of interest groups became richer (e.g. including contribution of information), the description of political game became more sophisticated (e.g. introducing differentiation of voters according to their knowledge), the description of politicians became more detailed (e.g. differentiation of ideological and vote maximization motivations). For an extensive discussion, see Grosman and Helpman (2001), for a review, see Mueller (2003) Chapter 20.

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individual enterprises.[67] If a certain policy has a higher positive effect on the national product, it will induce higher tax incomes. Consequently, public policies with higher income-generating effect get more support. Private demand for policies and income-generating effect has a positive connection; therefore, the intensity of demand is reflected even in dictatorships.[68]

Wintrobe (1990) and Tullock (1987) give a detailed analysis about the constraints of absolute power. The primary interest of a dictator is to keep his position, which requires the ability to successfully prevent or suppress revolts and coups. Different social groups can be motivated with different tools to accept the autocracy. Some groups get privileges in order to make them loyal, others are oppressed in order to decrease their ability to protest. This machinery of sticks and carrots is rationally designed as a cost effective incentive scheme; consequently, it must be sensitive to public demands.

Position Determines Success

It is a core topic of the political economy literature to discuss what makes someone successful or unsuccessful in conflicts concerning public issues, and what the sources of bargaining power are. The classic concepts like 'exit voice and loyalty' or 'distributional coalition' are based on the crucial role of advantage in an organization. Interest group literature offers several stories to conceptualize influence.

The fact that bargaining outcomes depend on bargaining positions has serious consequences.. Stakeholders design political and institutional schemes that sustain the balance of power among the stakeholders as the literature 'No Political Coase Theorem' demonstrates it. These schemes and the initial distribution of power in a society strongly influence the economic prospect because the most influential participants of political bargaining will not support measures threatening their power, not even if these steps could open up the path for a faster economic development.

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[67] From this perspective, it does not matter whether they want to use these resources to maximize their personal consumption (tinpots) or to form their countries following certain ideas (totalitarians).

[68] It is valid if the citizens have some capacity to keep a part of the benefits. It is usually true because deadweight loss of taxation motivates the state to use marginal tax rates under 1. In totalitarian regimes it is not always valid as Olson (2000) points out discussing the economic system of Soviet Union.

Classics

The bargaining power has a crucial role in the two great classics of political economy – Olson's Rise and Decline of Nations and Hirschan's Exit, Voice and Loyalty. Olson's theory gives insights on who and how can get central position in the distribution of economic gains, Hirschman develops a concept on how consumers or citizens can successfully protect themselves against these power concentrations.

Olson argues that the so-called 'distributional coalitions' can attain a great part of the value added of the whole economy because of their power represented by their monopolistic position in the economy as well as their embeddedness in the institutions that govern the distribution of wealth. Distributional coalitions have an initial advantage in organizing[69] themselves. It enables them to pursue policies that distort the distribution of economic interactions for their advantage. It will induce a counteraction of losers that may lead to political arms race. The final outcome – argues Olson – is a society where the ability to protect and utilize positions in redistributive games determines the success of the actors: the whole economy is a great bargaining and final individual payoff depends on bargaining position.

Hirschman argues that consumers' ability to protect against the fall of quality or the rise of prices depends on their ability to pursue effective actions to protect against it (voice) or to leave the unsatisfactory supplier (exit). He extends this approach to analyze political organizations, like trade unions or institutions, like the democratic party systems, as well. He argues that these two feedback mechanisms (voice and exit) can successfully prevent or turn back the fall of product quality if (1) the supplier has a slack, (2) consumers will not leave the supplier immediately when they realize some deterioration ,but send warning signals toward the producer and (3) these warnings represent credible threats of potential actions to voice or exit. The first two conditions mean that the interaction offers a mutual gain for both of them; thus, they are in a mutually beneficial, bargaining situation. Slack represents the gain of the producer. The loyalty in case of a small decline of quality indicates that the benefit of transactions is positive for the consumers, as well. The ability of successful protection is logically identical to the bargaining power and the exit option is like off-bargaining position. The consumers are more successful to protect their interests if these exit and voice actions are cheaper to organize and represent greater threat for the supplier.

[69] Olson's theory 'Logic of Collective actions' is the basis that analyzes organization advantages and disadvantages. It will be discussed where political investment will be analyzed.

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Efficiency of representation

Most theories of interest aggregation conceptualize the difference in the ability of involved actors to influence decisions. There are theories that emphasize that certain actors have an a priori better position to influence public decisions, others focus on the mechanism how better knowledge concerning quality or production of collective goods results in an advantageous position in bargaining.

When some voting mechanism determines political outcome, participants have different options to cast the decisive vote. In majority voting the median voter has a privileged situation because no candidate can get the necessary support without him. Consequently, he is always the net beneficiary of political decisions.[70] In situations when a minimum size coalition is necessary for a public decision, different groups have different chance to be members of the winning coalition that is represented by the Shapley value.[71]

If the decision mechanism reflects to the intensity of participants' determinedness, the effectiveness of the mechanism that transforms motivation into influence matters. It depends on the groups' ability to utilize the available organizational resources to pursue interests.[72] In Peltzman's model the success of organized interest depends on how much campaign spending is necessary to convince the losers of the policy, pursued by the group, to maintain the support of the politician who accept the financial support given for the policy. Other interest group models also conceptualize differences in influence with some technology parameters.[73]

Informational asymmetries also influence the efficiency of interest representation. Dixit (1996) conceptualizes the public actor who designs and implements policy as a multi-principal agent, and who defines his activity as a best response to these incentives. The power of incentives defined by different stakeholders of policy is influenced by the observability of public agents' activity. For example, if it is easier (more precise, more trustable etc.) to measure how much additional transport is induced by a road construction program than to measure the number of generated jobs, then the transport lobby can define better incentives than the groups interested in the rise of labor demand (like Trade Unions, or the pubic agents interested in generation of income tax or mitigation of social transfers). Tirole (1994) and Grossman-Helpman (2001) study the situation when the interest groups, who have an interest concerning the outcome of the policy, have an informational advantage and the influence gained by contribution depends on the trustworthiness as well as the value of information for

[70] The background and consequences of Median Voter Theorem is discussed by Downs (1954).
[71] Shapley value – Palgrave (1987)
[72] The efficiency to mobilize these organizational resources is also crucial, as we will see it in the next chapter.
[73] See references mentioned in previous section discussing effect of demand on policy.

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the decision maker. There is a trade-off between these two aspects, since the more specialized someone's knowledge is, the lower the possibility is to check the reliability of his signal. Consequently, actors who would like to utilize their informational advantage in the policy bargaining need a mechanism that supports the credibility of their information.

No Political Coase Theorem

A new branch of literature emphasizes the importance of political position as a determinant of policy outcomes referring to the impossibility of commitment to restrain utilization of power. The core of this argument is the following: if stakeholders involved have no real political power, they cannot force other actors to give up from their share of cooperative outcome and they cannot force the others to keep the agreement. Political agreements must be self-enforcing; thus, the success of actors involved depends on their ability to maintain their bargaining power in the long term.

Acemoglu (2002) argues that the agreement of the government (that defines tax level) and the economic actors (who decides investment level) is possible only if the actors are able to force each other to keep it. Government will tax away all income generated if it is more profitable, than the expected value of future tax incomes calculated with respect to the discount factor and the probability of holding the power in the future. Economic actors will choose to avoid investment into taxable activities if full confiscation is expected. Other outcomes than zero taxation – 100 percent tax level are only feasible if the position of actors mutually guarantee the feasibility of the agreement.

Grief (2005) gives examples of how it is possible discussing the coercion constraining institutions. He mentions three mechanisms: (1) „A balance of coercive powers within a polity … can limit the abuse of rights."[74] (2) „ A ruler's costs and benefits from abusing rights depends on administrative capacity and who controls the administration. ... Those controlling the administration are therefore in a position to take actions that are costly to the ruler. In particular, if the state's administration is controlled by the asset holders, abusing their rights can undermine, rather than foster a ruler's welfare. The capacity of, and control over the state's administrative can be structured in a way that the ruler can either credibly commit not to abuse rights or is deterred from doing so."[75] (3) " Furthermore, various technological and institutional factors limit a ruler's grabbing hand. These factors influence a ruler's benefits from abusing a particular asset and the extent to which economic agents can respond to

[74] Grief (2005) p 748.
[75] Grief (2005) p 748.

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expropriation by economically sanctioning the ruler. For example, a ruler gains little from capturing an asset whose value is lost without the original owner's complementary human capital, and abusing alien merchants' assets can drive the merchants away, depriving a ruler of trade benefits."[76]

Credibility of the private actors in the policy bargaining is similarly important. Beside mechanisms presented above that guarantee that the bargaining power of the private actors will be kept in balance with public ones, some devices are also necessary to protect the position of the public actor after the launch of the demanded policies. Politicians frequently use mechanisms that maintain the rational support of targeted beneficiaries even after the transfer is realized.

Dixit and Londregan (1995) and Dixit (1996) describe how politicians and certain interest groups lock themselves into a mutually beneficial connection. A politician offers not a lump-sum transfer but a permanent subsidy to a certain group that will be maintained until the politician keeps his power and the beneficiaries of the transfer keep their political support. This strategy needs a well-defined constituency group where beneficiaries have guarantees that new entrants will not wipe out their subsidies and the politician has a guarantee that fluctuation in the group will not wreck the agreement. The stagnating sectors where entry is not appealing or easily constrainable are good candidates to meet this condition. Public subsidies that maintain profitability of firms in these sectors do not motivate others to enter, but it is worthwhile for incumbents to sustain their economic activity. Dixit and Londregan (1995) use the example of textile and apparel industry where profit and income prospects do not motivate entry, and the flow of subsidies creates the described political alliance.

Robinson and Torvik (2005) describe how socially harmful development projects can function as mechanisms that guarantee the political support after the decision on investment. It is assumed that neither can the politician fully trust his political supporters, nor can the supporters trust the politician, although they have close connections. They need to solve the commitment problem to guarantee that the politician will keep his promises after the election and the supporters will not decrease their support to their politician. A project that is socially harmful but offers positive benefits for the supporters can function as a proper commitment device. For the politician, who enjoys the support of the beneficiaries, it is rational to complete the project, as it maintains his political advantage in this constituency. Rival political forces would not complete the project after the election (even if they promise to do

[76] Grief (2005) p 748.

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so) because it would be rational for them to use the necessary resources for other goals. For the beneficiaries of the project it is rational to support the initiator of the project because he is the guarantee for its completion. Socially beneficial projects could not help to build this mutual commitment (because it is rational for political rivals to complete them also); consequently, these will not be politically preferred.

Maintenance of bargaining power vs. political responsiveness

Policy is based on the balance of power; consequently, it remains stable until interests or the bargaining power of most influential groups do not change. Bargaining parties design mechanisms to ensure the credibility of agreement (discussed above) and they make efforts to maintain their bargaining position (discussed in next section and the next chapter). Therefore, policy decisions frequently delay response to emerging challenges and maintain a status quo that keeps the economy on a path of growth that is slower than possible.

Alesina et al. (2006) argue that the delay of reform is a consequence of a 'war of attrition' between different social groups about the distribution of costs of the necessary reform. They assume that there are two groups, and one of them has to pay more than half of the costs of stabilization. Groups are uncertain about the other groups' evaluation of the costs, so the passage of time will reveal which of the two groups is the weaker one. Groups choose to wait if the marginal cost of waiting is lower than its marginal benefit. The game ends when one of the groups gives up waiting. It occurs sooner for the group with the high cost of waiting. In this model 'patience' determines success, similarly to the altering offer game of Rubinstein. The core differences between the two approaches is that participants in the bargaining over reform do not have certain knowledge about the bargaining power of the others, which results in the delay of change in policy.

It is a core issue in the literature on the political economy of development that unfavorable division of power obstructs economic prosperity. "Economic institutions encouraging economic growth emerge when political institutions allocate power to groups with interests in broad-based property rights enforcement, when they create effective constraints on power-holders, and when there are relatively few rents to be captured by power-holders." (Acemoglu et al. (2004))"In those societies that began with extreme inequality, elites were better able to establish a legal framework that insured them disproportionate shares of political power." (Engermann; Sokoloff (2000)).

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The income of these elites stems from sectors that are not interested in the raise of domestic consumption or in the development of human resources because these sectors are large-scale, capital intensive ones with international sales and with low demand for skilled workers (e.g. minerals, cash crops). Because of the political structure, the profitability of these sectors is in the focus of the economic policy, thus public policies that could improve the productivity in other parts of the economy do not have priority. These are even opposed sometimes due to the potential price-increasing demand pressure on resources used by the core sectors. (Rajan, Zingales (2006)). Elites do not utilize available resources to modify the economic structure in prosperous times, but they spend them to stabilize or enjoy their privileged position, as it is discussed in the political economy literature of Resource Curse (Auty (2001), Sachs (1995)). Promising political or economic innovations are frequently blocked even in more critical times because "Innovations often erode elites' incumbency advantage, increasing the likelihood that they will be replaced. Fearing replacement, political elites are unwilling to initiate change and may even block economic development." (Acemoglu, Robinson 2006 APSR).

It is a core principle of political economy that position shapes the content of policy. As I have discussed, this positional advantage depends on the cost of effective organization, the probability to become a member of the winning coalition, information about the details of cooperative issues and credibility to keep the agreement. Actors' efforts to keep positional advantages create a status quo bias that maintains policies even in cases when it is seriously outdated.

An Ally is Always Helpful

The political economy literature offers several approaches to study economic actors' strategies concerning participation in the policy bargaining. I will present now six concepts that discuss this issue. The first and the second ones give insights into the extension of franchise rights in the 19th century. Congleton's (2004) approach shows how change in the influence and in the potential contribution to bargaining gain of workers motivates enfranchisement. Acemoglu et al. (2000) demonstrates how threat potential of outsiders motivates inclusion. The third concept (Laffont and Tirole (1991) and Tirole (1991) shows how information advantage of excluded parties impose costs on the policy implementation.

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Then, I will shortly present Grief's (2005) concept on organic and designed contract enforcement institutions and the approach of Acemoglu and Robinson (2006) on de jure and de facto power to show how hierarchy or distinction in forms of influence can help the maintenance of bargaining power. Finally, I show how Olson (1982) and Becker (1983) reach different conclusions concerning the dynamics in expansion of bargaining participation.

Economic growth motivates enfranchisement

Congleton (2004) argues that the extension of franchise right was driven by three main forces: (1) "Cost of organizing political interest groups is reduced by the same technological changes that increase the efficient scale of manufacturing and distribution." [p. 1.]. (2) Influence of organized interest ceteris paribus increased because specialization increased the potential loss due to boycotts, strikes. (3) Economic growth motivated the extension of franchise because (a) more people have reached income/property threshold of suffrage that decreased the relative social position of the median voter and (b) the tax base enlarging effect of enfranchisement motivated the actual median voter for expansion of political rights. This logic shows that the cost of political exclusion has increased, meanwhile potential benefit of franchise expansion has permanently increased for the incumbent electorates.

Give franchise to avoid revolution

The domestication of threatening actors excluded from polity is the key motive of franchise right extension as Acemoglu-Robinson (2000) argue. This article develops a model where the power is in the hand of the elite; however, the workers' threat to start a revolution motivates the incumbent to share some of the power with the potential revolutionists in the form of franchise right. This act decreases the incumbents' influence on politics and it will lead to expensive policies that benefit the newly enfranchised voters on the one hand. On the other hand, this inclusion eliminates the threat of revolution, and it has higher expected benefit than the price of new redistributing policies. Franchise right gives bargaining power for workers in policy issues. It a credible commitment of higher payoffs for them, and this institutional guarantee eliminates the threat of revolution.

Exclusion can be costly

The actors whose interests were not included into the bargaining over policy can try to influence the implementation through bribing the agency responsible for it. Consequently, the mechanism of implementation should be designed to resist these informational pressures in

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order to keep bargaining on the agreed track. Tirole (1991) and Laffont and Tirole (1991) analyze the mechanisms and costs to prevent policies from external pressures.

Laffont and Tirole (1991) study the case when the congress applies an agency to regulate a natural monopoly, but their framework is applicable to any situation when external actors try to bias an agreement on policy through unofficial payments to the agent who is responsible for implementation. The agency has an informational advantage that makes it possible to collude with the natural monopoly without recognition of the congress. In order to keep the control over the regulation of the natural monopoly, the congress has to design incentives that raise the cost of bribing the agency above the expected return of collusion between the agency and the natural monopoly.

Cost of bribing increases if the agency realizes a rise in the expected value of loyalty to the congress. It happens if more frequent supervision increases the risk of collusion or higher income enhances the potential loss if collusion is revealed. If other groups offer payment to the agency for collusion in a way that is in conflict with monopoly's offer, the bribe increases, as well.

The expected value of collusion decreases for the monopoly if the information advantage of the agency compared to the congress decreases. Information asymmetry decreases as a result of more supervision or more expertise on the side of congress. Information gap also decreases if the amount or quality of information collected by the agency decreases; for instance, because less information is used during the regulation of the natural monopoly. In this way, ex ante specified rules are less sensible to details of the situation, but these provide protection against corrupted discretions.

The administrators of the policy must be well-paid as well as supervised and the technology of the administration must be less sensible to information. These necessary steps partly represent the cost of exclusion of some interests during the policy process, and partly demonstrate that information advantage of the administrators results in a higher bargaining power and higher payoff for them.

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Hierarchy makes expansion feasible

Grief (2005) discusses the difference between expansion opportunity of 'organic' and 'designed' Contract Enforcement Institutions (CEIs). CEIs organize the mutually beneficial interaction of participants. Organic CEIs are based on reputation in a partnership network where the rules of cooperation emerge in a spontaneous way and become a shared convention of a closed community. Entrepreneurs consciously design Private Order CEIs and they offer

transaction cost decreasing services for their clients. In organic CEIs the costs of interaction are mitigated by shared standards and the threat to lose reputation. The participants of an interaction share its gains among themselves.[77] In designed CEIs the administration designs the facilitation and enforcement mechanism and a part of the surplus created by interaction is paid for these services.

The expansion potential of organic CEIs is limited because reputation needs time to build up, and the maximum size of the club is limited by the fact that the cost and quality to observe each others' prudence decrease when the group becomes larger. In designed CEIs the number of participants increase the income of the administration, and the higher incomes from facilitation increase the motivation to maintain the goodwill of the institution: the limit of expansion is purely technological.

The organic CEIs are more horizontally organized, expansion or modification of conventions needs a dominant support of participants. Designed CEIs are hierarchical, the administration decides about the organizational issue. Consequently, the designed CEIs are more flexible: the hierarchical organization makes it feasible to distinguish participants and protect the position of administration and influential stakeholders in case of expansion.

The distinction between de jure and de facto power

Acemoglu and Robinson (2006) argue that the extension of political rights does not result in equal influence on political decisions. In this model they distinguish de jure and de facto political power. "Former is the type of political power allocated by political institutions, later emerges from the ability to engage in collective action, or use brute force or other channels such as lobbying or bribery." [p. 326] "When elites who monopolize de jure political power lose this privilege, they still may exert disproportionate influence in politics by increasing the intensity of their collective action." [p 326] In cases when the elite has advantages to organize collective action, this advantage in de facto power can maintain their dominance in public decisions; consequently, they can protect the policies that favor them.

Expansion of policy = expansion of participation?

Different political economy concepts have different view on the balance of these forces.[78] Olson (1982) assumes that the groups that become organized at first can maintain or even increase their advantage. Specialization in political activities increases the expected gains

[77] See Grief (1993)
[78] For an overview, see Dunleavy (1991) Chapter 2.

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from them and improves the efficiency both to hinder the organization of countervailing interests and to protect their bargaining power advantage even if these groups became organized. As a result, privileged groups will be able to increase their influence and to increase their share from the value added of the economy.

Becker (1983) assumes a far more balanced political participation. This concept is based on the deadweight cost of redistributory policies. Consequently, if organized pressure is successful to increase transfers, the resulted utility loss of the representative taxpayer is higher than the utility gain of beneficiaries. Because of this difference in the marginal utility, the cost to organize unorganized losers can be higher than the cost to organize the target group of the transfer. If we assume that deadweight loss increases with the size of the redistribution, this advantage of affordable cost increases on the side of the losers. Thus, the probability that the benefactors of the policy will organize themselves increases with the size of policies.

Development and Increasing Return of Power Boost Investment into Politics

The political economy literature argues that economic development increases stakes in conflicts and the diminish of difference in political influence enhances rivalry. As I will show, this effect is indicated by interest group literature, rent seeking approach and size of the state literature.

Different interest group approaches conceptualize the final effect of particular interests as an outcome of a competition among them. In some approaches they define their political investment as a best response to others' political activities (see Becker (1983)). In other cases – like Pleltzman (1976) or Grossman-Helpman (1996) – vote-maximizing politicians facilitate this competition for policy outcomes. The third approach assumes that the autonomous public actor maximizes his utility defining a best response to the incentive schemes offered by interested private actors (see Dixit (1996)). All of these approaches assume that private interests compete against each other. Their results show that higher returns or more intensive competition for influence increases the political activity of the interest group.

The interest group theories are in close relationship with the concept of 'rent seeking activity'[79] that refers to the case when private actors compete for a monopoly position. The

[79] Krueger (1974), Tullock (1993), Bhagwati (1982)

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individually optimal level of efforts to get this monopoly position maximizes the difference between the return from this position and the necessary cost to acquire it. If economic prosperity increases the value of monopoly position, the optimal size of investments to attain will be ceteris paribus higher. If the chance of actors is close to equal to get the monopoly position, they will compete for it in a more intense way.

If we accept the assumption that higher potential return of an activity motivates higher level of investments into it, the expansion of public activities motivates higher level of political investments.

Empirical analyses show that public activities increase with economic growth.[80] If the volume of public activities increases, the potential return or loss of different actors also raises; consequently, the return of political investments becomes higher.[81] Some concepts of public expansion argue that higher demand for public activities or decreasing cost of public activities leads to the growth of the state. When the demand or efficiency of public goods raises, the intensification of political activities is a consequence of the increasing involvement of economic actors into the public issues – through either higher taxes or higher benefits from policies.

The concepts in the 'size of the state' literature directly refer to the increased political activities in several cases.[82] Extension of franchise results in an expansion of political activities and it leads to a bigger state in the form of launching new social and educational programs and more intensive redistribution. [83] The 'political models'[84] to explain government expansions argue that "greater government expenditure levels are due to increased rent-seeking activity".[85] Economic development results in a more detailed division of labor that leads to an increase in the number of interest groups and higher information asymmetry between the direct stakeholders and other actors. New policy fields emerge where the actors

[80] For a survey of size of the state literature see Mueller (2003) chapter 21, Hosley, Borcherding (1997)

[81] Baumol (1993) gives a historical overview to demonstrate that not the level, but the form of entrepreneurship differs between countries and ages. He argues that profit opportunity motivates the direction of innovation and if political activities offer higher returns, entrepreneurial activity will be higher in these sectors. In ancient Rome or in medieval China administration was the more appealing sector, in early medieval Europe warship was the main field of innovation.

[82] Several approaches to explain expansion of the state focus on the change in demand or price of public goods. In these cases rise of political activities can be a consequence of the increasing involvement of economic actors into the public issues – through higher taxes or higher benefits from policies.

[83] Acemoglu-Robinson (2000) and Congleton (2004) discuss how political forces lead to extension of francihse rights and expansion of public policies. Brock (2007) reviews the literature on political economy of redistribution.

[84] Hosley, Borcherding (1997)

[85] Hosley, Borcherding (1997) p 575.

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with more direct interest are more successful to represent their political demands, which usually means more spending of directly not interested tax-payers.

Political Investments Decrease Welfare

Political investments are intended to increase the share of the investor from the distributable assets giving up some opportunities to develop production. I will shortly discuss the following three issues to present some arguments of the political economy literature concerning why and how intensification of political activities decreases welfare:

- Political investments can increase because of the divergence of interests.
- Abundance of resources that emerge without productive efforts have a harmful effect on economic development.
- Rent seeking activities have a negative growth effect because these discourage production and innovation.

More conflict - more political investment

If exogenous factors increase political investments without changes in the amount of distributable assets, the disposable income will become lower. It happens if the redistributive conflict becomes fiercer.

The magnitude of redistributive conflicts increases if either the assets to be allocated or the differences in the endowment levels of actors become more important. Grossman (2001) develops a model to study the emergence of property rights. He assumes that actors have a common pool that offers resources to produce consumable goods. Rational actors can use their time and effort either to appropriate the common pool or to produce. Results reveal that rational actors invest more to become able to appropriate if the relative importance of assets to produce consumable goods increases.

Hirschman (1981) analyzes the forces behind social importance of income differences. He offers four factors that shape the individually perceived importance of inequality of wealth or prospects:

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- Share of the pie explanation[86] - Accessibility of goods with fixed amount in a society depends on relative income status. Increasing inequalities lead to worse relative position for the majority in the society, thus decreasing the access of some important goods.
- Relative position explanation –people evaluate their personal welfare in relative terms, so the perception of their decreasing status leads to smaller individual utility.
- Relative deprivation[87] – people perceive the period of growth or development as a chance for better life. Some of them are lucky, but most of them are not and they feel themselves to be losers of the progress.
- Anthropology – social diversion may have potentially harmful effect on personal bonds and social cohesion – This concept is a modification of the first one. In this case there are certain public goods whose amount is not fixed but decreasing in case of widening inequality.

Hirschman argues that if these forces are more powerful, the perceived loss of non-winners increases; consequently, they become more motivated to put efforts to increase their political influence.

Cases of cursed wealth

The intensity of political activities also increases if the distributable pool of resources increases. There are cases when the loss due to additional political investments offsets the raise of attainable resources. Empirical analyses show that development aids have no significant effect on economic growth, and huge resource pools frequently result in stagnation.

There is no recent study that would indicate the pure positive growth effect of development aids. Even the most supportive studies find that aid has a positive effect with diminishing return, which may become negative above a threshold level. Doucouliagos and Martin (2006) conclude that the 15 papers and 85 regressions analyzing the existence of diminishing return

[86] This explanation is valid for all zero sum games.

[87] Boudon (1986) gave a formal model of this originally Durkheimian concept. If expected value of investment into development options increases, the number of people who invest increases, too. As a consequence, the rate of ex post losers increases, as well. Let us assume that 25 percent of entrepreneurs become successful and the expected value of potential success motivates 20 percent of the society to invest. In this case 5 % will be better off, 15 % will be worse off (because of loosing their investments) and the situation will not change for 80 %. If expected value of success increases so that 40 percent of the society will take the risk of investment, 10 percent of the society will become successful and 30 % will fail. The improvement of prospects increased the share of losers from 15 to 30 % in the society.

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failed to prove decisively the existence of this so-called medicine effect. Some studies have found that aid has a negative effect on growth. Burnside and Dollar (2004) have found that aid has a negative effect that is significant at 10 % level after controlling national income and institutional quality – this significance disappears after including regional dummies into the model.

Sachs and Warner (1995) reveal that "economies with a high ratio of natural resource exports to GDP in 1970 (the base year) tended to grow slowly during the subsequent 20-year period 1970-1990." (p. 1.) Robinson et al. (2006) point out that "the empirical literature on the resource curse consistently emphasizes that resource dependent economies and resource booms seem to lead to highly dysfunctional state behavior, particularly large public sectors and unsustainable budgetary policies." (p. 448.)

Recent literature emphasizes that windfall resources are not deterministically harmful. Mehlum et al (2006) distinguishes the regime of grabber- and producer-friendly institutions. In the former case rent-seeking and production is competing activities, in the latter case the two type of activities are complementary. Robinson (2006) also emphasizes "the overall impact of resource booms on the economy depends critically on institutions since these determine the extent to which political incentives map into policy outcomes." Acemoglu et al. (2001) analyze the success story of Botswana to avoid the resource curse. They emphasize the following factors: inclusive stable tribal institutions that constrained the elite, maintenance of strong property rights, extremely huge amount of resources (diamonds) and individual political decisions to prevent the elite fights for rents.

The political economy literature suggests that windfall resources lead to slow growth because either the government is corrupt or the fight of economic actors for rents decreases productive efforts. Robinson et al (2006) build a model that is a close relative of the 'White Elephant' discussed earlier. The incumbent politician decides about windfall assets (like development aid or exploitation of natural resources) and he allocates resources between consumption and patronage to build a lock-in relation with his supporters. This approach implies that:

- Politicians over-extract natural resources because their discount rate is diminished with the probability to lose power.
- Resource booms increase the value of keeping the power, thus lead to higher spending on patronage.

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Negative growth effects of rent-seeking

The original rent-seeking approach[88] emphasizes that not only the deadweight loss of the monopoly represents the costs of rent-seeking, but also the nonexistence of monopolistic profit, as it is used to finance the costs to get and maintain the rent creating position. If we want to avoid judging the products and consumptions incurred by these rent-seeking activities to be inherently socially harmful ones, a dynamic approach is necessary to prove that rent-seeking activities substantially decrease the growth potential of the economy. Murphy et al. (1993) offer a systematic review of rent-seeking costs in this manner.

Murphy et al. (1993) argue that rent-seeking is socially costly because it decreases productive activities both directly and indirectly. Directly, rent-seeking has increasing return to scale; thus, "an increase in rent-seeking activity may make rent-seeking more (rather than less) attractive relative to productive activity" (p 409.). The indirect cost of rent-seeking appears because "rent-seeking, particularly public rent-seeking by government officials, is likely to hurt innovative activities more than everyday production. Since innovation drives economic growth, public rent-seeking hampers growth more severely than production." (p 409.).

The increasing return to scale is partly the consequence of the technological features of rent-seeking and it is partly due to the economic cost structure. This second effect refers to the fact that rent-seeking decreases the returns of production, which decreases the attractiveness of production.

The three technological forces of increasing return to scale are the following:

- Fix costs - It refers to the cost of organization, and the costs of entry to the rent-seekers' in narrow terms. In broad terms fix costs also represent the cost of setting up the rent-seeking system.
- Self-generating nature – the offense of some actors induces the defense activities of others
- "Strength in numbers." – the cost of individual rent-seeker to decrease the probability of legal or political counterattacks is small if the increasing frequency of rent-seeking activity decreases the probability of getting caught.

Rent-seeking, mostly public rent-seeking, induces a decreasing level of innovation[89] because it creates political and economic obstacles. The activities that are just under invention have no

[88] See Krueger (1974), Tullock (1993).

[89] Here innovation refers only to broadening of production possibilities. Innovation to improve position in redistribution has no growth effect, as we could see discussing Baumol (1993).

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lobby power. It is a serious issue mostly in cases when the realization of innovation endangers the profit of establishing economic actors.[90] Innovation is based on human capital that is a poor collateral; thus, innovators are in a disadvantageous position to cover the fix costs of political influence, such as bribes.

These problems can be solved if innovations could generate sufficiently high incomes with sufficiently low risk to compensate for the political support of the state or some influential patrons in a sufficiently short period of time. "If innovators destroy more profits than they create (perhaps because they increase consumers' surplus), and if the bureaucrats cannot collect the bribes from consumers' surplus, they might side with established monopolies and stop innovation." (p. 413)

Political Inequality is a Status Quo

The political economy literature offers several theories to explain how political inequality can be stable. Now I review some of these concepts focusing on three types of persistence that stabilize political differences: persistence of bargaining power differences, persistence of policies and persistence of political institutions.

When the background of bargaining power disparity weakens, adjustment to the new setting is not immediate because established policies are stiff themselves, as well. Similarly, in cases when the balance of power has already changed and policies have become inadequate, the outdated political differences can still be effective due to the inherent stability of the political institutions that frame and facilitate political bargaining.[91]

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[90] This influence bias is enlarged by the fact that economic losers are usually successful to protect their interests. Baldwin and Robert-Nicoud (2002) argue that economic losers are more motivated, thus invest more to improve their political influence because „in expanding industries entry tends to erode rents from lobbying, but in declining industries sunk costs rule out entry as long as the rents are not too high." (p. 1.)

[91] This approach is a based on the scheme offered by Williamson (2000). He distinguishes four levels of social analysis: level of norms, level of institutions, level of governance and level of transactions. This review will not discuss the role of norms in the stability of political differences because political economy is limited in the analysis of values and beliefs.

Persistence of bargaining power

Costs of organization, effectiveness of functioning and valuation of political benefits determine the bargaining power of actors.

The most widely applied approach to conceptualize the cost of organization is Olson's 'Logic of Collective Actions'. This concept emphasizes that expected utility of contribution to political activity decreases with the number of necessary participants. The main driver of this effect is not the smaller gain per capita, but the fact that both the expected impact and the visibility of individual contribution decrease with group size. If a group is bigger, one additional supporter has smaller effect on the probability of successful interest representation. More importantly, it is more costly to control contribution in a bigger organization. Collective action needs to find a solution for an n-person prisoners' dilemma game, where the observation and penalty of deviators is costly.

Olson argues that these costs are smaller if the group is more homogenous or if there are some selective incentives to motivate individual contribution. Selective incentives offer individual gains or penalties for potential contribution independently of the goal of the collective action. Participation in social networks, availability of exclusive services, physical threat, respect and self-respect[92] define an incentive scheme. If the organizers of a group can define and maintain this scheme, the chance of success increases.

The number of potential contributors to a collective action, their coherence and the arsenal of applicable selective incentives are mostly exogenously given. The personal skills of political entrepreneurs can increase or decrease the chance of successful political organization, but this factor cannot significantly modify the differences in the opportunity of interests to get a political representation.[93]

Some interests have advantages in effectiveness. Groups that control resources that are critical for other stakeholders of political decisions can put more pressure on others independently of

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[92] The direct benefit from the act of participation can be also regarded as a form of selective incentive. Participation as a self-expression may have an inherent value independently of the contribution to the collective action. The value of this act depends on the group norms endogenized by the members. If the organizers of the group can influence these group norms, it can enable them to construct nonmaterial motivation independently of the collective action's goal.

[93] If the probability of success motivates political entrepreneurs, no organizer will invest into the arrangement of groups and interests with heterogonous, numerous stakeholders and without available tools to create selective incentives. Even if someone shows results in some of these groups, it gives a good signal of personal abilities for the 'labor market' of political entrepreneurs. In this case an organizer of a chanceless group can expect that he will get an offer to work for other goals with higher expected payoffs.

the organization costs. There are actors who control goods or services that are very costly or impossible to substitute. They have a position in polity that is similar to the monopoly in economy.[94] The regulatory capture literature[95] demonstrates how successfully natural monopolies with informational advantage can represent their interests in the political arena. Economic conditions also influence the motivation of actors to spend on political activities. Becker (1983) argues that economic actors whose supply or demand is less elastic can win or lose more when market conditions change. If inelasticity is higher, deadweight cost is lower and it decreases the total social costs of a policy. Groups who can be supported with low deadweight loss and others who can be taxed without high deadweight cost have higher stakes in policy bargains; thus, we can predict that they will invest more into their political activities to seek political rents or protect against taxation.

Stigler (1971) and Baldwin and Robert-Nicoud (2002) argue that entry barriers also increase political activity.[96] Political benefits will motivate new entrants until the policy generated gain is higher than the cost of entry. Actors in sectors with low entry cost will be not motivated to get involved into political activities in order to achieve advantages because of low expected returns. An entry barrier depends on technological features – high fix costs compared to the size of the market. It can also be the consequence of market prospects: "in declining industries sunk costs rule out entry as long as the rents are not too high". (Baldwin and Robert-Nicoud (2002) p.1.).

Bargaining power frequently depends on the efforts of the political entrepreneurs. One's influence on the agenda and the procedure of bargaining depends on his political position and reputation that requires substantial investments[97]. These substantial fixed costs of political representation constrain the entry into, and thus decrease the flexibility of, political markets.

Size and structure of groups, economic positions, elasticity of supply and demand and fix costs of sectors have a dominant effect on the actors' political bargaining power. These structural features do not change fast; consequently, differences in bargaining power can be stable because of actors' difference in these characteristics.

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[94] Hirscman (1967) discusses how politicians take over control of a development project when they realize its power potential. Irrigation projects are good examples of how "control of projects would mean not only control over jobs and friends but also power to influence, to dominate, and to exploit the groups depending on the project" (p 55.).

[95] see Laffont-Tirole (1991)

[96] Entry barrier and inelasticity of supply frequently moves together but these are not the same phenomena. If entry is easier into a sector, its supply is more elastic. Its opposite, however, is not true because it is also possible that a market with given actors is supply-elastic – for example in case of Bertrand oligopoly.

[97] Baumol (1993) lists several examples for it.

Persistence of policies

Policies embody decisions of earlier political bargains. They are protected by the costs of renegotiation, implementation and modifications. Dixit (1996) gives an overview of these transaction cost obstacles. He emphasizes that not technical costs of policy rearrangement, but the techniques used to ensure credibility of policies are the real impediments of flexibility. We could see discussing the concept 'No Political Coase Theorem' that policies are frequently designed to function without external enforcement mechanisms. Beneficiaries and implementers of policy create lock-in situations (Dixit-Logrendan 1995), the implementing agency delegates the administration to the beneficiaries (Grief 2005). The government disables itself to withdraw political decisions through delegation of policy to agencies who are naturally committed to resist changes of policy (Dixit 1996). The agricultural policies that offer annual transfers to land owners or agricultural entrepreneurs, the 'white elephants'[98], the autonomy of certain professions[99], the independence of national banks are all examples of techniques that create credibility in a situation where agreements are not enforced by third party.

Beneficiaries of policies try to prevent economic and social changes that endanger their political position. As we discussed earlier, political regimes discourage innovation that could threaten the political status quo. Baumol (1993) argues in his historical overview that the political-economic setting motivates entrepreneurs to invest their efforts and creativity in fields that support its stability. As we discussed earlier, (referring to Murphy et al. (1993)) public rent-seeking activity – the political activity of economic actors to attain and sustain privileges – decreases innovation because it dries up the necessary supportive environment. Acemoglu and Acemoglu and Robinson (2000a) argue that incumbent monopolists are intended to block innovation if it endangers their position.

Even if exogenous changes makes modification of policies inevitable, the time consuming fight about the allocation of costs postpones reforms, as Alesina et al. (2006) argue. In this approach the relative winners of this war of attrition are frequently the groups with less bargaining power.

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[98] Robinson, Torvik (2005)
[99] Matthews (1991)

Persistence of institutions

Even if exogenous changes undermine the basis of political positions and strong shocks ruin policies, the basic institutions of a society can stabilize some of the political advantages. North (1990) defines that "Institutions are the rules of the game in a society, or, more formally, are the humanly devised constrains that shape human interaction." (p. 3.) The rules of the game define the process of policy making and the position in this process is a crucial source of bargaining power. In this way persistence of institutions stabilize the differences in bargaining powers.

The case of QWERTY (David (1985)) is a classic example to demonstrate the persistence of socially inefficient systems. The setup of the typewriter was initially designed in a way that slows down typing because the maximum speed was technologically limited. This technical constraint disappeared fast, a superior setting of keyboard was designed, but the speed-limiting setting has remained the dominant one. North (1990) mentions four self-reinforcing mechanisms that can stabilize inferior systems: 1, large fix costs of change 2, large amount of human capital and innovative efforts related to the existing system 3, change of technology needs coordination and/or cooperation of other actors because of network effects 4, adaptive expectations. In case of institutions these mechanisms are effective to block institutional change. Thus, institutions can survive and keep alive coded political advantages even in cases when their social and economic basis is withered.

Weingast (1997) explains the stability of regimes with the coordination problem of actors without political representation. "Citizens can police the state only if they react in concert to violations of fundamental limits by drawing their support from the sovereign or political officials. The natural diversity of interests and experiences hinders the ability of citizens to react in concert; they are unlikely to have similar views about the appropriate limits on the state action and the rights of citizens. Problems arising from the disagreement are exacerbated because violations of the rights of one group often benefit other group." (p. 261) He argues that the control of the state needs a shared view about its limits and willingness to defense these limits.[100]

[100] These requirements construct a collective action problem. Consequently, if the change of social and economic conditions created enough motivation and assets for benefactors of an institutional setting, they can challenge it.

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Political institutions define the legitimacy of actors who manage them. Consequently, politicians and bureaucrats are interested in their protection. Political economy theories offer detailed analysis of what the basis of public actors' position is. Their power can be based on

- advantages of coercive power[101]
- ability to offer services for contract enforcement[102]
- skills and chances to organize an autocratic regime[103]
- success in democratic competition to design policies that ensure the necessary support of voters and interest groups to win an election[104]
- monopoly of knowledge concerning the details and technology of public management[105].

It is a dominant and mostly unchallenged assumption of these approaches that the very first priority of public actors is to keep their position. Thus, politicians and bureaucrats work hard to sustain the stability of the institutions that formalizes their power.

Political Inequality Motivates Exit

Exit option can compensate for the weakness of political representation for actors who do not have sufficient opportunities to represent their interests in the policy process. If exit is more appealing, it represents a more credible threat. Exit may have several forms. People and companies can change their location. They can secede and found a new political unit. They can also partly opt out of the state, making their economic activity invisible for the public actors. Also, outsiders have an option that is a special case of exit: they can restrain from entry if expected gain is not sufficiently high.

Tiebout (1956) argues that people's option to choose between governments offering different tax-public good packages forces local polities to improve their services. This 'vote with feet' mechanism motivates polity to reflect the demand of people with low individual interest representation abilities, as well. If people or companies can relocate themselves without costs and the number of jurisdictions is sufficiently high, the governments will compete for tax

[101] Schelling (1971), Benson (1999), Olson (2000) Dixit (2004), Bates at al. (2002)
[102] Weingast, North, Milgorm (1990), Grief, Milgrom (1994) Dixit (2004), Grief (2005),
[103] Tullock (1989), Wintrobe (1998)
[104] Downs (1954), Peltzman (1976), Austen-Smith (1971), Grossman-Helpman (1996)
[105] Weingast (1991), Moe (1990), Laffont-Tirole (1991), Tirole (1994) Dixit (1996), Niskanen (2001)

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payers, and everyone can find a location where the portfolio of taxes and local services is ideal for him.

Buchanan and Faith (1987) emphasize the role of potential secession as an alternative option compared to the classic exit option. In this case people opt out of the existing political unit in order to establish a new one. This option defines a credible threat that constrains the ability of the dominating political coalition to extract fiscal surplus from the less influential ones. Buchanan and Faith develop a model where the government have a monopoly of offering public goods and collect taxes. The 'sharing coalition' controls the state and the income of outsiders is taxed to finance the transfer toward members of this coalition. The equilibrium tax rate maximizes the net income of members of the sharing coalition without inducing secession. This tax rate is stable because public goods are produced with increasing return to scale; consequently, the cost of its organization would be higher for secessionists. "The sharing coalition, in essence, taxes the nonsharers for the benefit of living in a larger polity." [p 1027.] If income difference of people is introduced, the model predicts that richer ones will be members of the sharing coalition because their financial advantage would increase the feasibility of secession, and it would decrease the maximum level of redistribution without secession.

This alternative political unit may have several forms. It can be the secession of countries as it has been happening in several Eastern-European countries. State can lose control over certain regions where some alternative power organizes the life, such as pirates, drug-barons or revolutionists. Secession can be partial where alternative organizations successfully replace the state in the organization and maintenance of order. In this case some spheres of the life is organized in an informal way.[106]

In their review on informal sector, Castells and Portes (1989) show that informal economy is not the economy of the poor world but a way to organize economic activities outside the realm of public institutions. They report an increase of the importance of these informal activities and the two first reasons behind this refer to the motivation of business to avoid the spheres where they would have disadvantage because of the lack of adequate political

[106] See Schelling (1967), Schelling (1971) and Dixit (2004)

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influence.[107] First, they refer to the motivation of companies and individual workers to organize business without the presence of organized labor. The second force behind the expansion of the informal sector is "the reaction against the state's regulation of the economy, both in terms of taxes and social legislation" [p. 28.].

DeSoto (2000) argues that the informal sector emerges because formal institutional rules do not offer adequate services to protect property rights, neither do they facilitate economic transactions for people outside the traditional politically-embedded sectors of the economy. His suggestive essay gives examples from the English and American history to show that this phenomenon is not a special feature of the less prosperous parts of the world. His normative conclusion goes even further: states have been and can be successful in economic development if they can offer credible services that motivate and help the return of informal companies into the legal world. Legal protection offers more transaction options and opens the access to financial markets. It boosts economic development that helps poor countries to decrease poverty, to fight successfully against separatism and terrorism.

Azam et al. (2004) develop a model to show that companies do not enter into the modern sector in order to protect themselves against political predation. Functions on formal and transparent markets, accounting and reliance on finance intermediaries enhance economic productivity in a way that enables the government to extract rents from firms. The government can alter the exchange rate, distort prices on input and output markets, modify tax and tariff policies or even seize the companies' assets. The government has to decide whether to choose short term gains that will discourage activity in the modern sector or to keep its reputation in order to improve the long term tax income prospects. As a response, companies rationally improve their exit options, which is the traditional or informal economy for firms that cannot easily relocate their production abroad.

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Summary

[107] They also mention three other reasons: the increasing competitive pressure to decrease labor costs, the inability of states to provide adequate public environment in zones of fast industrialization and the crisis of the '70s that motivated people to find and accept the flexible techniques of surviving.

Based on the presented results of the literature, I have found that political economy offers some general concepts concerning public decisions. There are seven concepts I will discuss in this chapter:

1. *Bargaining reflects demand for policy;* thus, when actors modify their intention concerning public issues, the content or the structure of policies will change.
2. *Position determines success;* thus, if one has some advantage in the political decision process, he will get a higher payoff. The emergence of this advantage is a path-dependent process. The drivers improving the political positions are lower costs of organization or exit, higher chance to become a member of a winning coalition, better access to politically influential resources (money, hardly substitutable resources, information), higher level of credibility either to threat or to support and more patience (lower time cost) in political debates.
3. *An ally is always helpful*; consequently, actors try to manipulate the circle of participants in policy debates. The costs and benefits of exclusion, the possibility of differentiation of participants and the motivation of outsiders to enter into policy debates shape actions in the participation setting process.
4. *Development and increasing return of power boost investment into politics.* The rise of stakes or the improved efficiency of political efforts motivates these investments both directly and indirectly. Direct effect is based on increasing marginal gain. The indirect effect is the consequence of increasing marginal loss of non-investment because better prospects also motivate others' political investments.
5. *Political investments decrease welfare.* The rise of political investment is frequently the consequence of the higher divergence of interests that motivates raise of political efforts even if expected gains will not increase. If there is a fixed amount of available wealth (like natural resources), it diverts efforts from productive investments in order to improve positions in its allocation. If one has the potential and the motivation to create a similar situation artificially, a diversion of resources from making to taking emerges through not only seeking, but also creation of rents.
6. *Political inequality is a status quo* because differences in bargaining power are based on characteristics of actors that are stable. Even if actors' positions change, policies have their own persistence. Also, the institutions that create policies can postpone their modification even if these are suboptimal for all participants.
7. *Political inequality motivates exit* mainly through two mechanisms. First, if someone can increase the threat to withdraw his contribution to a common good, he can

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increase his share from its gains. Second, inequality decreases the expected gains of participation, thus making it more appealing to be outside of the realm of this common enterprise.

The next chapter will present a modeling framework that is compatible with these results based on general and robust assumptions.

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Chapter II.2. – Nash Bargaining Model of Policy Change

Introduction

I will present a Nash Bargaining based approach in this chapter that makes it possible to conceptualize the general results of the literature review. I argue that the theory of Nash bargaining offers a general framework to study policy design. The superiority of this concept is partly based on the generality and strength of assumptions behind it and partly on its flexibility and simplicity, so the practical appeal of the offered solution.

In the first subchapter I will shortly review the theory of Nash Bargaining Concept. This classic approach of cooperative game theory is based on the result that there is only one outcome of a bargaining situation that fits to some appealing assumptions concerning its process and outcome. I will discuss the assumptions behind the process of bargaining and some key issues concerning participation in bargaining in public realm. Supplement II.1. gives an explicit definition of Nash Bargaining.

In the second subchapter I will present a Nash Bargaining based model assuming that there are actors who would like to modify the existing policy into different direction. If they cannot agree on the details of the motivation, the policy will collapse. I will show that someone's influence on policy outcome increases if the value of his exit option, his bargaining power or the intensity of demand for change increases and a policy option will get closer to realization if the number of its supporters increases in a bargaining situation.

I will develop the model in the third and fourth subchapters introducing activities to improve bargaining position. I assume that there is a preparation period before the bargaining on policy when actors invest to increase their bargaining power or to enhance their off-bargaining payoff. At first I will study how characteristics of bargaining shape the optimal level of bargaining power increasing investment, then I study activities to develop off-bargaining position.

In the fifth subchapter I will assume that two participants of bargaining decide about their political investments as a best response to each other's strategies. There is a Nash equilibrium driven preparation phase before the Nash bargaining in this setting.

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A Review of Nash Bargaining Concept

Bargaining situations emerge when actors have an opportunity to create gains through cooperation and they have to agree how to share the costs and benefits of this joint enterprise. The opportunity for bargaining becomes realized if there are actors with the option and motivation to cooperate and there is a process that facilitates them to make an agreement.

Bargaining is a kind of equilibrium selection process. In a nonzero game situation there are potential outcomes that are Pareto superior compared to other ones. If some of these outcomes are feasible – there are mutually consistent beliefs and strategies of actors that support the realization of these outcomes – the participants need some mechanism that supports them to choose one of the achievable Pareto superior outcomes. If we assume that actors can communicate[108] and they can give credible promises, bargaining becomes an available equilibrium selection mechanism beside mechanisms that functions even without communication: evolution[109] or conventions[110]. So, if actors can negotiate: threat[111], promise[112] and agree[113] then they can select the equilibrium themselves instead of some external device. The condition of participation in this exercise and the process of bargaining will be discussed in the next sections.

Nash's concept[114] is based on the idea that the bargaining processes – the structures of the negotiation game – have some general features and because of these characteristics the equilibrium outcome supported by rational strategies of bargaining participants will have a pattern that fits the axiomatic criteria of the Nash Bargaining solution. In an informal way, the concept of Nash Bargaining states that rational actors are able to utilize the potential gains of

[108] Possibility of communication needs that actors mutually assume about each other a certain level of intelligence to be able to send and understand messages. They need to believe to have a shared cultural background that guarantees identical interpretation of messages. Actors also need some guarantees to believe that the other's message has some consistent relation with reality, because communication needs some credibility. See Farell & Rabin (1996.)

[109] Evolution has two driving forces: random modification of strategies and the natural selection of actors whose interaction patterns increase their survival rate. See Hirschleifer (1978) and Masters (1983).

[110] Conventions refer to the shared perception of actors concerning description of nature and patterns of interaction. Conventions accumulate the shared experiences of earlier interactions to help actors to find a solution in a new situation. See Ullman-Margalit (1990)

[111] Someone can credibly commit herself to follow a strategy that offers a payoff for all participants that is Pareto inferior.

[112] Someone can credibly commit herself to keep herself to an ex ante declared option even in a choice situation where other options offers higher payoff.

[113] Actors can fix the details how their choices condition each other in a mutually understandable and credible way.

[114] Nash (1950) and Nash (1953)

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cooperation if they can agree and keep agreements. In this case two characteristics determine participants' final share of the collective gain: their alternative payoffs they could realize without agreement and their bargaining power.

The Nash Bargaining is intended to summarize the result of negotiation stories, so the comparison of the outcome of strategic situations of cooperation issues with the Nash Bargaining result offers a test for this concept.[115] These tests seem to support the concept, although "none of the non-cooperative bargaining models which have been studied implement the Nash bargaining solution *exactly*. In each case, the implementation is *approximate* (or exact only in the limit)"[116].

The assumptions used in different approaches to analyze policy design situations are usually consistent with the assumptions of the solution concept, in this way we can perceive Nash Bargaining as an essence of knowledge also.[117] We usually accept the rationality of actors and the existence and consistence of rules to communicate and agree – and these are the main building blocks of NBC.

Participants of Bargaining

Cooperative ventures usually have several participants. In case of policies it is frequently a core issue who are in the bargain and who are out of it.

Someone is involved into a bargaining game if (1) he can credibly contribute to the cooperation (2) with potential gain.

1. *Contribution to the cooperative venture must be credible*

   Credibility has two aspects. At first it must be guaranteed that someone will follow the agreement and pursue the action he promised to his partners. Some mechanism must ensure that if someone declares to pay a contribution, to give political support or to resist from harmful attacks, he will keep his promise to do so.

   At second, this action should happen because of the agreement, so it would not happen if it was not the part of the agreement on terms of bargaining. If someone would do the same

[115] The hallmark and the essence of the Nash program is therefore the imperative to test abstract or informal reasoning with simple but specific negotiation models. Binmore & Dashgupta (1987) p. 9.
[116] Binmore & Dashgupta (1987) p. 24.
[117] It is a good question whether similarity of assumptions is based on path dependence of scientific work or it happens because these assumptions are right but to discuss this issue is beyond the scope of this dissertation.

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independently of the fact whether she is included into the collective action or not, its success would be independent on her participation. For example, if a politician would support a project because electoral interests force him to do so, he cannot credibly threaten other stakeholders to withdraw his support. If a trade union has no capacity or financial background to organize a strike, its representatives cannot contribute to the success of the company with their promise not to organize it.

Consequently the baseline to assess someone's contribution is to compare what would be her effect on the gross return of collective action if she is involved or not. In this way someone becomes a candidate to participate in the bargain if there are well founded expectations concerning the value added of her participation either in a form of contribution as a response to inclusion or a credible threat in case of exclusion. It is a core issue what gives the ground for the necessary credibility. This question will be discussed in the next section.

2. *The collective net gain due to the contribution must be higher than the cost of the effort maker*

If someone's participation is more costly for him than the expected value of the net value added of his contribution for the whole collective action, he is not in a collective situation with the others.

These net gains are to be calculated not simply on a contrafactual basis, the costs to change the participation structure matters also.[118] The analysis should not ask simply 'how much more gains would be there to share if someone would be or would not be involved into the business?', but in a more realistic manner: 'how the net present value of the collective action would change if someone were included into or excluded from it?'. For example, if someone's inclusion would increase the cooperative gains but it is less than the costs of his training and introduction into the practice on the one side and the cost of incumbents to accommodate to the new setting on the other side, transaction costs prevent the extension of bargaining.[119] For example, the members of a trade society that has a well established Merchant Law, would be better off if the number of members in their trading network would be higher. Inclusion of new members gives benefit in long term but costs – mainly due to the risk that a new member will not follow the rules of the society – emerge

[118] This emphasis of path dependency is important when real policy processes are in the focus of analysis. See North (1990)

[119] It is fairly possible if the participants of the cooperation has a high discount rate because their preferences or the risks of their activity makes future payoffs less valuable.

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immediately after the admission. If members of the trade society are not patient enough, they will find it better to leave expansion opportunities unutilized.[120]

If someone got high-level skills and a central position in the bargaining process, his exclusion would need the rearrangement of the bargaining in two ways. At first, the lost knowledge should be replaced. Second, there would be costs for all participants to restructure their positions – meaning uncertainty for a while, investments into the competition in the position reallocation etc. In these cases the net gain of inclusion can be the avoidance of harms that might emerge as a consequence of someone's rational actions in case of exclusion.[121] For example, it is possible that a godfather of a village offers protection of property and guarantees for trade transaction at a price that ensures a high profit for him. He can maintain these terms of business even if he has not sufficient potential to suppress a revolt because it can be a violent process to find his successor and the new don would need a period to collect enough expertise to facilitate the economic transactions.[122]

These conditions define the frontier between participants and others in a clear way.

Being out - There are actors for whom the contribution to the cooperative outcome is more costly than its expected gain. They will not be taken into consideration during the bargaining process because their best response is to accept any kind of bargaining outcome. They are not participants of the bargaining although it can influence their final outcome. For example, it can be prohibitively costly for poor peasants working for a plantation to organize themselves and they have no real options to move into a town because of high distances and lack of education. In this case if the price of crops falls, the peasants have no other option than to accept the cut of wages.

Being in - There are actors without voice who can influence the bargaining outcome canceling their contribution in a way that (1) the expected return of this action is positive for them and (2) it decreases the expected payoff of some participants of the bargaining. They are participants of the bargaining with minimal or zero bargaining power, consequently they will get a 'take it or leave it' offer with a payoff that is just above the level that would motivate them to block the cooperative action. For example if workers in a factory cannot organize

[120] The example is inspired by Grief (1993) that analyses the institutions of Maghribi traders.
[121] Cost and benefit of actions should be interpreted in broad sense. For example if revenge gives satisfaction for someone, the action is irrationally only from instrumental point of view. It is not so if we judge rationality as a consistence between actions and preferences about different states of the world.
[122] This example is motivated by Dixit (2004) who analysed the role of maffia in business facilitation.

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themselves they cannot force the management to increase their wages when the firm becomes more profitable. But if the whole industry enjoys prosperity that increases demand for labor, the management will offer an increase of wages to decrease the motivation of employees to look for a new job.

Process of Bargaining

The Nash Bargaining solution is a consequence of assumptions concerning the negotiation before agreement on details of cooperation and credibility of its implementation. "The word cooperative is used because the two individuals are supposed to be able to discuss the situation and agree on a rational joint plan of action, an agreement that should be assumed to be enforceable."[123] Options, reactions and final outcome of player are determined by conventions concerning the game, the role of time during the bargaining and participants' knowledge concerning the situation and each other. [124]

Commitments are important in two key aspects: (1) communication of actors is meaningful if their declarations have some credibility and (2) agreement is feasible if actors bind themselves to it. There are cases when statements and agreements are self-enforcing because they refer to a feasible equilibrium outcome. In other cases reputation mechanisms[125] motivate participants to keep the agreement and the rules of communication. In this view all bargaining games are only parts in a sequence of bargains: not only payoff of a given bargain is to be maximized but participants take care of forming others' expectations about themselves in the later interactions also. The return to be honest, tough, generous or incalculable emerges not in the case when these virtues are presented but in the next bargaining situations when this image contributes to higher payoff. Reputation mechanisms link the different bargaining situations. Past cases are taken into consideration as a basis of expectations; future events have also effects because reputation for those times is partly based on effect of present choices. These conscious expectation management efforts will create shared beliefs about how to treat each

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[123] Nash (1953) p. 128
[124] "One cannot usually offer a sensible estimate of what is likely to happen without having a view on the roles ascribed to commitment, time and information within the bargaining process." Binmore-Dasgupta (1987) p 10.
[125] The simplest reputation mechanism is repetition. For example in Prisoners' dilemma game to keep commitment is rational if value and chance of future cooperation is sufficiently high, thus extra pay-off of one time deviation is smaller than expected value from the flow of cooperative gains. More complicated reputation mechanisms work in other case when actors alternative is not simply coordinate or not coordinate but they can choose with whom to cooperate. In these cases cooperative attitude makes someone worthwile to deal with. See more in footnote 26.

other in a bargaining situation, how to solve a coordination problem to choose between the possible outcomes together: conventions will emerge.[126]

Different conventions lead to different bargaining procedures and different bargaining outcomes. These shared views concerning the way to communicate, the way to solve conflicts and the expectations about each other create the cooperative infrastructure. "The choice of solution concept must necessarily entail a whole mix of implicit assumptions about the nature of the cooperative infrastructure within which the game is thought to operate." [127]

The conventions that direct bargaining situations may create arbitrating and enforcement institutions. In these cases the opportunity to get a gain from mitigation of transaction costs leads to a division of labor in the management of bargaining situations.[128] Special agents will appear to facilitate the interactions offering services like guarantees[129], arbitration[130], enforcement[131] or protection[132]. In these cases the interaction facilitator becomes a participant of the bargaining also, with their own stakes and reputation.

Bargain needs time (and other costs connected to the complicatedness of the negotiation) and actors may differ how much patience, resources they have for the negotiations. These process related differences influences bargaining power of the participants. If delay of agreement or costs of bargaining that depend on its length are less important for someone than for others, he can successfully claim higher payoff for not slowing down the bargaining process. Asymmetry of time relevant bargaining costs has a great role in case of strikes, in negotiation of firms with different capital background or in violent conflicts with asymmetric costs of warfare.

Beside this quantitative aspect, time has a qualitative role in bargaining situations also. The (convention or facilitator directed) choreography of negotiation defines the order of offers and counteroffers. This division of opportunities in time to influence the negation defines the agenda setting power of the participants.

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[126] As we could see earlier (Footnote 62), convention can work as an equilibrium selector mechanism in itself. In case of bargaining it has a crucial role as one of the mechanisms that facilitate communication and enforcement.
[127] Binmore Dashupta (1987) p30
[128] North (1990) shows how institutions emerge to decrease the transaction cost of interactions.
[129] Grief (2005) analyses in detail how different contract enforcement institutions emerge and function.
[130] Milgrom, North, Weingast, (1990) discusses how legal entrepreneurs solved the legal debates of traders in the fairs of the XIth century. Their reputation based on the acceptability of his judgments, meanwhile traders lost reputation if they did not accept the decision of the law merchant.
[131] Grief, Milgrom and Wingast (1994) analyzes how guild could enforce their members to keep the boycott decisions.
[132] Specialization in protection has a broad literature. Beside Dixit (2004) it is worthwile to mention Bates, Grief, Mirta (2002) that analyses the equilibrium of aggression and protection activities with and without state.

NBC has a strong information assumption. It supposes that actors know the rules and the structure of the game and they know a lot about each other. Utility function and strategy options are assumed to be common knowledge. It is a generally used and frequently blamed assumption of economics. There are several results assuming a less universal information structure[133] but most of the economic applications accept this full information (or consistency of expectations with reality) assumption – mainly because in most of the cases it is necessary to keep analysis of bargaining situations manageable.
This assumption of full information is frequently applied in a more restrictive manner, assuming that actors have only a good guess about certain characteristics concerning others' intentions and options. It means that everyone has an uncertain knowledge concerning these characteristics that can be represented with an unbiased probability distribution. In this way knowledge is represented with true information concerning the expected value of others' options and intentions. More informed someone about others, smaller the variance of his expected values describing their characteristics.

This concept can be perceived either as a broad description of subgame-perfect equilibrium of strategic games concerning cooperation or as a theory of equilibrium selection among Pareto efficient equilibria of a strategic situation. The strategic games are usually conceptualized in a way that participants give offers to each other in an exogenously defined sequence till the stage when some conditions are satisfied that enables one of the participants to declare about a given offer that it will be the outcome of the negotiation. In these strategic games someone can get a higher final payoff if conventions offer him higher influence on final outcome than for others or if the costs of bargaining are smaller from him. The three main sources of these costs are: (1) conventions prescribe bargaining specific costs, (2) the time of participation and the delay of agreement is costly and (3) information is uncertain.

The most famous game is the altering offer game presented by Rubinstein[134] where participants have to agree on how to share a fixed amount. They propose a way for sharing after each other till one of them accepts the offer of the other. Assuming full information and costliness of bargaining, actors will agree at the very beginning of the game in a way that fits to NBC. In this case bargaining power of actors depends on their costs attached to number of

[133] Binmore, Dasgupta (1987) p 31.
[134] See Osborne, Rubinstein (1990)

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steps or to the amount of time till agreement. The player for whom bargaining is less costly, will accept the immediate agreement only if others – who can loose more from delay – offer him a payoff that makes it profitable for him also to avoid costly negotiations.

The subgame perfect solution of a dictator game is a Nash bargaining solution also. In this case the game has two stages. At first one of the players (the dictator) offers a share of the cooperative gains and then the other player decides whether to accept it or not. If the offered payoff is higher for him than the expected payoff without an agreement, it is rational for him to accept it. In this case the bargaining power of the second player is zero, thus he will get a 'take it or leave it' offer just above his alternative payoff. Based on this logic, principal-agent situations can be treated as a special case of Nash bargaining. The principal gives a 'take-it-or leave-it' offer (incentive scheme) that is based on the expected utility of the agent from the alternative options, on his risk attitudes, and on his expected information advantage. [135] Zero bargaining power does not mean lack of influence but a final veto right – that can be powerful in several cases. Actors may get involved into political activity to modify their off bargaining position, as we will discuss it in detail later.

There can be several different ways of bargaining concerning the same issue based on differences of commitments, conventions, expectations, negotiating procedures etc. NBC fits well to most of these situations because the assumptions of these concepts are mostly applicable to them. The language of this concept is broad enough to summarize these procedural differences and their effect on the result of bargaining into meaningful categories of gain from cooperation, exit option and bargaining power.

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[135] See Sappington (1991)

Modeling Policy Bargaining

I define the policy bargain in a classic asymmetric Nash bargaining framework. The utility of actors in group 1 is $u_1(x)$ and in group 2 is $u_2(x)$, when policy modification x is realized. Actors have to agree concerning the details of this modification otherwise the policy will be terminated. In this case the first sector's payoff will be $\xi 1$, the second sector will realize $\xi 2$ payoff. The bargaining power of actor is represented by $\nu 1$ and $\nu 2$.

Following the logic of Nash Bargaining concept, the outcome of bargaining will be that value of x that maximizes expression 'pol'.

1. $pol = (u_1(x) - \xi 1)^{\nu 1} (u_2(x) - \xi 2)^{\nu 2}$

For example, assume that the representatives of labor and service sectors have to agree concerning the modification of the human policy in a certain situation but they propose opposite directions to modify the volume of policy. If they cannot agree about the details of modification, this public development activity will be cancelled, so they will not get public assistance to increase efficiency of labor.

The first group opts for expansion of policy and the second group proposes contraction. For sake of simplicity I will assume that the modification would have linear effect on their utility; a and b represents the intensity of utility enhancing or mitigating effect of policy modification. The actors prefer contraction or expansion only in a range ($|x| < \theta$) – this range represents the size of policy modification that would be optimal fot the actors. I will assume throughout the analysis that this constrain is not binding.

2. $u_1(x) = u1 + a\,x$, $u_2(x) = u2 - b\,x$, $|x| < \theta$

Industry prefers higher, service sector opts for lower level of human policy. If the policy outcome is the mean of their proposed policies they will realize u1 and u2 utility levels. If the difference between actual policy outcome and this average is x (assuming that policy outcome is always lower than industry's optimal level and higher than service sector's optimal level), change of representative industrial actor's utility will be a*x, change of representative service sector agent' utility will be –b*x.

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Solving the maximization problem

$$\frac{\partial}{\partial x} sol := (u1 + a\,x - \xi 1)^{\nu 1}\,(u2 - b\,x - \xi 2)^{\nu 2}$$
$$((x\,(\nu 1 + \nu 2)\,a - \nu 2\,(-u1 + \xi 1))\,b + \nu 1\,a\,(-u2 + \xi 2))/((u1 + a\,x - \xi 1)$$
3. $$(-u2 + b\,x + \xi 2)) = 0$$

We can define the solution of the bargaining process[136]:

4. $$x = \frac{-\nu 2\,(u1 - \xi 1)\,b - \nu 1\,a\,(-u2 + \xi 2)}{(\nu 1 + \nu 2)\,a\,b}$$

Analyzing the effect of economic variables on the bargaining outcome we can see that a sector has a higher impact on the final policy outcome if they are more interested in this change, if they have more bargaining power or the threat to terminate the policy is less dangerous for them.

5. $$0 < \frac{\partial}{\partial a} x\,,\ 0 < \frac{\partial}{\partial \xi 1} x\quad 0 < \frac{\partial}{\partial \nu 1} x$$

6. $$\frac{\partial}{\partial b} x < 0\,,\ \frac{\partial}{\partial \xi 2} x < 0\ \ \frac{\partial}{\partial \nu 2} x < 0$$

Now I will use this framework to analyze how the characteristics of bargaining influence the policy outcome. The results of my analysis make it possible to formulate three statements that fits to the insights presented in the literature review.

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[136] SOC is satisfied for this solution

$$\frac{\partial^2}{\partial x^2} sol = -a^2\left(u1 + \frac{b\,(-u1 + \xi 1)\,\nu 2 - \nu 1\,a\,(-u2 + \xi 2)}{(\nu 1 + \nu 2)\,b} - \xi 1\right)^{\nu 1}$$
$$\left(u2 - \frac{b\,(-u1 + \xi 1)\,\nu 2 - \nu 1\,a\,(-u2 + \xi 2)}{(\nu 1 + \nu 2)\,a} - \xi 2\right)^{\nu 2} b^2\,(\nu 1 + \nu 2)^3 \,/\,($$
$$((-u1 + \xi 1)\,b + a\,(-u2 + \xi 2))^2\,\nu 2\,\nu 1)$$

Statement 1. - Bargaining Reflects Demand for Policy

Statement: If both actors increase their demand for public development activity, the public intervention will ceteris paribus expand.

Proof: If someone's demand for public development activity increases the same level of expansion will have a more positive or less negative effect on her utility, so either a increases or b decreases. As we could see $0 < \frac{\partial}{\partial a} x$, $\frac{\partial}{\partial b} x < 0$, so the statement is true.

For example, assume that industry proposes a 10 unit large policy and service sectors would mostly welcome a 5 unit large public activity and 8 units is the policy equilibrium. If an exogenous shock - like the rise of labor productivity as a consequence of technological process - motivates both actors to upgrade their political demand (independently of the size of this change) the human policy will expand and spending on it will be more than 8 units.

This result supports the assumption used in Part I. analyzing demand for public development policy. Based on it we can give prediction on the direction of policy modification in cases when actors who opt for different levels of public intervention modifies their political demand into the same direction.

Statement 2. - Position Determines Success

Statement: Someone realizes better outcome if she has better position in the negotiation process because of more bargaining power or higher payoff for off-bargaining option.

Proof: $0 < \frac{\partial}{\partial \xi 1} x \quad 0 < \frac{\partial}{\partial \nu 1} x$, $\frac{\partial}{\partial \xi 2} x < 0 \quad \frac{\partial}{\partial \nu 2} x < 0$

The result that growth of bargaining power increases payoff seems straightforward. This result has a strong consequence. If policy outcome strongly depends on bargaining power, the schemes assuming that someone gives up some bargaining power in order to get a more appealing policy are not feasible because there will be no device that would guarantee to keep

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an agreement like this. Only better position in political decision-making process can guarantee more favorable policies in the future.

Increasing appeal of off-bargaining option for an actor makes him more terminated. Imagine that industry could solve easier the problems than the service sector that would emerge if the government canceled human policies. This advantage is manifested in higher return on private intra firm education programs and social insurances because of its bigger firm size and smaller employee fluctuation. This more advantageous off-policy scenario will help them to achieve an agreement with ceteris paribus higher level of public activity in the field of human policies.

The consequences of this straightforward result are far reaching. If we accept that bargaining power determines gains from policies, groups without power to get and keep their shares will not get more than the value of the option being outside of the bargaining. Consequently economic actors are interested to improve their position in order to increase their payoffs. Political activities in order to maximize payoff through investment into development of bargaining position will be analyzed in the next chapter.

Statement 3. - An Ally is Always Helpful

Statement: The inclusion of a third group into the bargain biases the policy outcome into the direction preferred by the new entrant. If she promotes expansion (contraction) of policy, the outcome of policy bargaining will be higher (lower) for three participants then for two.

Proof: The maximum of formula 'sol1' gives the solution for bargaining of two actors, 'sol2' is the maximand of a three-actor bargaining.

7. $sol1 := f(x)^{v1}\, g(x)^{v2}$

8. $sol2 := f(x)^{v1}\, g(x)^{v2}\, h(x)^{v3}$

The net gain from bargaining is f(x), g(x) and h(x) for the first, second and third actors, respectively. For sake of simplicity the off-agreement value is assumed to be zero for all of them. Now I assume that the third actor opts for expansion of policy (c>0) similarly to the first group. The second group would like to see contraction of policy.

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9. $f(x) := a\,x + u1$, $g(x) := u2 - b\,x$, $h(x) := c\,x + u3$

Statement 3. says that:

10. (x | $sol1(x^o) \le sol1(x)$ for any $x \neq x^o$) < (x | $sol2(x^o) \le sol2(x)$ for any $x \neq x^o$)

I will use logarithm of sol1 and sol2 because it makes calculations simpler.

11. $lsol1 = \nu1\ \ln(a\,x + u1) + \nu2\ \ln(u2 - b\,x)$

12. $lsol2 = \nu1\ \ln(a\,x + u1) + \nu2\ \ln(u2 - b\,x) + \nu3\ \ln(c\,x + u3)$

13. $\frac{\partial}{\partial x} lsol1 = \frac{\nu1\ a}{a\,x + u1} - \frac{\nu2\ b}{u2 - b\,x}$

14. $\frac{\partial}{\partial x} lsol2 = \frac{\nu1\ a}{a\,x + u1} - \frac{\nu2\ b}{u2 - b\,x} + \frac{\nu3\ c}{c\,x + u3}$

$\frac{\partial^2}{\partial x^2} lsol1$ and $\frac{\partial^2}{\partial x^2} lsol2$ are negative so the 'x' value that equalizes $\frac{\partial}{\partial x} lsol1$ and $\frac{\partial}{\partial x} lsol2$ with zero gives the bargaining outcome.

If we maximize sol1, solving $\frac{\partial}{\partial x} lsol1 = 0$ we get

15. $x = \frac{\nu1\ a\ u2 - \nu2\ b\ u1}{a\ b\ (\nu1 + \nu2)}$

I will show that for this value of x $0 < \frac{\partial}{\partial x} lsol2$, consequently the x value that maximizes sol2 is bigger than x. Substituting x into (16) we get an expression for $\frac{\partial}{\partial x} sol2$.

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16. $\frac{\partial}{\partial x} sol2 = \frac{\nu3\ c\ a\ b\ (\nu1 + \nu2)}{(u3\ (\nu1 + \nu2)\ a - c\ \nu2\ u1)\ b + c\ \nu1\ a\ u2}$

Its sign is identifical with the sign of s3.

17. $s3 = (\nu1\ a\ b + \nu2\ b\ a)\ u3 + c\ (\nu1\ a\ u2 - \nu2\ b\ u1)$

It is trivial that s3>0 if x>0, now I show that it is also true if x<0.

If s3<0 then the following inequalities are hold

18. $\nu1\ a\ u2 + \frac{u3\ a\ b\ (\nu1 + \nu2)}{c} < \nu2\ b\ u1$

19. $\frac{u3\ a\ b\ (\nu1 + \nu2)}{c} < -\nu1\ a\ u2 + \nu2\ b\ u1$

20. $\frac{u3}{c} < -x$

$c\ x + u3 < 0$

It is not possible, because the net bargaining outcome cannot be less than zero for any participants. Thus, s3>0 is true in cases when x<0 also.

Consequently, we can see that value of x that maximizes sol2 is higher than the value maximizing sol1.

This result fits to the basic intuition that if one option gets further supporters in a policy debate, this option will be more reflected by the final political outcome. Consequently incumbent participants can improve their position if they can include their alliances into the bargaining and they can exclude potential participants who would support policy proposals that conflict with their interests.

This statement suggests that the issue of participants of policy bargaining is more complicated as it seemed at the discussion of the previous chapter. There I argued that the collective gain

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due to contribution must be higher than the cost of the effort maker. There are cases when this condition is neither necessary nor sufficient to get someone involved into a policy bargaining. Many incumbents would oppose someone's involvement even if it increased collective gains because the participation of the new entrant would change the distribution of cooperative outcome. There are also cases when the incumbents who have higher influence on entry decisions gains from someone's entry, although his net contribution to the aggregate payoff is negative.

As we could see in the discussion of Statement 2., pre bargaining commitments that promise someone compensation for his decreasing benefit from cooperation due to measures that decrease his bargaining position are not credible. Consequently if incumbents have the right to decide whom to involve, they will accept a candidate if the expected value of their payoff will not decreased with this inclusive act. This modified participatory condition raises many interesting issues, now I will discuss four of them: the effect of biased influence on participatory decisions, the consequence of this statement concerning strategies for entry, protective techniques of incumbents, probable path of inclusion and the path of policy bargains.

Participation Setting

If a subgroup of bargainers controls the entry to the policy debates, they can shape the whole bargaining setting following their interests because they would involve partners who agree them. The right to decide about participation is so influential that either the process of entrance is regulated in a strict and detailed way or the bargainers have two separate groups: those who control entry and have significant bargaining power on the one side and those who have no voice in decisions concerning expansion of participation and their bargaining power is close to zero.[137] It means that either participation in the policy designing process is strictly regulated or that a narrow group of influential stakeholders discuss and agree on the core issues of policy and they share the bulk of policy generated surplus among each other.

Participants may make entry easy in order to realize the potential rise in cooperative gains and create constrains to minimize the bargaining power of new entrants. They can create some

[137] It means that their net gain from participation in the cooperative exercise is just above their off-bargaining payoff.

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procedures or conventions that make it permissively expensive to modify the patterns of redistribution in a way that hurts incumbents. For example if renegotiation of cost and benefit sharing is complicated and slow, or the actor who is decisive concerning these rules is interested in the maintenance of status quo, incumbents are protected against new entrants.
Incumbents open the preparation process for stakeholders if they have no reason to be afraid of new partners or the gain from broadening the partnership circles of a public activity has a high expected gain from increasing legitimacy (smaller probability of attacks against the policy) or from more contribution (for example information).

Strategies for Entry

If someone would like to become participant of policy design, she has either to formulate herself to be acceptable or to create credible threats in case of exclusion. The first option means that the candidate must send credible signals that his inclusion will not modify the redistributive patterns in a way that is harmful for the incumbents. Someone would have higher chance for it if he had a higher contribution to the cooperative gain or he was more indifferent concerning those aspects of the cooperation that rise conflicts among participants. In the setting of Statement 3. it means that u3 must be sufficiently high and c must be sufficiently low. In every days language it means that "Be shy and work hard if You want to get on."
The second option (to threaten from outside) is based on the fact that the consequences of exclusion can be asymmetric among incumbents also. Some incumbents may find it less harmful to loose some from their cooperative rent then the costs of protection and threat against the excluded candidate. This effect can motivate the inclusion of someone who credibly threatens from outside those participants of the cooperative enterprise who would loose with his participation due to the change in the pattern of redistribution.
For example representatives of transport companies would be worse off if small villages were included into the bargaining concerning transport development because relatively more money would be spent on small road and mass traffic in the countryside and less on the main trade routes. But transport sector is the greatest victim of farmers' blockade on roads also. If their inclusion could cut the risk of blockades more than the potential loss due to reorientation of infrastructure funds, the incumbent transport sector would opt for the inclusion of the countryside.

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Protective Techniques of Incumbents

Incumbents have motivation and tools to manipulate entries even in cases when it is strictly regulated. They can decrease the threat potential of non-welcomed candidates: they can protect themselves in three main ways: (1) directly, (2) through procedures of entry and participation or (3) through manipulating the circumstances of entry

1. They can give up the activities which make them vulnerable; they can develop potential of counter threat. The transport sector may use more intensively railroads or waterways that cannot be blocked. They can motivate government to declare it as a crime to block main roads. They can make a sectoral agreement to cut transport supply in harvesting period.
2. Incumbents can decrease the incentives for participation. If potential new entrants are small, a high fee of participation (e.g. in form of lengthy, complicated procedures) can keep them out. Bargaining power of new entrant can be kept in a low level if key positions of policy bargaining are maintained for incumbents through seniority rules, through great role of informal bargaining schemes that are not open for new entrants etc.[138]
3. If someone's entry can be threatening for some incumbents it can be balanced by some other newcomers into the cooperative enterprise who rebalance the political map.[139] Transport sector is not so anxious about invitation of small villages' representatives if the majors of big towns become participants in the policy bargain in the same time.

Path of Policy Bargaining

A policy emerges when some interested and influential actors proposes it. The circle of actors involved into the bargaining of policy design depends on the contemporary situation. Initiators of policy invite those actors who can contribute to the success of the new policy either with effort or through decreasing obstacles of successful implementation.

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[138] Mayors of small villages may find it not so promising to accept the invitation to the working group to discuss the preparation of partnership concerning IHALGA-RCC (Initiative for the Harmonization of Lisbon and Goeteborg Agenda with Respect to the Convergence Criteria) even if they know that it means that the government would like to cut road construction budget and promises long term logistic center concession and easier regulation of container transport as a compensation for the transport sector if they know that the deputy state secretary who will negotiate with the DG Transport is Brussels was the CEO of a big cargo company.
[139] Weingast (1997) mentions that the expansion of US in the first half of the XIXth century happened in a consciously balanced way to keep the political status quo between North and South.

The key stakeholders of a policy field are usually given when the effects of a policy becomes recognizable for others. It induces them to formulate reactions to this new policy: they can be indifferent; they can make efforts for involvement; they can become motivated to initiate other policies. These reactions may change the group of participants in the policy bargain, the rules and outcomes of this bargaining. These changes induce further reactions, so the bargaining and its policy output evolves further in a path dependent way.[140]

As a policy matures its size or influence usually increases. It motivates the actors who are excluded form the policy bargaining to get involved in order to get benefits or to avoid harms of this cooperative enterprise. It induces the enlargement of the bargaining circles. On the other side, the cost of entry and the cost to get influence in the bargaining process increase for late|comers because of the self-protecting activity of incumbents. The relative strength of these contradictory forces shapes the pattern of participation both in structure and time.

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[140] North (1990) describes the logic how path dependency formulates institutions, Dixit (1996) presents models and stories based on this approach.

Optimal size of Bargaining Power Enhancing Investment

Now I assume that one of the participants can improve their bargaining power with investment. His initial bargaining power is $\nu 0$ and an effort with cost c1 can increase it to level $\nu 1$. This activity is assumed to function with decreasing marginal efficiency (2).

21. $\nu 1 := f(\nu 0, c1)\ ,\ 0 < \frac{\partial}{\partial c1} f(\nu 0, c1)\ ,\ \frac{\partial^2}{\partial c1^2} f(\nu 0, c1) < 0$

Economic actors can increase their bargaining power through improving their position in the bargaining process. Negotiations have their institutional procedure and there are actors who have better access to the agenda setting. Commitments throughout the bargaining can be more or less credible based on the expectation of the negotiation partners. Expectations concerning issues of the bargaining can be more or less precise, more or less trusted based on information concerning each other. Bargaining is frequently facilitated by some specialist who may be more or less sympathetic to some stakeholders. Actors can make successful efforts to increase their influence on agenda setting, to make their commitments more trustworthy, to get better quality information about each other or to get the sympathy of mediators. Political economy and public choice literature offers several concepts to conceptualize this type of political activity as we discussed earlier.

The introduction of decreasing marginal efficiency reflects two assumptions of the bargaining process:

- The political activities have a fix cost element. At first a group needs some infrastructure to be able to collect the necessary resources. They need some minimal organization, some rules, some mechanisms that ensures individual contribution to collective actions etc. At second, the improvement (and maintenance) of bargaining power needs some sunk cost investments like acquiring the necessary knowledge, building reputation etc. At third, these kind of activities have a minimum size that must be reached to have a minimal impact.
- There is a maximum level of bargaining power increase that can be reached by any political activity. Agenda manipulating techniques becomes more visible and opposed. Credibility is hard to be increased above a certain level. The price that the facilitators

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ask for advantageous treatment rises not linearly but with increasing steepness because it costs them more in credibility or reselection prospects.

Using the results of the previous chapter Actor 1's investment level to improve her bargaining power can be explicitly expressed given the conditions of the bargaining situation.[141] The return of bargaining for her is a*x-c1 (24.). This expression gets its maximum value when $\frac{\partial}{\partial c1} mx = 0$ is satisfied (25) [142].

22. $$mx := \frac{a\,(u2 - \xi 2)\,\mathrm{f}(\nu 0, c1) - \nu 2\,(u1 - \xi 1)\,b}{(\mathrm{f}(\nu 0, c1) + \nu 2)\,b} - c1$$

23. $$\frac{\partial}{\partial c1} mx = \frac{\nu 2\,((u1 - \xi 1)\,b + a\,(u2 - \xi 2))\left(\frac{\partial}{\partial c1}\mathrm{f}(\nu 0, c1)\right) - (\mathrm{f}(\nu 0, c1) + \nu 2)^2\,b}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\,b} = 0$$

Based on this result we can write up a condition that is always satisfied if the investment level maximizes the bargaining gain of actor 1.

24. $$G := \frac{\nu 2\,((u1 - \xi 1)\,b + a\,(u2 - \xi 2))\left(\frac{\partial}{\partial c1}\mathrm{f}(\nu 0, c1)\right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\,b} = 1$$

I will use implicit function theorem to study the effect of economic characteristics on the optimal level of bargaining power enhancing investment. Because of decreasing marginal efficiency of the investment activity $\frac{\partial}{\partial c1} G < 0$, consequently the signs of derivatives show the direction how economic characteristics effect on optimal investment level ($\frac{\partial}{\partial char} c1 = \frac{\partial}{\partial char} G$).

[141] The logic and results for analysis are the same for actor who opts for contraction of policy.
[142] The Second Order Condition is satisfied because

$$\frac{\partial^2}{\partial c1^2} mx = \nu 2\,((u1 - \xi 1)\,b + a\,(u2 - \xi 2))$$
$$\left((\mathrm{f}(\nu 0, c1) + \nu 2)\left(\frac{\partial^2}{\partial c1^2}\mathrm{f}(\nu 0, c1)\right) - 2\left(\frac{\partial}{\partial c1}\mathrm{f}(\nu 0, c1)\right)^2\right) \Big/ ((\mathrm{f}(\nu 0, c1) + \nu 2)^3\,b)$$

that is smaller than zero.

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25. $$\frac{\partial}{\partial c1} G = \left((\mathrm{f}(\nu 0, c1) + \nu 2) \left(\frac{\partial^2}{\partial c1^2} \mathrm{f}(\nu 0, c1) \right) - 2 \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)^2 \right) \nu 2$$
$$((u1 - \xi 1)\, b + a\, (u2 - \xi 2)) \,/\, ((\mathrm{f}(\nu 0, c1) + \nu 2)^3\, b)$$

Statement 4. - Stakes Motivates Political Activity

Statement: The optimal level of investment to improve bargaining power (c1) is higher for actor 1. if her relative stakes are higher in the bargain: policy change is more valuable (a is higher) for her and lower for the bargaining partner (b is lower).

Proof: Comparative statics analysis shows that $0 < \frac{\partial}{\partial a} c1$ and $\frac{\partial}{\partial b} c1 < 0$.

26. $$\frac{\partial}{\partial a} G = \frac{\nu 2\, (u2 - \xi 2) \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\, b}, \quad \frac{\partial}{\partial b} G = -\frac{\nu 2 \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right) a\, (u2 - \xi 2)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\, b^2}$$

This result links Statement 1. and Statement 2.. We can see that when policy demands moves into a given direction, it leads to change of policy not only directly through modification of bargaining outcome (Stat 1.) but indirectly also. When a policy option becomes more valuable for an actor, he will invest more to increase his bargaining power that results a favored modification of policy outcome (Stat 2.).

In this way the assumption that we applied during the analysis in Part I. gets a further support. If each actors' policy demand change into the same direction, the policy outcome will be modified not only because of the direct change of Nash Bargaining Outcome but because of the rational political activity of actors to invest into the improvement of their bargaining power.

Statement 5. - Importance of Policy Increases Political Activity

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Statement: The optimal level of investment to improve bagaining power (c1) is higher for actor 1. if the expected value of cooperation increases for the participants (u1 or u2 becomes higher, $\xi 1$ or $\xi 2$ becomes lower) .

Proof: Comparative statics analysis shows that $0 < \frac{\partial}{\partial u1} c1$, $0 < \frac{\partial}{\partial u2} c1$, $\frac{\partial}{\partial \xi 1} c1 < 0$ and $\frac{\partial}{\partial \xi 2} c1 < 0$.

27. $$\frac{\partial}{\partial u1} G = \frac{\nu 2 \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2} \quad , \quad \frac{\partial}{\partial u2} G = \frac{\nu 2\, a \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\, b}$$

28. $$\frac{\partial}{\partial \xi 1} G = -\frac{\nu 2 \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2} \quad , \quad \frac{\partial}{\partial \xi 2} G = -\frac{\nu 2\, a \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1) \right)}{(\mathrm{f}(\nu 0, c1) + \nu 2)^2\, b}$$

If a policy is more important, actors invest more into it, independently of their intensity for expansion or contraction. It means that if we compare two policy bargains where the participants have the same demands for policy reduction or extension, but the utility gain from the actual level of public intervention is higher in case A then B, the actors will invest more into bargaining power enhancement in case A. If industry realizes 4 units increase of their payoff from human policy and service sector gets 2 units and they realize 10 and 8 unit payoffs from infrastructure development, both of them will spend more to get influence in the infrastructure debate.

The intuition behind this result is that the issue of bargain is how to share the total amount of utility gains from the public development activity. In the first case the total gain is 6, in the second one it is 18, three times more then in the previous case. If someone has the same advantage, it probably results a higher gain if the cake to share is three times bigger.

Policies that are more important for actors are usually bigger (uses more resources) in cases when actors' preferred size of policies is determined through equalization of their marginal benefits and marginal costs. The latter one is mostly depend on the alternative cost of resourced redirected from private to public utilization through taxation. The marginal cost of taxation equals the tax rate plus some deadweight loss. If the marginal return on human

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development is higher than on infrastructure development for industrial agents at any size of policies (unitary expansion of public development activity has a higher positive impact on utility), industrialists will opt for higher spending in human development. Based on this logic, Statement 2. induces that political activity of stakeholders is more intensive in case of policies that are more expanded, thus political investments increase with the level of public intervention.

Statement 6. - Better Position Smoothes Political Investment

Statement: The optimal level of investment to improve bargaining power (c1) is lower for actor 1. if her initial bargaining power ($\nu 0$) is higher assuming that the efficiency of investment is independent of the initial value of bargaining power.

Proof: Comparative statics analysis shows that $\frac{\partial}{\partial \nu 0} c1 < 0$.

$$\frac{\partial}{\partial \nu 0} G = 2$$

29. $$\left(\left(-\frac{1}{2} \mathrm{f}(\nu 0, c1) - \frac{1}{2} \nu 2\right)\left(\frac{\partial^2}{\partial \nu 0 \, \partial c1} \mathrm{f}(\nu 0, c1)\right) + \left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1)\right)\left(\frac{\partial}{\partial \nu 0} \mathrm{f}(\nu 0, c1)\right)\right)$$
$$((-u1 + \xi 1)\, b + a\, (-u2 + \xi 2))\, \nu 2 \,/\, ((\mathrm{f}(\nu 0, c1) + \nu 2)^3\, b)$$

Because of independence between $\nu 0$ and c1 $\frac{\partial^2}{\partial \nu 0 \, \partial c1} \mathrm{f}(\nu 0, c1) = 0$, $\frac{\partial}{\partial \nu 0} \mathrm{f}(\nu 0, c1) = 1$.

Consequently:

30. $$\frac{\partial}{\partial \nu 0} G = -2 \frac{\left(\frac{\partial}{\partial c1} \mathrm{f}(\nu 0, c1)\right) \nu 2 \, ((u1 - \xi 1)\, b + a\, (u2 - \xi 2))}{(\mathrm{f}(\nu 0, c1) + \nu 2)^3}$$

The assumption that the impact of activities to increase bargaining power is independent of its initial level is based on the insight that the same package of political activity has the same impact in any cases. This assumption is not always defendable. For example it seems to be plausible that it is more costly to increase bargaining power from zero to any positive value

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than to realize the same increase from a value that represents a more influential participation. It is also probable that it is easier to improve bargaining position if it is around average of other actors' similar value than to increase it when it is far more higher than others' one. Statement 5. is true for far weaker assumptions[143], but their formulation seems to be simple technicality without some concept that could describe how the level of bargaining power influences the efficiency of investments to raise it further. Without these kind of stories the independency assumption seems to be satisfactory (not more demanding and far more parsimonious than other possible assumptions).

This result has two consequences. At first, increasing bargaining power decreases the optimal size of political investments that suggests that less influential actors are more motivated to take efforts to improve their bargaining position. It implies a kind of catch-up of politically less influential groups. At second fall of bargaining power motivates to rise spending on it, so no one accepts to fall back in the political arena. But bargaining power is always relative, it has an impact compared to others' position, that is focused by the next statement.

Statement 7 - Rivalry Motivates the Stronger and Threatens the Weaker

Statement:. The optimal level of investment to improve bargaining power (c1) increases with the bargaining power of the negotiating partner ($\nu 2$) if actor 1's bargaining power after the investment is higher than actor 2's.

Proof: Comparative statics analysis shows that $0 < \frac{\partial}{\partial \nu 2} G$ if $0 < f(\nu 0, c1) - \nu 2$.

$$31.\ \frac{\partial}{\partial \nu 2} G = \frac{((u1 - \xi 1)\, b + a\,(u2 - \xi 2)) \left(\frac{\partial}{\partial c1} f(\nu 0, c1) \right) (f(\nu 0, c1) - \nu 2)}{(f(\nu 0, c1) + \nu 2)^3\, b}$$

This results shows that if someone has a lead in bargaining power she is motivated to keep

[143] The weaker condition is:
$$0 < \left(-\frac{1\, f(\nu 0, c1)}{2} - \frac{1\, \nu 2}{2} \right) \left(\frac{\partial^2}{\partial \nu 0\, \partial c1} f(\nu 0, c1) \right) + \left(\frac{\partial}{\partial c1} f(\nu 0, c1) \right) \left(\frac{\partial}{\partial \nu 0} f(\nu 0, c1) \right)$$
It is always true if $\frac{\partial^2}{\partial \nu 0\, \partial c1} f(\nu 0, c1) < 0$, so the efficieny of bargaining power increasing activities fall with bargaining power.

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this advantage with increase of political activities if others' political influence rise. The bargainers with smaller bargaining power get negative incentive for political activities when the powerful partners become more powerful.

The two statements concerning the effect of change in bargaining power suggests that political arm-race is possible but its emergence is not straightforward. Advantage in bargaining power motivates to keep but not to increase it. Less bargaining power motivates expansion of political activity. If this motivation is stronger then the disincentive effect of the advantage protecting activity of the more powerful one, an upward spiral of investment into bargaining power enhancement may take place.

Summary

In this section I extended the classical Nash Bargaining Framework with the introduction of political activity. As we could see the rather general assumption (decreasing marginal efficiency) concerning investment in order to improve bargaining power made it possible to conceptualize several effects that are familiar from political economic literature. Higher stakes in modification of policy or a higher expected payoff of the policy motivate to invest more into political activities. Higher someone's relative advantage in bargaining power is, lower the level of his political investments will be.

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Investment to Improve Off-Bargaining Option

Actors frequently get involved into development of their off-bargaining options in order to get a better position in the negotiations. Better outside option makes commitments more credible, so it is frequently useful to increase appeal of exit to get a more strong voice. In this section I will show that the optimal volume of this activity decreases with improvement of relative bargaining power.

I will assume that a participant of bargaining can invest to improve her off-bargaining position ($\xi 1$) and this activity has a decreasing marginal utility.[144] I will study the case of actor who is interested in the expansion of policy. The logic to analyze those actors' optimal political investment who are interested in the contraction of policy are identical.

32. $\xi 1 = \xi 0 + \mathrm{f}(c2)$

Actors can improve their off-policy scenarios either with preparing to individual action if the bargaining and the relevant public activity collapse or improving their ability to get involved into alternative bargaining situations.

The firms of the service sector can response the termination of human policy either with private substitutes or closing up their businesses. If the service sector is successful to decrease their loss if they have to give up their activities selling their assets and changing their field of activity (e.g. through entering into industry) their off policy payoff becomes higher. There is a similar effect if they have better access to technologies that enable them to substitute the human resources with capital (e.g. through computerization).

Someone has alternative bargaining situations if there is an option to choose among partners of cooperation. For example when a firm gets involved into a bargain concerning some public policies there is a huge difference in its off-agreement option if this company can relocate the production into one another country or not. If it is possible, the expected value of successful agreement in a country defines the not-agreement point for bargaining with the other country. This partner-flexibility of bargaining is possible among policy fields also, not only among jurisdiction. For example if an industry can cheaply increase its bargaining power in the

[144] In this formulation I use the assumption that initial level of off-bargaining position and the return on political activity are independent of each other. The arguments O presented in the previous section concerning investment into bargaining power are valid here also.

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bargaining concerning human endowment because, they simply switch the focus of their political activities toward policies to increase the amount of labor instead of pursuing improvement of its efficiency. If an industry experiences that their experience became more valuable in job creation and they loose positions in the negotiations concerning industrial policy, it is more promising to negotiate with the Ministry of Employment instead of Ministry of Economics.

Flexibility in autonomous response or in chancing of partner of cooperation can be increased in several ways. These activities also have coordination needs, sunk costs and minimal size like in the case of investment into bargaining position, that is why I use the decreasing marginal efficiency approach again.

I use the same logic as in the previous section: the gain of bargain is mx=r*a-c2 for sector 1.

33. $$mx = \frac{a\,(u2 - \xi 2)\,\nu 1 - \nu 2\,(u1 - \xi 0 - \mathrm{f}(c2))\,b}{(\nu 1 + \nu 2)\,b} - c2$$

Maximizing value of mx for c2, we can express a condition that is always satisfied for optimal level of investment.[145]

34. $$G := \frac{\nu 2\left(\frac{\partial}{\partial c2}\,\mathrm{f}(c2)\right)}{\nu 1 + \nu 2} = 1$$

This condition shows that optimal level of investment into the improvement of off-bargaining position depends only on the bargaining power of the actors involved.

Statement 8. - If Voice is Less Spend on Exit

Statement: The optimal level of investment to increase off-bargaining payoff of sector 1. decreases if the relative bargaining position improves ($\nu 1$ becomes ceteris paribus higher or $\nu 2$ becomes ceteris paribus lower).

[145] Second Order Condition is satisfied: $\frac{\partial^2}{\partial c2^2}\,mx < 0$, $\frac{\partial^2}{\partial c2^2}\,mx = \frac{\nu 2\left(\frac{\partial^2}{\partial c2^2}\,\mathrm{f}(c2)\right)}{\nu 1 + \nu 2}$

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Proof: The comparative statics based on implicit function theorem shows that $\frac{\partial}{\partial \nu 1} c2 < 0$ and $0 < \frac{\partial}{\partial \nu 2} c2$.

35. $$\frac{\partial}{\partial \nu 1} c2 := -\frac{\frac{\partial}{\partial c2} G}{\frac{\partial}{\partial \nu 1} G} = \frac{\left(\frac{\partial^2}{\partial c2^2} \mathrm{f}(c2)\right)(\nu 1 + \nu 2)}{\frac{\partial}{\partial c2} \mathrm{f}(c2)}$$

36. $$\frac{\partial}{\partial \nu 2} c2 := -\frac{\frac{\partial}{\partial c2} G}{\frac{\partial}{\partial \nu 2} G} = -\frac{\nu 2\left(\frac{\partial^2}{\partial c2^2} \mathrm{f}(c2)\right)(\nu 1 + \nu 2)}{\left(\frac{\partial}{\partial c2} \mathrm{f}(c2)\right)\nu 1}$$

This results shows that the improvement of off-bargaining power is more important for the less influential actor. Furthermore, the motivation to respond with the development of exit option to the others' raising bargaining power is stronger if the bargaining power disadvantage is higher.

Social actors who have lower influence on public decisions are more active to build their capacities to get off the social interactions either through real exit (moving away) or improving the utilization of their resources outside the realm of policy bargains, mostly in the informal sector.

Statement 7. gives one more important insight: the motivation to develop off-bargaining option increases for less influential economic agents if sum of bargaining powers ($\nu 1 + \nu 2$) increases. In the NBC the relative size of these two variables matter. But as previous sections shows, if actors make their individual choices to invest into the improvement of their bargaining power, it is possible that a political arm race takes form (as it will be discussed in the next subchapter). In this case both actors invest in order to improve their bargaining position that results a small relative improvement of position even at a mutually high level of political investment. If it occurs the less influential actor will increase further her efforts in the other political field to increase their off-bargaining payoff also.

Summing up, we can see that development of exit option is more appealing for less influential actors. This asymmetry will increase if the difference in bargaining power or the average level of bargaining powers becomes higher.

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The Effect of Race for Political Influence

Now I will study how the characteristics of bargaining situation influence the payoff of actors assuming that both participants of bargaining can improve his position through investment into his bargaining power. I assume that both actors choose the level of political investment that maximizes his payoff considering the other's strategy. In this way Nash equilibrium defines the political activities of actors in order to improve their position in the Nash Bargaining.

I assume that bargaining power enhancement is a linear function of invested resources.

37. $\nu 1 := \nu 01 + c1\ n1 - fc1$

38. $\nu 2 := \nu 02 + c2\ n2 - fc2$

Agent 1.'s bargaining power is $\nu 01$ without investment. Improvement of bargaining power has a fix cost (fc1). If it is covered, one unit of effort into increase of bargaining power increases it with n1. I assume that bargaining power is always positive, so $fc1 < \nu 01$. The policy investment of agent 2. is formalized similarly.
These representations assume that political activities have a fix cost and a linear variable cost. This simplified approach makes analysis tractable and helps us to focus on the main relations between economic position and bargaining power. Other representations would be similarly ad-hoc without more detailed knowledge about the technology of political investments. This approach assumes that actors need some organization, preparation, access building that is the minimal requirement to get into the game then their influence increases with the amount of efforts.

The outcome of the bargaining is defined as we could see in previous sections. The utility gain of sector 1. is a*r, and it is -b*r for sector 2. One of them will loose, the other will win with the renegotiation of the policy. Both agents invest into the improvement of his bargaining power in c1 or c2 amount. Their net return from the bargain is mx1 and mx2.
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39. $$x = \frac{a\,(u2 - \xi 2)\,\nu 1 - \nu 2\,(u1 - \xi 1)\,b}{(\nu 1 + \nu 2)\,a\,b}$$

40. $$mx1 = \frac{a\,(u2 - \xi 2)\,\nu 1 - \nu 2\,(u1 - \xi 1)\,b}{(\nu 1 + \nu 2)\,b} - c1\ ,$$

$$mx2 = -\frac{a\,(u2 - \xi 2)\,\nu 1 - \nu 2\,(u1 - \xi 1)\,b}{(\nu 1 + \nu 2)\,a} - c2$$

Optimizing mx1 and mx2 we get an expression for c1 and c2. [146] Assuming that actors know these best responses of each other, we can define c1 and c2 as a function of exogenous characteristics substituting these optimization results into each other.

41. $$c1 := \frac{a\,((u2 - \xi 2)\,a + b\,(u1 - \xi 1))\,n2\,n1^2 + (fc1 - \nu 01)\,(a\,n1 + b\,n2)^2}{(a\,n1 + b\,n2)^2\,n1}$$

42. $$c2 := \frac{b\,((u2 - \xi 2)\,a + b\,(u1 - \xi 1))\,n1\,n2^2 + (fc2 - \nu 02)\,(a\,n1 + b\,n2)^2}{(a\,n1 + b\,n2)^2\,n2}$$

Using these results we can analyse when exogenous changes in characteristics induce growth of political activity (c1) and bargaining gains (mx1) together and where can we predict changes in opposite direction concerning investment into bargaining power and policy renegotiation gain.

If size of political investment and policy gains moves together, political investment is motivated by opportunity to gain more from policy bargaining. If optimization requires more investment but the final gain will be less, the motive behind bargaining power enhancement is protective. Actors become more active in pre-bargain preparation only to keep their position, not to improve it. This is the case where political activity may become intensified without contribution to the net gain of actors.

[146] The solutions that satisfies both First and Second Order Conditions are:

$$c1 = (-b\,c2\,n2 - \nu 01\,b - b\,\nu 02 + b\,fc2 + fc1\,b + \sqrt{n1}\,\sqrt{b}\,\sqrt{(-c2\,n2 + fc2 - \nu 02)\,(-u1\,b + \xi 1\,b - a\,u2 + a\,\xi 2)}\,)/(n1\,b)$$

$$c2 = (-a\,c1\,n1 - a\,\nu 02 - a\,\nu 01 + a\,fc2 + a\,fc1 + \sqrt{a}\,\sqrt{n2}\,\sqrt{(-u1\,b + \xi 1\,b - a\,u2 + a\,\xi 2)\,(fc1 - c1\,n1 - \nu 01)}\,)/(a\,n2)$$

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Statement 9. - Political Investment and Payoff Rises with Other's Involvement

Statement: The bargaining gain (mx1) and the size of optimal political investment (c1) of actor 1. move into the same direction (both of them rise of fall) if the potential bargaining gain of the other actor (u2 or $\xi 2$) changes. They increase if u2 increases or $\xi 2$ decreases.

Proof: comparative statics gives the results that $\frac{\partial}{\partial \xi 2} c1 < 0$, $0 < \frac{\partial}{\partial u2} c1$ and

43. $\frac{\frac{\partial}{\partial u2} c1}{\frac{\partial}{\partial u2} mx} = \frac{n2\ b}{a\ n1}$, $\frac{\frac{\partial}{\partial \xi 2} c1}{\frac{\partial}{\partial \xi 2} mx} = \frac{n2\ b}{a\ n1}$.

When potential bargaining gain of actor 2. increases due to some external factors, others launch proposals to get a share of this additional output opportunity. Sector 2.'s increasing motivation to reach an agreement increase the potential to give concessions during the renegotiation of policy. It induces actor 1. to increase his bargaining potential that will help him to increase her realized outcome from policy bargain.

If industry's potential gain from human policy increases, its representatives will be more eager to reach agreement and less keen on pursuing the modification of policy that is beneficial for them. Consequently it is worthwhile to invest more efforts to improve their bargaining positions for agents of service sector.

Statement 10. - More Involvement - More Politics - Less Gain

Statement: The bargaining gain (mx1) and the size of optimal political investment (c1) of actor 1. move into the opposite direction (one of them rises when the other one falls) if

- her potential bargaining gain (u1 or $\xi 1$)
- her initial bargaining power ($\nu 01$) or the fix cost of bargaining (fc1)

changes. Bargaining gain decreases with importance of policy (u1) and fix cost of political activity (fc1) and it increases with initial bargaining power ($\nu 01$) and off-bargaining utility ($\xi 1$).

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Proof: Comparative statics give the result that

44. $0 < \frac{\partial}{\partial u1} c1$, $\frac{\partial}{\partial \nu 01} c1 < 0$, $\frac{\partial}{\partial \xi 1} c1 < 0$, $0 < \frac{\partial}{\partial fc1} c1$

45. $\frac{\frac{\partial}{\partial u1} c1}{\frac{\partial}{\partial u1} mx} = \frac{a\ b\ n2\ n1}{-b^2\ n2^2 - 2\ b\ a\ n1\ n2}$, $\frac{\frac{\partial}{\partial \xi 1} c1}{\frac{\partial}{\partial \xi 1} mx} = -\frac{a\ n1}{b\ n2 + 2\ a\ n1}$

46. $\frac{\frac{\partial}{\partial \nu 01} c1}{\frac{\partial}{\partial \nu 01} mx} = -1$ $\frac{\frac{\partial}{\partial fc1} c1}{\frac{\partial}{\partial fc1} mx} = -1$.

When sector 1. realizes that their gains from bargaining raises, their best response is to increase political activity although they will not be able to keep the whole utility gain for himself. The importance of agreement concerning policy relatively increases for him because they would loose more if policy would be terminated. Thus, they inevitably have to give some concessions to his bargaining partner. Higher stakes leads to higher political activity but his increasing cooperative payoff motivates the other party to develop his bargaining power also. When someone's payoff without renegotiation increases his final share would be higher if the result of renegotiation would not consider it. But bargaining over policy reflects to the distribution of all gains from cooperation, and agreement is formulated in relative terms. Thus, it needs investments into bargaining position to protect this additional gain from policy, but the best response is a mix of increased political investment and some compensation to sector 2. in term of policy characteristics.

When someone realizes that his bargaining power increases, he will need less investment into political activities to reach the same terms of agreements, consequently he can keep more resources for herself that increases her net payoff. Increasing fix cost of bargaining power enhancing activity has just the opposite effect. More resources are necessary to keep the same position, so political investment level rises and it decreases the disposable income.

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Statement 11. - Strong Ones Fight, Weak Ones Give it up

Statement: The bargaining gain (mx1) and the bargaining power investment (c1) decreases for actor 1. with the improvement marginal efficiency of bargaining power improving investment of actor 2. (n2) if actor 2 has higher stakes in the policy bargain ($a\,n1 < b\,n2$). If sector 1. has higher stakes ($b\,n2 < a\,n1$) rise of n2 increases actor 1.'s optimal investment level (c1) and decreases her bargaining gain (mx1).

Proof: Comparative statics shows that

47. $\frac{\partial}{\partial n2} mx1 < 0$, $\frac{\frac{\partial}{\partial n2} c1}{\frac{\partial}{\partial n2} mx1} = -\frac{1}{2}\frac{a\,n1 - b\,n2}{n1\,a}$

The relative bargaining power of actor 1. decreases if efficiency of political activity increases for actor 2. It leads to smaller share from cooperative gain for actor 1. Raise of n2 motivates actor 1. to increase his investment in bargaining power enchancing activity only if his stakes are sufficiently high compared to the other actor ($b\,n2 < a\,n1$).

If actor 1's relative gain from the modification of policy (a) or the efficiency of his political activity (n1) is not sufficiently high, his best response is to decrease political investments because its marginal gain will decrease. This is the situation of being surrender: if the other actor who had some advantage in the bargaining because of higher stakes (b) or more efficient political investments (n2), it is better to withdraw and accept the smaller share from cooperative gain in case on further improvement in the efficiency of actor 2.'s political investment.

If someone's stakes in the bargaining over policy are sufficiently high, the increasing political efficiency of his counterpart will motivate him to intensify his political activity. His net gain will decrease because the necessary additional political investments can only decrease the fall of his cooperative share but this more active defense is his best response.

Thus, if someone has a sufficient efficiency or a motivation advantage in a bargaining situation, he will respond with more intensive political activity if investment into the enhancement of bargaining power becomes more efficient for the other participant of the

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bargaining. If someone has disadvantageous position in the bargaining, other's increasing political efficiency will motivate him to afford less to the improvement of bargaining position. The net gain from the cooperation will decrease in both cases.

This result is an extended version of Statement 7. There we could see that actor 2's increasing bargaining power motivates to intensify political activity if someone has bargaining power advantage. Now bargaining power is endogenous, so advantage in intensity of political demand and political technology matters.

If someone cannot get this advantage, his partner can rationally expect that with improvement of political efficiency he can increase his net benefit from bargaining because the other will respond with mitigation of her investments into bargaining position. Thus, gains from the efficiency improvement of political activity are higher for someone with initial advantage in the policy bargaining. It will lead to fall of bargaining power for others who will invest more into the improvement of their off bargaining position (Statement 8.).

It suggests that political innovation has higher gains for those participants of policy bargaining who have a more advantageous position in it. If it is true, they will be innovative in the political fields also that stabilizes or increases their relative advantage compared to the less influential stakeholders.

Statement 12. - Political Arms Race

Statement: The net bargaining gain (mx1, mx2) falls and the bargaining power enhancing investment (c1,c2) increases for actors if the marginal gain of bargaining power enhancing investment changes in the same rate for both actors (n1, n2).

Proof: assume that n1=n and n2=q*n. In this case comparative statics gives the result.

48. $\frac{\partial}{\partial n} c1 = \frac{\nu 01 - fc1}{n1^2 q}$, $\frac{\frac{\partial}{\partial n} c1}{\frac{\partial}{\partial n} mx1} = -1$

49. $\frac{\partial}{\partial n} c2 = \frac{\nu 02 - fc2}{n1^2 q}$, $\frac{\frac{\partial}{\partial n} c2}{\frac{\partial}{\partial n} mx2} = -1$

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We assumed that $fc1 < v01$ to ensure that bargaining power never can be negative.

Rise in the marginal gain of political activity motivates both actors to increase their political investment and both of them will realize a decrease in their final payoff. This result demonstrates that political arms race is usually harmful for participants. If they could agree to mutually decrease their political investments, both of them would be better off. In this case their shares from cooperative gain would be the same without the loss of resources spent on political activities. But this is a Prisoners' dilemma like situation, so some additional credibility mechanism would be necessary to make this political détente feasible. If it would be available investments into bargaining power would be useful in the bargaining concerning constraints on political activity also. Thus it seems plausible that general increase in political efficiency is harmful because it decreases the final payoff for all participants of bargaining.

Summary

The results of my analysis can be summarized in the following points:

1. The activity of an actor to improve his bargaining power increases if
   - He is more interested in the modification of policy[147]
   - Any participants initial (ex ante modification) return from the cooperation increases[148]
   - The difference between his bargaining power and the bargaining power of one another participant decreases[149]
2. Net gain from bargaining over policy decreases for someone although his political investment into the bargaining power increases if
   - His initial (ex ante modification) return from the cooperation increases[150]
   - The efficiency of political investment increases in the same way for all participants of the bargaining[151]
3. The activity of an actor to improve his off-bargaining position increases if his bargaining power becomes relative smaller compared to the other bargaining partner.[152]

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[147] See Statment 4.
[148] See Statement 5., 9. and 10.
[149] See Statement. 6., 7., 11. and 12.
[150] See Statement 10.
[151] See Statement 12.
[152] See Statement 8.

The implication of these results closely fit to the findings of political economy literature. These results directly support four of the discussed insights:

- Development and balance of power boosts investment into politics
- Rise of political investments leads to decrease welfare
- Political and economic inequality can be a stable staus quo
- Political inequality motivates exit.

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Summary

The application of the NBC to policies yields results that are consistent with the basic approaches of political economy using parsimonious assumptions as well as simple analytical tools. It requires further research to reveal whether this similarity is to be perceived as a verification of the NBC approach based hypotheses or it is the consequence of the logical identity of assumptions.

My results are based on a concept where the Nash equilibrium determined the level of political investments then the NBC defines the cooperative outcome. This 'fight then deal' sequence is broadly accepted by political economy concepts. The Nash equilibrium is also a dominantly applied tool. Two assumptions of the NBC – variance of utility representation and strong rationality – are also broadly accepted in economic theories to analyze public issues. I believe that most of the economic concepts to analyze political situations are consistent with the third assumption of the NBC that is either convention consistency or independence of irrelevant alternatives.[153] The detailed study of this issue above is the scope of my dissertation.

The analysis also offers some suggestions that are worth further research in the future. The results suggest that (1) political inequality is a stable equilibrium; (2) sometimes it can be socially harmful if public development activities become more efficient; (3) exit is a more probable source of political collapse than increasing resistance.

- **No automatic convergence of representation** – Unbalanced political representation is a probable outcome. If there are not any exogenous mechanisms that give efficiency advantage in political investments for actors with lower initial level of bargaining power, differences in political influence are persistent. This result has serious consequences. It suggests that political systems with equal political representation can emerge only in special cases. Consequently, successful efforts to promote empowerment of politically disadvantaged groups need to counterbalance not only the

[153] The intuition behind this belief is based on the argument that the economic models of political situations usually assume that the actors behave in the same way in different interactions when they find themselves in the same situation – that seems to be similar to the assumption of the convention consistency.

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existing differences in political rights, but also the difference in ability to defend or improve them.

- **Political efficiency decreases payoff -** As we could see, if the expected gain from a policy increases, it can motivate additional political activities that are more costly than the rise of policy gain. In this case better opportunities result in a worse outcome. If political investment becomes more efficient for both actors, they will invest more in order to improve their bargaining position without the increasing return through better terms of policy. Again, better technologies result in the fall of net gains. Increasing political efficiency is counterproductive in both cases, as it induces political overinvestment. It implies that technological development in a political field can be deteriorating, higher involvement or better representation technologies may induce political arms race.

- **Political collapse because of exit is more probable than because of voice** – Actors with smaller influence in political decisions have higher motivation to improve their off-bargaining position (exit option) than to invest into their bargaining power. This result implies that increasing economic and political disparity in a society makes opting out of the system more appealing than an organization of political challenge to the regime. Emigration, withdrawing into illegal economy, passive behavior can be the realizations of this exit option. Consequently, it is a higher risk for highly unequal regimes that people would leave than attack them.

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Supplement II.1. – Definition of Nash Bargaining Solution

Assumptions

The process of bargaining defines condition concerning the strategic game that guarantee that people know each other (put it more weakly anyone's expectations concerning the others' behavior are consistent with their experienced choices) and they can negotiate with each other[154]:

- *Rationality* – The participants of the bargaining have consistent and complete ordering over the possible outcomes
- *Information* – "Each person is assumed fully informed on the structure of the game and on the utility function of his co-player".[155]
- *Cooperative Infrastructure* – "There is an adequate mechanism for forcing the players to stick to their threats and demands once made; and one to enforce the bargain, once agreed. Thus we need a sort of umpire, who will enforce contracts or commitments."[156]

If there is a bargaining situation corresponding to the above conditions, the Nash bargaining solution is the only solution that satisfies the following criteria[157]:

- *Invariance to equivalent utility representations* - Players' preferences, not the specific utility function that are used to represent them, are basic
- *Symmetry* - The players are interchangeable
- *Pareto Efficiency* – players never agree on an outcome when there is available one another outcome that makes them better off.
- *Independence of Irrelevant Alternatives* - If the solution for a bargain with more possible outputs is available in a bargain situation with less possible output, its solution will be the same – if the negotiators gradually eliminate outcomes as unacceptable, until just one remains, then it may be appropriate to assume this condition.

[154] Binmore, Dasgupta (1987) p 11.
[155] Nash (1953) p. 130 Nash
[156] Nash (1953) p. 130 Nash
[157] Osborne, Rubinstein (1990) p 11-13.

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In the original setting Nash used the symmetry assumption in order to abstract from any differences in bargaining ability of actors. As we discussed earlier, actors may have different position in bargaining – in these cases the asymmetric (or general) Nash solution is the only one that satisfies the other conditions.[158]

Pareto Efficiency condition can be replaced with a weaker condition, with strong individual rationality.[159] It means simply that there is a solution that is strictly preferred by each bargainers compared to the outcome in case of non-agreement.

The Independence of Irrelevant Alternatives (IIA) condition assumes that outcomes outside of the non-agreement point have no effect on the final result of bargaining. This axiom assumes a bargaining method in which actors eliminate outcomes after each other. But there are other procedures when an available alternative that is not a real candidate to be the solution of a bargaining influences the final agreement (e.g. when procedure is based on to find a compromise between the possible best outcomes of actors). Binmore and Dashgupta (1987) offer one another, weaker condition that can supplement IIA: Convention Consistency (CC).

CC is satisfied if a bargaining situation can be decomposed into two issues and the convention that is used to agree gives the same result either the two issues are negotiated separately or in a unified manner. For example if two towns has to agree on two separate issue, the location of a common facility (i.e. a bridge), and the details of a shared activity (protection of the river from pollution), the bargaining agreement will be the same if they organize one committee for the bargaining of the two issues or if they agree on the two issues independently (or after each other).

Meanwhile IIA based on the insight that options are gradually eliminated (offers of actors gradually converge to solution), CC is more permissive about this process, it only assumes that actors follow the same conventions in each part of the bargaining. IIA assumes that outcome is independent from the outcomes that are rejected by any of the actors (it does not matter what we cannot agree on), CC supposes that the outcome is independent of the organization of the bargaining issues.

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[158] Binmore, Rubinstein, Wolinsky (1986) shows that asymmetric NBC is applicable when there is asymmetry in the bargaining procedure or in parties' beliefs. These include, for example, the case of longer waiting time after one party's offer than after the other's offer and the case of different beliefs concerning the probability of breakdown in the risk model.

[159] Binmore, Dasgupta (1987) p 23.

Consequently if rational actors face a bargaining situation with shared knowledge and conventions to find an agreement, the Nash bargaining solution emerges if the axioms 'Invariance to Equivalent Utility Representations', 'Strong Individual Rationality' and either 'Independence of Irrelevant Alternatives' or 'Convention Consistency' is satisfied.

The Nash Bargaining Solution

The essence of Nash Bargaining Concept is that rational actors are able to utilize the potential gains of cooperation if they can agree and keep agreements. In this case three characteristics determine participants' final share from the collective gain: their potential gain from cooperation, the alternative payoffs they could realize without agreement and their bargaining power.

In a more formal way Nash Bargaining Solution (1) is the only solution of a bargaining situation that satisfies 'Invariance to Equivalent Utility Representations', 'Strong Individual Rationality' and either 'Independence of Irrelevant Alternatives' or 'Convention Consistency'. This concept predicts an outcome that maximizes the weighted product of bargaining generated utility of actors, where weights represent their bargaining power. This outcome can be expressed in an additive way also: in this case the bargaining power weighted sum of logarithm of bargaining gains is to be maximized to get the Nash solution.

50. $$NBS = argmax\left(\prod_{i=1}^{n}(u_i - \xi_i)^{\nu_i}\right) \text{ for } u_{1..n}$$

51. $$NBSL = argmax\left(\sum_{i=1}^{n}\nu_i \ln(u_i - \xi_i)\right) \text{ for } u_{1..n}$$

The expected utility of actor i is u_i after the realization of cooperation. His outcome would have been ξ_i if the interested parties had not agreed. Any possible agreement would yield more utility for i than ξ_i. This off-agreement payoff represents the expected utility for the case when interested parties cannot agree. For example if two towns are negotiating on building a bridge together cannot agree, the off-agreement payoff for them is the best feasible outcome for them without cooperation. For any of the towns it can be zero (no spending, no

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gain), negative (lack of agreement means loss of external development transfer) or positive (money is used to finance a second best local project or one another cooperative enterprise with lower expected payoff).

The bargaining power (ν_i) reflects the position of actor i in the bargaining process. It is not about their skills. "With people who are sufficiently intelligent and rational there should be not any question of "bargaining ability", a term which suggests something like skill in duping the other fellow."[160] Advantage in bargaining power refers to some positional superiority. In Rubinstein's altering offer game[161] the two actors differ in patience: one of them looses more than the other if the bargaining gets longer, consequently she accepts a smaller share from cooperative gain to get it faster. Similarly difference in bargain power can be based on differences in costs of bargaining directly or in term of increasing risk. Positional advantage can be based on rules of the game also. For example when someone's participation is nothing more than to accept a take it or leave it offer, her bargaining position is zero. More influence someone has in the framing of the agreement, higher her bargaining power is.

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[160] Nash (1953) p. 138.
[161] Osborne, Rubinstein (1990) Ch. 3.

Conclusion

Economic changes influence economic actors' political interests. The final policy outcome reflects these changes of interests both directly, influencing stakes in bargaining and indirectly, reshaping structure of political investments into bargaining positions. This study has detailed this process. The analysis of political demand in Part I. has been based on the effect of economic changes on market structure assuming monopolistic competition. The investigation of interest aggregation in Part II. was based on the Nash Bargaining concept.

I have studied how exogenous changes in economic conditions modify the structure and the magnitude of public development activities. The motivation of this study was to give theoretical contribution to new policy analysis tools that facilitate decision makers instead of giving prescriptions to them. I have defined public development activities as conscious efforts of public actors to modify economic conditions in the future. I have focused on two issues in separated but logically connected studies: first, I have investigated how economic changes influence political interests of economic actors, and second, I have examined the aggregation of these interests into a policy outcome.

The main contribution of this research is that it reveals some new relations concerning the effect of economic changes on political demand (Part I.) and it offers a simple but robust approach to conceptualize the aggregation of these political demands (Part II.).

Part I. investigates how the changes in economic conditions modify political interests through their effect on market structure. The literature mostly assumes that political interests are exogenous and identify actors by their interests. My research shows that if we identify actors with their property and economic position, the political interests are not independent of external conditions. I use monopolistic competition models that make it possible to describe economic equilibrium with finite elasticity of substitution between competing products on the market.

Part II. investigates how changes in political interests modify political outcome. I argue that the direct application of the Nash Bargaining theory leads to insightful statements concerning cost and outcome of policies. My results are consistent with the main findings in the great bulk of the political economy literature. The results of the models in Part I. are the starting points in this framework in order to see how these political demand changes influence final policy outcome. The main statement of this part is that simple bargaining models are satisfactory to reproduce the core results of case specific non-cooperative game theoretic

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approaches and this approach is also consistent with many findings of political theory research.

The two parts together offer a broad framework to conceptualize the effect mechanism how exogenous shocks shape volume and structure of public development activities. The main results of this approach are summarized in the next section.

Main results

The results of the models analyzing political demand in Part I. can be summarized in three points:

- **Advantage at the advantaged** – Each model shows that it is more probable that those policies will get higher support of economic actors that improve the situation of the more sophisticated or more developed sector. It suggests that if public development activities are mostly defined by interests of private actors concerning policy outcomes, the more developed industries will be favored by public programs. This result is striking because no assumption concerning the bargaining power of actors has been applied.

- **Duality Curse** - Economic conditions influence development perspectives not only directly, but also indirectly: sometimes these conditions enable the economy to rearrange public development activities flexibly and without conflicts, in other cases policy responses are conflicting or weak because of diverging interests. Comparative statics results of the models revealed that in most cases either the development level and the prospect of basic, labor-oriented sectors or the balanced status and development of economic sectors create an environment where conflicts are weak concerning public development activities. The opposite is also true: the higher the advantage of the more sophisticated or more developed sector – the more dual the economy –, the more conflicts emerge concerning policies; thus, the policy will be a stalemate or less responsive to economic interests. This result has a serious policy implication: in countries with more dualistic economy the ability of policies to serve economic interests is smaller. Following this logic, we can assume that in dual economies it is not the pressure from economic actors that dominates the political arena.

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- **Efficient market – responsive policy trade-off** – The results show that consensus on policies is more probable if policies cannot drastically modify the market structure. As a result, if market shares are not sensible to policies, the interests of political actors make it feasible to accommodate public development activities to exogenous shocks in a responsive way. If competition is fierce, economic processes enlarge the differences in the effect of public development activities on different asset owners. In this case conflicts concerning policy response will be more intense, and rearrangement of public development activities will be less flexible. Consequently, we can assume that public policies are less responsive to economic interests when market is more efficient. This trade-off may have serious policy implications: it is hard to develop the market and avoid conflicts concerning public policy at the same time.

Analysis in Part II conceptualizes interest aggregation process in the Nash Bargaining based framework. My inquiry does not simply reproduce several political economy results in a parsimonious way, but it offers further interesting findings.

First results (analysis disregarding investment into bargaining power) show that (1) bargaining reflects demand for policy, (2) position in bargaining determines success, and (3) an ally is always helpful. These statements seem to be straightforward but their consequences are important. The result that bargaining reflects demand for policy gives a strong support to the shortcut used in models of Part I (where I simply assumed that policy outcome reflects the change in the policy interest of economic actors). The "ally is always helpful" result implies that not only agenda setting, but also strategic moves to define actors of bargaining (that I called participation setting) are important.

Results of models assuming a two-phase bargaining with individual political investments in phase one and bargaining in phase two yield the following results:

- Political and economic inequality can be a stable status quo;
- Development and balance of power boosts investment into politics;
- Rise of political investments leads to decrease in welfare;
- Political inequality motivates exit.

These results are based on sound assumptions that are widely accepted in economic inquiry; thus, their consequences are robust, as well:

- **No automatic convergence of representation** – Without an exogenous process (based on technology, ideology, reallocation of resources etc.) that fundamentally

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improves the efficiency of political investment for actors with lower initial level of bargaining power, political influence remains unbalanced. This is a striking result as it implies that the emergence of a regime based on equal political representation is not straightforward at all, and supporting efforts face serious challenges.

- **Political efficiency decreases payoff** - On the one hand, we could see that if the utility enhancing effect of a given policy increases, it can motivate such an intense rise of political activity that final payoff will decrease. In this case the improvement of a public development activity induces more political investment than the policy gain; therefore, better opportunities result in a worse outcome. On the other hand, if the return of political investment increases for both actors, they will increase their political activity even though their net gains fall. In both cases increasing political efficiency decreases their utility – in the first case the increase in policy returns, in the second case the rise in the return of bargaining power improvement induces political overinvestment. These results suggest that the increasing efficiency of policy and political representation do not lead to higher level of welfare, these improvements can be destructive.

- **Political collapse because of exit is more probable than because of voice** – Fewer influential actors are more motivated to invest into the improvement of their off-bargaining position (exit option) than to improve their bargaining power. Based on this result, we can predict that economic and political divergence in a society will motivate opting out of the system instead of an organization of political challenge to the regime. This exit may happen through emigration, withdrawing into illegal economy, passive behavior etc. Thus, it is a higher danger for regimes with extreme inequality that people would turn away rather than turn against them.

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I have studied two aspects of political economy of public development activities: the formation of individual interests concerning public development activities and the mechanism that aggregates individual interests into policy. The main linkage between the two approaches is that the shortcut used in Part I. to connect change of interest and change of policy is

supported by findings of Part II.[162] Further research is necessary to develop a unified framework that studies change in political interest and policy outcome in a more integrated way.

Further research

Further research is necessary to develop a complete concept of the political economy of public development activities. The inclusion of missing key actors of public development activities and empirical testing are the main future tasks in addition to a closer integration of demand and aggregation analysis.

The main reason to disregard these issues when analyzing public development activities was to keep the focus of the project tractably narrow. The study of interest aggregation had a primary role because of its functional importance. As I have argued there, the insights of the bargaining approach are equally valid for public and private actors. Consequently, this approach can function as a general aggregation mechanism in a broader framework including not only policy outcome oriented private actors, but also private and public actors with stakes in policy inputs and procedures.

The focus on policy outcome oriented private actors got a priority because the question 'How the beneficiaries of policy outcomes modify their interests?' has normative priority compared to the same question concerning public or private actors with stakes connected to policy inputs.

The empirical analysis would need adequate data to conceptualize the structure and magnitude of public development activities, but these data are not easily available. Serious efforts would have been necessary to construct applicable and trustable data, which was beyond the scope of this project.

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Integration of political demand formation and aggregation

The key theoretical problem is to answer the question why actors behave individually in the market and why they act collectively in the political field. In other words, why they are able to organize lobby but unable to organize a cartel. This question can be answered in four different ways:

[162] Statement 1. shows that if each actor increases his demand for public development activity, the public intervention will ceteris paribus expand. Statement 2. and 4. reveal that there is more investment to improve bargaining power; thus, there is a bigger impact on policy outcome if relative stakes are higher in the bargain.

1. The simplest answer is to say that we accept this assumption on the basis of everyday observations: we can find that it is far more frequent that a group is politically organized but economically not, the assumption based on observation is well-grounded.

2. We can argue that the transaction costs of cartel is higher than the costs of political action. In case of political action exclusion would be far more feasible, while collective action can be successful with a lower cooperation rate. The potential gain of a political entrepreneur is far higher in the case of a political action.

3. We can accept that there are cases when strategic interaction is also present on the market. In this case a conceptualization of interest formation must be developed including cases when perfect or monopolistic competition of sectors is replaced with oligopolistic market structure.

4. The more comprehensive solution would be to involve an explicit theory of collective action into the unified approach. It is a rather demanding task – the separate statements mentioned in option 2. should be organized into a coherent framework.

If this theoretical problem is solved, the assumptions of the two models would be fully consistent. Only one task remains, to merge the two models into a unified setting. This task poses some technical problems. In the models of Part I. the effect of exogenous shocks modifies actors' policy interests in a nonlinear way. Some simplifications are necessary in order to develop a functioning and unified model.

Analyzing Public Development Activities in a broader Framework

I assumed that actors put efforts to represent their interests in the process of policy formation because they would like to see public activities that modify economic characteristics in a way that increases their utility through higher income or cheaper, more variable supply. People may have other motivations to get involved in the bargain concerning public development activities: there are private actors with sales, rent or value motivation as well as public actors.

Sales, rent and value oriented private actors - In addition to the effect of policy outcome, there are other types of private motivation concerning policy: stakes in supply, stakes in rents, non-economic stakes. There are industries that are the key suppliers of public development activities. These industries always have direct and intensive interest concerning public development activities. There are groups that look at policies as rent opportunities. Public

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development activities mean pure monetary flows for them. There are also groups involved in the formation of public development activities, whose core interest is beyond the economic realm.

The external shocks that shape changes of demand for public development activities are not, or only weakly, relevant for them. Their interests are more constant because sale, transfer or value oriented motives are not sensitive to economic changes. Consequently, these interests make development policy less responsive to economic phenomena dynamically and less interested in issues of economic issues statically.

Public actors - Public development activities are launched and managed by public actors responding to the claims of stakeholders. The number of public actors involved is high: elected politicians and appointed bureaucrats do their business in a web of institutions. These institutions have different positions and stakes in the process of decision preparation and making, in policy implementation, in the regulation as well as the management of feedback mechanisms and support facilities.

This network of actors - the state - is hard to be perceived as a mission-defined organization, such as a profit-seeking firm or an issue determined organization. It is the system that is emerged by and for interactions that disables exclusion. The actors involved in this interaction facilitation business organize their activities following their interests to keep, improve and utilize their position. The effect of public actors can be conceptualized as their response to the incentives defined by the other actors through the channels of the decision making mechanism.

The private and public actors whose stakes are defined by aspects of inputs and procedures and not by outputs of policy have strong effect on public development activities. A framework that contains complementary models with consistent assumptions, variables and structures could complete the political economic analysis of public development activities.

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Empirical analysis

The empirical test of modeling results would require an analysis of the connection between the characteristics of economic sectors and the volume of public development spending. Economic characteristics shape the interest of actors, and their political assets define their ability to influence policy outcome. The main obstacle for empirical analysis is that comparable data on public development spending are not easily available. In this very moment it seems that adequate variables for dependent variable are not available. Further research may reveal some trustable databases.

Finally

The introduction of market structure can open a new perspective for political economic analysis because it enables us to open the black box of political interests. The broad concept of monopolistic competition makes it possible in a tractable way. Political economy models usually accept the assumptions behind the Nash Bargaining solution and this approach offers a general and flexible tool to conceptualize political interest aggregation processes. The results based on the application of these concepts for the political economy analysis of public development activities are consistent with several general findings of political economy, and also reveal some new convincing ideas. This outcome suggests that political economy may offer powerful tools for policy analysis and it may support policy makers to design public development activities in a way that makes it easier to meet social demand.

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References

Acemoglu, Daron (2002) Why not Nolititical Coase Theorem? Social Conflict, Commitment and Politics *NBER* 9377.

Acemoglu, Daron ; Robinson, James A. (2000a) Political Losers As a Barrier to Economic Development –*AER* Vol. 90. No 2.

Acemoglu, Daron; Johnson, Simon (2005) Unbundling Institutions *JPE* Vol. 113.

Acemoglu, Daron; Johnson, Simon; Robinson, James A. (2002) An African Success Story: Botswana *CEPR* 3219

Acemoglu, Daron; Johnson, Simon; Robinson, James A. (2004) Institutions as the Fundamental Cause of Long-Run Growth *NBER* 10481.

Acemoglu, Daron; Robinson, James A (2006) De Facto Political Power and Institutional Persistence *AER* Vol 96. No 2.

Acemoglu, Daron; Robinson, James A (2006) Persistence of Power, Elites and Institutions *CEPR* 5603

Acemoglu, Daron; Robinson, James A. (2000b) Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective *QJE* Vol. 115. No 4.

Aghion, Philippe and Schrankerman, Mark (2004) On the welfare effects and political economy of competition-enhancing policies *The Economic Journal*, 114 (October),

Alesina, Alberto; Ardagna, Silvia; Trebbi, Francesco (2006) Who adjusts and when? On the Political Economy of Reforms *NBER* No. 12049

Archibald, G. C. (1987) Monopolistic Competition. in Eatwell John (ed.) and Milgate, Murray (ed) and Newmann Peter (ed.) (1987) *The New Palgrave: a Dictionary of Economics* The Macmillan Press, London

Austen-Smith, David (1981) Voluntary Pressure Groups *Economica*, New Series Vol 48. No. 190

CEU eTD Collection

Auty R.M. (2001) The political economy of resource-driven growth *European Economic Review, Vol* 45, Number 4

Azam, Jean Paul; Bates, Robert; Biais, Bruno (2004) Political Predation and Economic Development *www.wcfia.harvard.edu/seminars/pegroup/BatesPredation.pdf*

Baldwin, Richard E.; Robert-Nicoud, Frederic (2002) Entry and asymmetric lobbying: Why governments pick losers *NBER* 8756.

Banerjee, Abhijt and Duflo Esther (2005) Growth Theory through the Lens of development economics. In Aghion, Philippe ans Durlauf, Steven (eds.) (2005) *Handbook of Economic Growth* Elsiwer

Bates, Robert; Greif, Avner; Singh, Smita (2002) Organizing violence *Journal of Conflict Resolution* Vol 46.

Becker, Gary S. (1985) Public Policies, Pressure Groups and Dead Weight Costs *Journal of Public Economics* Vol. 28

Benson, Bruce L. (1999) An Economic Theory of the Evolution of Governance and the Emergence of State *Review of Austrian Economics* Vol. 12. No. 2.

Bhagwati J.N. (1982) Directly unproductive profit-seeking (DUP) activities: a welfare theoretic synthesis and generalization *JPE* Vol. 90. No. 5.

Binmore, Ken; Rubinstein, Ariel; Wolinsky, Asher (1986) The Nash Bargaining solution in economic modeling, *The RAND Journal of Economics*

Borck, R. 2007: Voting, inequality and redistribution. *Journal of Economic Surveys*, Vol. 21, No. 1.

Boudon, Raymond (1986) The Logic of Relative Frustration in Elster, Jon (ed.) (1986) *Rational Choice* New York University Press, New York

Buchanan, James M., Musgrave, Richard Abel (1999) *Public Finance and Public Choice: Two Contrastiong Visions of the State* MIT Press, Cambridge, Mass.

Buchanan, James M.; Roger L. Faith (1987). Secession and the Limits of Taxation: Toward a Theory of Internal Exit, *AER* Vol. 77 No. 5.

CEU eTD Collection

Burnside, Craig; Dollar, David (2004) Aid, Policies, and Growth: Revisiting the Evidence *World Bank Policy Research Working Paper* No. 3251

Castells, Manuel; Portes, Alejandro (1989) World Underneath: The Origins, Dynamics, and Effects of the Informal Economy in Portes, Alejandro and Castells, Manual and Benton, Lauren A. (1989) *The Informal Economy: studies in advanced and less developed countries* John Hopkins University Press, Baltimore, Maryland

Congleton, Roger D. (2001) The politics of government growth in Shughart, William F. and Razzolini, Laura (eds) (2001) *The Elgar Companion to Public Choice* Edward Elgar Publishing Limited, Cheltenham, UK

Congleton, Roger D. (2004) Economic Development and Democracy: does Industrialization Lead to Universal Suffrage? *Homo Oeconomicus* Vol. 21. No 1.

Cullis, John G. and Jones, Philip R. (1992) *Public Finance and Public Choice: analytical perspectives* McGraw-Hill, London

David, Paul A. (1985) Clio and the Economics of QWERTY *AER* Vol 75. No. 2.

DeSoto, Hernando (2000) *The Mystery of Capital* Basic Books

Dixit, Avanish K. and Stiglitz Joseph E. (1977) Monopolistic Competition and Optimun Product Diversity. *AER* Vol 67 No. 3

Dixit, Avinash (1996) *The Making of Economic Policy: a Transaction-Cost Perspective* MIT Press, Cambridge, MASS

Dixit, Avinash (2004): *Lawlessness and Economics: Alternative Modes of governance* Princeton University Press, Princeton NJ

Dixit, Avinash; Londregan, J. (1995) Redistributive Politics and Economic Efficiency *APSR*, Vol. 89, No. 4.

Doucouliagos, Hristos; Paldam, Martin (2006): Aid Effectiveness on Accumulation: A Meta Study - *Kyklos* Vol 59. No. 2.

Doucouliagos, Hristos; Paldam, Martin (2006) *The aid effectiveness literature The sad result of 40 years of research* -http://www.econ.au.dk/vip_htm/mpaldam/Papers/Meta-meta.pdf

CEU eTD Collection

Downs, Anthony (1957) *An Economic Theory of Democracy* Harper, New York

Engerman, Stanley L.; Sokoloff, Keneth L.(2000) History Lessons: Institutions, Factor Endowments, and Paths of Development in the New World *JEP* Vol 14. No 3.

Farell, Jospeh and Rabin, Matthew (1996) Cheap Talk *JEP* Vol 10. No 3.

Ferejohn, John A; Fiorina, Morris P. (1974) The Paradox of Not Voting *APSR* Vol. 68. No. 2.

Fujita, Masahisa, Paul Krugman and Anthony Venables (1999). *The Spatial Economy: Cities, Regions and International Trade*. MIT Press, Cambridge Mass.

Gallup, John Luke, Sachs, Jeffrey D and Mellinger, Andrew D. (1999) Geography and Economic Development. *International Regional Science Review* Vol. 22. No 2.

Gauthier, David (1986) *Morals by Agreement.* Calderon Press, Oxford University Press, Oxford UK.

Gavin, Michael Gavin and Hausmann, Ricardo (1998) *Nature, Development and Distribution in Latin America - Evidence on the Role of Geography, Climate and Natural Resources* - Inter-American Development Bank Working paper #378

Grand, Julian Le (1990) Equity Versus Efficiency: The Elusive Trade-Off. *Ethics* Vol. 100. No. 3.

Grief, Avner (1993) Contract Enforceability and economic institutions in the early trade: The Maghribi Traders' Coalition *AER* Vol 83. No 3.

Grief, Avner (2005) Commitment, Coercion and Markets: The Nature and Dynamics of Institutions supporting exchange In Menard, Claude; Shirley, Mary M (2005) *Handbook of New Institutional Economics* Springer, Dordrecht

Grief, Avner; Milgrom, Paul; Weingast, Barry R. (1994): Coordination, Commitment and Enforcement: the Case of the Merchant Guild *JPE* Vol 102. No 4.

Grossman, Herschel I. (2001) The Creation of Effctive Porparty Rights –*AER* Vol 91. No 2.

Grossman, Gene M.; Helpman, Elhanan (1996) Electoral Competition and Special Interest Politics *Review of Economic Studies* Vol. 63. No. 2.

CEU eTD Collection

Grossman, Gene M.; Helpman, Elhanan (2001) *Special Interest Politics* MIT Press, Cambridge, Mass.

Hare, R. M (1976): Ethical Theory and Utilitarianism. in Lewis, H. D. (1976) *Contemporary British Philosophy*. Allen and Unwin, London

Hirschman, Albert O. (1981) *Essays in Tresspassing* - 3rd chapter: The changing course for income inequality in the course of economic development Cambridge University Press, Cambridge Mass.

Hirschman, Albert O. (1958) *The Strategy of Economic Development*. Yale University Press, New Haven

Hirschman, Albert O. (1967) *Development Projects Observed* Brookings Institution Press, Washington D.C.

Hirschman, Albert O. (1970) *Exit, Voice, Loyalty* Harvard Universety Press, Cambridge, Mass

Hirshleifer, J. (1978) Competition, Cooperation and Conflict in Economics and Biology *AER* Vol 68. No 2.

Hoff , Karla and Stiglitz, Joseph E. (2001) Modern Economic Theory and Development. In Meier , Gerald M, Stiglitz, Joseph E. Stiglitz (Eds). (2001) *Frontiers of Development Economics: the future in perspective* The World Bank, Washington and Oxford University Press, New York

Hosley, Cheryl M. and Bocherding, Thomas E. (1997) Why does government's share of national income grow? – In Mueller, Dennis C. (ed.) (1997) *Perspectives on Public Choice* Cambridge University Press, Cambridge, UK.

Isard, Walter and Azis, J. Iwan and Matthew, P. Drennan and Miller, Ronald E. and Saltzman, Sidney and Thorbecke. (1998) *Methods of Interregional Regional Analysis.* Ashgate Publishing Limited, Aldershot

John C. Harsanyi, John C. (1977) : Morality and the Theory of Rational behaviour. *Social Research* Vol. 44. No. 4.

Krueger. Anne O. (1974) The Political Economy of Rent Seeking Society *AER* Vol 64. No 3.

CEU eTD Collection

Krugman, Paul. (1991) Increasing Returns and Economic Geography. *JPE* Vol 99 no. 3

Krugman, Paul. (1996) Geography Lost and Found in Krugman, Paul. (1996) *Development, Geography and Trade*. The MIT Press Cambridge, Mass.

Krugman, Paul. (1998) A „slime mold" model of city formation in Pines, David; Sadka Efraim; Zilcha, Itzhak (eds) (1998) *Topics in Public Economics*. Cambridge University Press, Cambridge UK

Laffont, Jean-Jacques; Tirole, Jean (1991) The Politics of Government Decision Making: A theory of Regulatory Capture *QJE* Vol 106. No. 4.

Leite, Carlos; Weidmann Jens (1999) Does Mother Nature Corrupt? Natural Resources, Corruption and Economic Growth *IMF Working Papers* WP/99/85

Martin, Philippe J and Rogers, Carol Ann. (1994b) *Trade Effects of Regional Aid.* CEPR Discussion Paper No. 910, London

Martin, Philippe J and Rogers, Carol Ann. (1994a) *Industrial Location and Public Infrastructure.* CEPR Discussion Paper No. 909, London

Masters, Roger D. (1983) The biological nature of the state *World Politics*

Matthews, R. C. O. (1991) the Economics of Professional Ethics: Should the Professions be more like Business? *The Economic Journal* Vol. 101. No. 407.

McGuire, Martin; Olson, Mancur Jr.(1996) The economics of authocracy and majority rule: the invisible hand and the use of force *JEL* Vol 34.

Mehlum, Halvor; Moene Karl; Torvik, Ragnar (2006) Instutions and the Resource Curse *The Economic Journal*, 116 (January), 1–20..

Meltzer, Allan H., Richard, Scott F. (1981) A Rational Theory of the Size of Government *JEP* Vol. 89. No 5.

Milgrom, P. R; North Douglass C.; Weingast, Barry R. (1991) The Role of Institutions in the Revival of Trade: the Law Merchant, Private Judges and the Champagne Fairs *Economics and Politics* Vol.1.

CEU eTD Collection

Moe, Terry M. (1997) The positive theory of bureucracy in in Mueller, Dennis C. (ed.) (1997) *Perspectives on Public Choice* Cambridge University Press, Cambridge, UK.

Mueller, Dennis C. (1997) Constitutional Public Choice In Mueller, Dennis C. (ed.) (1997) *Perspectives on Public Choice* Cambridge University Press, Cambridge, UK.

Mueller, Dennis C. (2003) *Public Choice III. Cambridge University Press* Cambridge UK

Murphy, Kevin M.; Shleifer, Andrei; Vishny, Robert W. (1993) Why Is Rent-Seeking So Costly to Growth? *AER*, Vol. 83, No. 2,

Nash, John F. (1950) The Bargaining Problem *Econometrica* (18) 155-62

Nash, John F. (1953) Two-person cooperative games *Econometrica* 21 128-140

North, Dogulass C. (1990) *Institutions, institutional change and economic performance* Cambridge University Press, Cambridge UK

Nozick, Robert (1974) *Anarchy, State and Utopia*. Basic Books, NY

Nugent ,Jeffrey B; Robinson , James A. (2005) *Are Factor Endowments Fate?* CEPR 3206.

Olson, Mancur (1971) *The Logic of Collective Action* Harvard University Press, Cambridge MASS

Olson, Mancur (1982) *The Rise and Decline of Nations* Yale University Press, New Heaven

Olson, Mancur (2000) *Power and Prosperity: Outgrowing Communist and Capitalist Dictatorships* Basic Books, New York

Osborne, Martin J.; Rubinstein, Ariel (1990) *Bargaining and Markets* Academic Press San Diego, California

Ostrom, Elinor (2000) Collective Action and the Evolution of Social Norms *JEP* Vol. 14. No 3.

Baldwin, Richard, Rikard Forslid, Philippe Martin, Gianmarco, Ottaviano, and Frédéric Robert-Nicoud (2003). *Economic Geography and Public Policy* Princeton Universitiy Press, Princeton N.J.

CEU eTD Collection

Ottaviano, Gianmarco I P and Puga, Diego. (1997) *Agglomeration in the Global Economy: a Survey of the 'New Economic Geography'* CEPR Discussion Paper No. 1699, London

Peltzman, Sam (1976) Toward a more general theory of regulation *Journal of Law and Economics* Vol. 19. No. 2.

Puga, Diego and Venables, J Anthony. (1996) *The Spread of Industry: Spatial Agglomeration in Economic Development*. CEPR Discussion Paper No. 1354, London

Puga, Diego. (1996) *The rise and Fall of Regional Inequalities*. Center for Economic Performance Discussion Paper No. 314, London

Rabinowitz, George; Macdonald, Stuart E. (1989) A Directional Theory of Issue Voting *APSR* Vol. 3. No 1.

Rajan ,Raghuram G.; Luigi Zingales (2006) *The Persistence of Underdevelopment: Institutions, Human Capital, or Constituencies?* NBER 12093

Rawls, John (1971) *A theory of justice.* Oxford University Press, Oxford

Robert-Nicoud, Frederic, Sbergami, Federica (2004) Home-market vs. vote-market effect: Location equilibrium in a probabilistic voting model. *European Economic Review* Vol. 48. No 1.

Robinson, James A.; Torvik, Ragnar (2005) White Elephants *Journal of Public Economics* Vol. 89

Robinson, James A.; Torvik, Ragnar; Verdier, Thierry (2006) Political Foundations of the Resource Curse. *Journal of Development Economics* Vol 79. No 2.

Rodrik, Dani (1996) Understanding Economic Policy Reform *JEL* Vol. 34.

Sachs, Jeffrey D.; Warner, Andrew M. (1995) *Natural Resource Abundance and Economic Growth* NBER *5398*

Sappington , David E.M. (1991): Incentives in Principal-Agent Relationships *JEP* Vol 5. No 2.

CEU eTD Collection

Schelling, Thomas C. (1971) What is the business of organized crime? – *Journal of Public Law* Vol. 20. No 1.

Scitovsky, Tibor (1954) Two Concepts of External Economies. *JPE* Vol 62 p.143-p.151

Sen, Amartya (1987) Ethical Issues In Income Distribution: National and International. in Sen, Amartya (1987) *Resources, Values and Development.* Basil Blackwell, Oxford

Shafer, D. Michael (1953) *Winners and loser: how sectors shape the developmental prospects of states.* Cornell University Press, Ithaca

Stigler, Goerge J. (1971) The theory of economic regulation *The Bell Journal of Management and Science* Vol 2. No 1.

Stiglitz, Joseph E. (1988) *Economics of the Public Sector* W. W. Norton New York

Tavistock Institute (2003) *The Evaluation of Socio-Economic development – The Guide*. www.evalsed.info

Tiebout C. (1956) A Pure Theory of local Government Expenditures *JPE* Vol. 64. No. 5.

Tirole, Jean (1994) The Internal Organization of Government *Oxford Economics Papers* Vol. 46.

Torsten, Persson, Tabellini, Guido (1994) Is Inequality Harmful for Growth? *AER*, Vol. 84, No. 3

Tullock, Gordon (1987) *Autocracy* Kluwer Academic Publisher, Dordrecth

Tullock, Gordon (1993) *Rent Seeking* E. Elgar Aldershot, England

Ulman-Margalit (1990) *Emergence of norms* Oxford University Press, Oxford

UNDP (2006) *Human Development Report 2006.* UNDP, NY

Weingast, Barry R. (1981) Regulation, Reregulation and deregulation: The Political Foundations of Agency Clientele Relationships *Law and Contemporary Problems* Vol.44. No 1.

CEU eTD Collection

Weingast, Barry R. (1997) The Political Foundations of democracy and the Rule of Law *APSR* Vol 91. No 2.

William A. Niskanen (2001) Bureaucracy in William F. Shughart II and Laura Razzolini, eds., *The Elgar Companion to Public Choice.* Cheltenham, UK: Edward Elgar, 2001.

Williamson, Oliver E. (2000) The New Institutional Economics: Taking Stock, Looking Ahead *JEL* Vol. 38 No. 3.

Wintrobe, Ronald (1998) *The Political Economy of Dictatorship* Cambridge University Press, Cambridge, UK.

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Appendix I – Proof of statements in Chapter I.2.1.

III.1. Proof of Statement 1.

Statement 1. Labor and Capital owners evaluate similarly the change of economic characteristics in general. Utility of economic actors increases if

- K or L rises
- or β falls.

Proof – The first derivatives of the utility functions shows that the statement is true. (We know that $0 < \phi, \phi < 1$)

1. $$u_{labor} := \frac{L\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha}$$

2. $$\frac{\partial}{\partial L} u_{labor} = \frac{\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} \left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi} \phi\right)}{\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right) \alpha}, \quad 0 < \frac{\partial}{\partial L} u_{labor}$$

3. $$\frac{\partial}{\partial K} u_{labor} = -\frac{L\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1 + \phi)\left(\frac{\alpha K}{L \beta}\right)^{\phi}}{K\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right) \alpha}, \quad 0 < \frac{\partial}{\partial K} u_{labor}$$

4. $$\frac{\partial}{\partial \alpha} u_{labor} = -\frac{L\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} \left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi} \phi\right)}{\left(1 + \left(\frac{\alpha K}{L \beta}\right)^{\phi}\right) \alpha^2}, \quad \frac{\partial}{\partial \alpha} u_{labor} < 0$$

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5. $$\frac{\partial}{\partial \beta} u_{labor} = \frac{L\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1+\phi)\left(\frac{\alpha K}{L \beta}\right)^{\phi}}{\beta\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)\alpha}, \quad \frac{\partial}{\partial \beta} u_{labor} < 0$$

6. $$u_{capital} := \frac{L\left(\frac{\alpha K}{L \beta}\right)^{\phi}\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha}$$

7. $$\frac{\partial}{\partial L} u_{capital} = -\frac{\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1+\phi)\left(\frac{\alpha K}{L \beta}\right)^{\phi}}{\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)\alpha}, \quad 0 < \frac{\partial}{\partial L} u_{capital}$$

8. $$\frac{\partial}{\partial K} u_{capital} = \frac{L\left(\frac{\alpha K}{L \beta}\right)^{\phi}\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}\left(\phi+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)}{K\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)\alpha}, \quad 0 < \frac{\partial}{\partial K} u_{capital}$$

9. $$\frac{\partial}{\partial \alpha} u_{capital} = \frac{L\left(\frac{\alpha K}{L \beta}\right)^{\phi}\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1+\phi)}{\alpha^2\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)}, \quad \frac{\partial}{\partial \alpha} u_{capital} < 0$$

10. $$\frac{\partial}{\partial \beta} u_{capital} = -\frac{L\left(\frac{\alpha K}{L \beta}\right)^{\phi}\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}\left(\phi+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)}{\beta\left(1+\left(\frac{\alpha K}{L \beta}\right)^{\phi}\right)\alpha}, \quad \frac{\partial}{\partial \beta} u_{capital} < 0$$

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III.2. Proof of Statement 2.

Statement 2. - Both labor and capital owners' incomes increase if L rises (although in different pace). Labor owners' income is insensitive to other economic characteristics. Meanwhile capital owners' income increases with α and K and decreases with β.

Proof - The first derivatives of the income functions shows that the statement is true. (We know that $0 < \phi, \phi < 1$)

1. $Inc_{labor} := L$

2. $\frac{\partial}{\partial L} Inc_{labor} = 1$

3. $Inc_{capital} := L \left(\frac{\alpha K}{L \beta} \right)^{\phi}$

4. $\frac{\partial}{\partial L} Inc_{capital} = \left(\frac{\alpha K}{L \beta} \right)^{\phi} (-1 + \phi), 0 < \frac{\partial}{\partial L} Inc_{capital}$

5. $\frac{\partial}{\partial K} Inc_{capital} = \frac{L \left(\frac{\alpha K}{L \beta} \right)^{\phi} \phi}{K}, 0 < \frac{\partial}{\partial K} Inc_{capital}$

6. $\frac{\partial}{\partial \alpha} Inc_{capital} = \frac{L \left(\frac{\alpha K}{L \beta} \right)^{\phi} \phi}{\alpha}, 0 < \frac{\partial}{\partial \alpha} Inc_{capital}$

7. $\frac{\partial}{\partial \beta} Inc_{capital} = - \frac{L \left(\frac{\alpha K}{L \beta} \right)^{\phi} \phi}{\beta}, \frac{\partial}{\partial \beta} Inc_{capital} < 0$

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III.3. Proof of Statement 3.

Statement 3. The optimal size of labor endowment enhancing policies for labor owners rises if exogenous effects improve technologies in labor sector (α goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of capital sector improves (β goes down).

Proof – Comparative statics is used to investigate the effect of exogenous shocks on the optimal policy level.

$$1.\quad u := \frac{(\mathrm{L}(t) - t)\left(1 + \left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{n_{worker}\,\alpha}$$

The utility function can be decomposed to income and structural parts.

$$2.\quad u = \frac{1\,(\mathrm{f}(t) - t)\,\mathrm{g}(t)}{n_{worker}},\ \mathrm{f}(t) = \mathrm{L}(t),\ \ \mathrm{g}(t) = \frac{\left(1 + \left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

$$3.\quad G := -\frac{\left(1 - \left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right)\mathrm{L}(t)\left(1 + \left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\right)}{(\mathrm{L}(t) - t)\,(1-\phi)\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)} = 1$$

$G = 1$, thus there is a solution only if $1 - \left(\frac{\partial}{\partial t}\mathrm{L}(t)\right) < 0$

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Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

As it is discussed in Supplement I.2.2.

$\frac{\partial}{\partial t} G < 0$ because $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$

4. $$\frac{\partial}{\partial t} \mathrm{g}(t) = -\frac{\left(1+\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (1-\phi)\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)}{\mathrm{L}(t)\left(1+\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\right)\alpha}$$

5. $$\frac{\partial}{\partial \alpha} G = -\frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right)\mathrm{L}(t)\,\phi}{(-\mathrm{L}(t)+t)\,(-1+\phi)\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\alpha}, \quad \frac{\partial}{\partial \alpha} G < 0$$

6. $$\frac{\partial}{\partial K} G = -\frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right)\mathrm{L}(t)\,\phi}{(-\mathrm{L}(t)+t)\,(-1+\phi)\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)K}, \quad \frac{\partial}{\partial K} G < 0$$

7. $$\frac{\partial}{\partial \beta} G = \frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right)\mathrm{L}(t)\,\phi}{(-\mathrm{L}(t)+t)\,(-1+\phi)\left(\frac{\alpha K}{\mathrm{L}(t)\,\beta}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\beta}, \quad 0 < \frac{\partial}{\partial \beta} G$$

Based on these results, we can see that $\frac{\partial}{\partial \alpha} t < 0$, $\frac{\partial}{\partial K} t < 0$ and $0 < \frac{\partial}{\partial \beta} t$.

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III.4. Proof of Statement 4.

Statement 4. The optimal size of capital endowment enhancing policies for labor owners rises if exogenous effects increase labor endowment (L goes up) or improves technologies in capital sector (β goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of labor sector improves (α goes down).

Proof - The same approach is used as in the case of Statement 3. The policy is assumed to have the features that satisfy Second Order Condition. Policy maximizes utility of representative labor owner if G=1. Comparative statics givves the results of Satement 4.

1. $$G := \frac{\mathrm{K}(t)\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)}{(L-t)\,(1-\phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)}$$

As it is discussed in Supplement I.2.2. $0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t}\mathrm{g}(t)$

2. $$\frac{\partial}{\partial t}\mathrm{g}(t) = -\frac{\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}(-1+\phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)}{\mathrm{K}(t)\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)\alpha},\quad 0 < \frac{\partial}{\partial t}\mathrm{g}(t)$$

3. $$\frac{\partial}{\partial L} G = \frac{\mathrm{K}(t)\left(L + L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi} - \phi\,L + \phi\,t\right)}{(-L+t)^2\,(-1+\phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L},\quad \frac{\partial}{\partial L} G < 0$$

4. $$\frac{\partial}{\partial \alpha} G = -\frac{\mathrm{K}(t)\,\phi}{(-L+t)\,(-1+\phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\alpha},\quad \frac{\partial}{\partial \alpha} G < 0$$

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5. $$\frac{\partial}{\partial \beta} G = \frac{\mathrm{K}(t)\,\phi}{(-L + t)\,(-1 + \phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\beta}, \; 0 < \frac{\partial}{\partial \beta} G$$

To see effect of changing capital endowment the functions are slightly modified: $\mathrm{K}(t)$ is replaced with $\mathrm{K}(K0, t)$. K0 shows the initial capital endowment level without policy intervention. It is assumed that $0 < \frac{\partial}{\partial K0}\mathrm{K}(K0, t)$.

6. $$\frac{\partial}{\partial K0} G = -\frac{\left(\frac{\partial}{\partial K0}\mathrm{K}(K0, t)\right)\left(-\left(\frac{\alpha\,\mathrm{K}(K0, t)}{\beta\,L}\right)^{\phi} - 1 + \phi\right)}{\left(\frac{\partial}{\partial t}\mathrm{K}(K0, t)\right)(-L + t)\,(-1 + \phi)\left(\frac{\alpha\,\mathrm{K}(K0, t)}{\beta\,L}\right)^{\phi}}, \; 0 < \frac{\partial}{\partial K0} G$$

Based on these results, we can see that $0 < \frac{\partial}{\partial L} t$, $0 < \frac{\partial}{\partial \alpha} t$, $\frac{\partial}{\partial K0} t < 0$ and $\frac{\partial}{\partial \beta} t < 0$.

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III.4. Proof of Statement 5.

Statement 5. The optimal size of labor technology improving policies for labor owners rises if exogenous effects increase labor endowment (L goes up) or improves technologies in labor sector (α goes down). Optimal size of this policy decreases when capital endowment increases (K goes up) or technology of capital sector improves (β goes down).

Proof - The same approach is used as in the previous cases. The policy is assumed to have the features that satisfy Second Order Condition. Policy maximizes utility of representative labor owner if G=1. Comparative statics gives the results of Statement 5.

1. $$G := -\frac{\alpha(t)\left(1+\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\right)}{(L-t)\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\phi+1\right)},\ \frac{\partial}{\partial t}\alpha(t)<0$$

As it is discussed in Supplement I.2.2. $0<\frac{\partial}{\partial t}G$ because $0<\frac{\partial}{\partial t}\mathrm{g}(t)$

2. $$\frac{\partial}{\partial t}\mathrm{g}(t)=-\frac{\left(1+\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\phi+1\right)}{\alpha(t)^{2}\left(1+\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\right)},\ 0<\frac{\partial}{\partial t}\mathrm{g}(t)$$

3. $$\frac{\partial}{\partial L}G=\frac{\left(L\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\right)^{2}\phi+((2\phi+1-\phi^{2})L+\phi\,t\,(-1+\phi))\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}+L\right)\alpha(t)}{L\,(L-t)^{2}\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\phi+1\right)^{2}},$$

$$\frac{\partial}{\partial L}G<0$$

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4. $$\frac{\partial}{\partial K} G = \frac{\alpha(t)\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\,\phi\,(-1+\phi)}{(L-t)\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\,\phi+1\right)^{2}\,K},\ 0 < \frac{\partial}{\partial K} G$$

5. $$\frac{\partial}{\partial \beta} G = -\frac{\alpha(t)\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\,\phi\,(-1+\phi)}{(L-t)\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\,K}{\beta\,L}\right)^{\phi}\,\phi+1\right)^{2}\,\beta},\ \frac{\partial}{\partial \beta} G < 0$$

To see effect of changing labor technology, the functions are slightly modified: $\alpha(t)$ is replaced with $\alpha(\alpha 0, t)$. $\alpha 0$ represents the initial capital endowment level without policy intervention. It is assumed that $0 < \frac{\partial}{\partial \alpha 0}\beta(\alpha 0, t)$.

6. $$\frac{\partial}{\partial \alpha 0} G = -\frac{\left(\frac{\partial}{\partial \alpha 0}\alpha(\alpha 0, t)\right)\left(-\phi\left(\left(\frac{\alpha(\alpha 0, t)\,K}{\beta\,L}\right)^{\phi}\right)^{2}+(-2\,\phi-1+\phi^{2})\left(\frac{\alpha(\alpha 0, t)\,K}{\beta\,L}\right)^{\phi}-1\right)}{\left(\frac{\partial}{\partial t}\alpha(\alpha 0, t)\right)(-L+t)\left(\left(\frac{\alpha(\alpha 0, t)\,K}{\beta\,L}\right)^{\phi}\,\phi+1\right)^{2}},$$

$$0 < \frac{\partial}{\partial \alpha 0} G$$

Based on these results, we can see that $0 < \frac{\partial}{\partial L} t$, $\frac{\partial}{\partial \alpha} t < 0$, $\frac{\partial}{\partial K} t < 0$ and $0 < \frac{\partial}{\partial \beta} t$.

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III.6. Proof of Statement 6.

Statement 6. The optimal size of capital technology improving policies for labor owners rises if exogenous effects increase labor or capital endowment (L or K goes up) or improves technologies in capital sector (β goes down). Optimal size of this policy decreases when technology of labor sector improves (α goes down).

Proof - The same approach is used as in the previous cases. The policy is assumed to have the features that satisfy Second Order Condition. Policy maximizes utility of representative labor owner if G=1. Comparative statics gives the results of Statement 6.

1. $$G := -\frac{\beta(t)\left(1+\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)}{(L-t)(1-\phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)}, \frac{\partial}{\partial t}\beta(t) < 0$$

As it is discussed in Supplement I.2.2. $0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} g(t)$

2. $$\frac{\partial}{\partial t} g(t) = \frac{\left(1+\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1+\phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)}{\beta(t)\left(1+\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)\alpha}, 0 < \frac{\partial}{\partial t} g(t)$$

3. $$\frac{\partial}{\partial L} G = -\frac{\beta(t)\left(L + L\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi} - \phi L + \phi t\right)}{(-L+t)^2 (-1+\phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right) L}, \frac{\partial}{\partial L} G < 0$$

4. $$\frac{\partial}{\partial \alpha} G = \frac{\beta(t)\phi}{(-L+t)(-1+\phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)\alpha}, \frac{\partial}{\partial \alpha} G < 0$$

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5. $$\frac{\partial}{\partial K} G = \frac{\beta(t)\,\phi}{(-L + t)\,(-1 + \phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)K}, \frac{\partial}{\partial K} G < 0$$

To see effect of changing capital technology the functions are slightly modified: $\beta(t)$ is replaced with $\beta(\beta 0, t)$. $\beta 0$ represents the initial capital endowment level without policy intervention. It is assumed that $0 < \frac{\partial}{\partial \beta 0}\beta(\beta 0, t)$.

6. $$\frac{\partial}{\partial \beta 0} G = \frac{\left(\frac{\partial}{\partial \beta 0}\beta(\beta 0, t)\right)\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi} + \left(\frac{\partial}{\partial \beta 0}\beta(\beta 0, t)\right)\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)(\phi}{(L - t)\,(-1 + \phi)\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)^{2}}$$

$$, 0 < \frac{\partial}{\partial \beta 0} G$$

Based on these results, we can see that $0 < \frac{\partial}{\partial L} t$, $0 < \frac{\partial}{\partial \alpha} t$, $0 < \frac{\partial}{\partial K} t$ and $\frac{\partial}{\partial \beta 0} t < 0$.

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III.7. Proof of Statement 7.

Statement 7. The optimal size of labor endowment enhancing policies for capital owners rises if exogenous effects increases capital endowment (K goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when labor endowment increaes (L goes up) or technology of labor sector improves (α goes down).

Proof - The utility function can in the decomposed way is

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := \mathrm{L}(t)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}$, $\mathrm{g}(t) := \frac{\left(1 + \left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := -\frac{\left(1 - \left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi} + \left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi} \phi \left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right) \mathrm{L}(t) \left(1 + \left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\right)}{\left(\mathrm{L}(t)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi} - t\right)(1-\phi)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)} = 1$

Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

As it is discussed in Supplement I.2.2.

$\frac{\partial}{\partial t} G < 0$ because $\frac{\partial}{\partial t}\mathrm{g}(t) < 0$

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4. $$\frac{\partial}{\partial t} g(t) = -\frac{\left(1+\left(\frac{\alpha K}{\beta L(t)}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (1-\phi)\left(\frac{\alpha K}{\beta L(t)}\right)^{\phi}\left(\frac{\partial}{\partial t} L(t)\right)}{L(t)\left(1+\left(\frac{\alpha K}{\beta L(t)}\right)^{\phi}\right)\alpha}, \frac{\partial}{\partial t} g(t) < 0$$

To study how exogenous changes modify the optimal level of policy the variable that is attached by exogenous shock will be the function of x.

Now L(t) is substituted with L(L0,t) to se the effect of change in Labor endowment

5. $$\frac{\partial^2}{\partial L0\, \partial t} L(L0, t) = 0$$

6.
$$\frac{\partial}{\partial L0} G = -\Bigg(\left((-1+\phi)(L(L0,t)\phi + t(-1+\phi))\left(\frac{\partial}{\partial t} L(L0,t)\right) + L(L0,t)\phi\right)\left(\left(\frac{\alpha K}{\beta L(L0,t)}\right)^{\phi}\right)^2 + \left((t - t\phi)\left(\frac{\partial}{\partial t} L(L0,t)\right) - t + 2L(L0,t)\phi\right)\left(\frac{\alpha K}{\beta L(L0,t)}\right)^{\phi} - t - t\phi\Bigg) \left(\frac{\partial}{\partial L0} L(L0,t)\right)\left(\frac{\partial}{\partial t} L(L0,t)\right)$$

After omitting $\left(\frac{\partial}{\partial L0} L(L0,t)\right)\left(\frac{\partial}{\partial t} L(L0,t)\right)$ (its sign is positive) and substituting

7. $$t = -\frac{\left(\left(1-\left(\frac{\partial}{\partial t} L(L0,t)\right)+\phi\left(\frac{\partial}{\partial t} L(L0,t)\right)\right)\left(\frac{\alpha K}{\beta L(L0,t)}\right)^{\phi}+1\right)L(L0,t)}{\left(\frac{\partial}{\partial t} L(L0,t)\right)\left(\frac{\alpha K}{\beta L(L0,t)}\right)^{\phi}(-1+\phi)}$$

that we got solving G=1, The sign of this expression is identical with the sign of

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8.

$$dG = -\mathrm{L}(L0,t)\left(1+\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}\right)\left(\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}(-1+\phi)+1\right)$$
$$\left(\left(\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\phi+1-\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}+1+\phi\right)\Big/\Big($$
$$\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}(-1+\phi)\Big)$$

Its sign is identical with the sign of

9.

$$dG2 = \left(\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}(-1+\phi)+1\right)$$
$$\left(\left(\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\phi+1-\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}+1+\phi\right)$$

Because G>0

10. $$1-\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(t)}\right)^{\phi}+\left(\frac{\alpha K}{\beta\,\mathrm{L}(t)}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)<0$$

11. $$\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)(-1+\phi)\left(\frac{\alpha K}{\beta\,\mathrm{L}(t)}\right)^{\phi}+1<0$$

Because of the assumption that optimal policy exist t>0

12. $$0<\left(1-\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)+\phi\left(\frac{\partial}{\partial t}\mathrm{L}(L0,t)\right)\right)\left(\frac{\alpha K}{\beta\,\mathrm{L}(L0,t)}\right)^{\phi}+1$$

Consequently, DG2<0, thus $\frac{\partial}{\partial L0}G<0$

Now effect of exogenous change in α is studied.

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13. $$\frac{\partial}{\partial \alpha} G = -\frac{\phi\, \mathrm{L}(t)\left(\left((-1+\phi)\,(\mathrm{L}(t)+t)\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)+\mathrm{L}(t)\right)\left(\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\right)^{2}+2\,\mathrm{L}(t)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t}\right.\right.}{\alpha\left(-\mathrm{L}(t)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}+t\right)^{2}(-1+\phi)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)}$$

Its sign is identical with sign of dG2

14. $$dG2 = \left((-1+\phi)\,(\mathrm{L}(t)+t)\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)+\mathrm{L}(t)\right)\left(\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\right)^{2}+2\,\mathrm{L}(t)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}-t$$

solving G=1 for t we get

15. $$t = -\frac{\mathrm{L}(t)\left(\left(1-\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)+\phi\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}+1\right)}{\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}(-1+\phi)}$$

Substituting this value into dG2 we get

16. $$dG3 := \frac{\mathrm{L}(t)\left(\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}(-1+\phi)+1\right)\left(1+\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\right)}{\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}(-1+\phi)}$$

Because G>0

17. $$1-\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}+\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)<0$$

18. $$\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)(-1+\phi)\left(\frac{\alpha K}{\beta\, \mathrm{L}(t)}\right)^{\phi}+1<0$$

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Consequently, dG3>0, $0 < \frac{\partial}{\partial \alpha} G$.

Now effect of exogenous change in K and β is studied. These two variables move together, thus I will study the effect of st, $st = \frac{K}{\beta}$.

19. $$\frac{\partial}{\partial st} G = -\frac{\mathrm{L}(t)\left(\left((\mathrm{L}(t)+t)(-1+\phi)\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)+\mathrm{L}(t)\right)\left(\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}\right)^{2}+2\,\mathrm{L}(t)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}-\right.}{st\left(\mathrm{L}(t)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}-t\right)^{2}(-1+\phi)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)}$$

20. $$dg2 := \left((\mathrm{L}(t)+t)(-1+\phi)\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)+\mathrm{L}(t)\right)\left(\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}\right)^{2}+2\,\mathrm{L}(t)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}-t$$

Substituting the value of t calculated above we get

21. $$dg3 := \frac{\left(\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}(-1+\phi)+1\right)\mathrm{L}(t)\left(1+\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}\right)}{\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)\left(\frac{\alpha\, st}{\mathrm{L}(t)}\right)^{\phi}(-1+\phi)}$$

As we could see earlier

22. $$\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right)(-1+\phi)\left(\frac{\alpha K}{\beta\,\mathrm{L}(t)}\right)^{\phi}+1<0$$

Consequently dG3>0, $0 < \frac{\partial}{\partial st} G$ - $0 < \frac{\partial}{\partial K} G$, $\frac{\partial}{\partial \beta} G < 0$.

Based on results we can see that $\frac{\partial}{\partial L0} t < 0$, $0 < \frac{\partial}{\partial \alpha} t$, $0 < \frac{\partial}{\partial K} t$, $\frac{\partial}{\partial \beta} t < 0$.

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III.8. Proof of Statement 8.

Statement 8. The optimal size of labor technology enhancing policies for capital owners rises if exogenous effects increases capital or labor endowment (K or L goes up) or improve technologies in capital sector (β goes down).

Proof - The same approach is used as before. The utility function can in the decomposed way is

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := L\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}$, $\mathrm{g}(t) := \frac{\left(1 + \left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha(t)}$

Technology enhancing policy cuts production costs, thus $\frac{\partial}{\partial t}\alpha(t)$.

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G = \frac{\left(\alpha(t) - L\left(\frac{\alpha(t)\, st}{L}\right)^{\phi} \phi \left(\frac{\partial}{\partial t}\alpha(t)\right)\right)\left(1 + \left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\right)}{\left(-L\left(\frac{\alpha(t)\, st}{L}\right)^{\phi} + t\right)\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\phi + 1\right)}$

Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

As it is discussed in Supplement I.2.2.

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$0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} \mathrm{g}(t)$

4. $$\frac{\partial}{\partial t} \mathrm{g}(t) = -\frac{\left(1+\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} \left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\phi+1\right)}{\alpha(t)^2\left(1+\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\right)}$$

5. $$\frac{\partial}{\partial st} G = \left(L\,\phi\left(((-L-t)\,\phi+L)\left(\frac{\partial}{\partial t}\alpha(t)\right)+\alpha(t)\right)\left(\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\right)^2 + 2\,L\,\phi\left(\alpha(t)-t\left(\frac{\partial}{\partial t}\alpha(t)\right)\right)\left(\frac{\alpha(t)\, st}{L}\right)^{\phi} - L\,\phi\left(\frac{\partial}{\partial t}\alpha(t)\right)t-\alpha(t)\,(\phi\, t-L-t)\right) \left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\phi \Big/ \left(\left(\frac{\partial}{\partial t}\alpha(t)\right) st\left(L\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}-t\right)^2\left(\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\phi+1\right)^2\right)$$

Substituting value of t that gives solution for G=1

6. $$t = \frac{\left((-\phi\, L+L)\left(\frac{\partial}{\partial t}\alpha(t)\right)+\alpha(t)\right)\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}+\alpha(t)}{\left(\frac{\partial}{\partial t}\alpha(t)\right)\left(\left(\frac{\alpha(t)\, st}{L}\right)^{\phi}\phi+1\right)}$$

We get that $\frac{\partial}{\partial st} G < 0$, Consequently $\frac{\partial}{\partial K} G < 0$ and $0 < \frac{\partial}{\partial \beta} G$.

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7.

$$\frac{\partial}{\partial L} G := \left(\left(\phi\,(t+L) \left(\frac{\partial}{\partial t} \alpha(t) \right) - \alpha(t) \right) L\,\phi \left(\left(\frac{\alpha(t)\,st}{L} \right)^{\phi} \right)^2 + L \left(\phi \left(\frac{\partial}{\partial t} \alpha(t) \right) t + \alpha(t)\,(-2\,\phi - 1) \right) \left(\frac{\alpha(t)\,st}{L} \right)^{\phi} + \phi \left(\frac{\partial}{\partial t} \alpha(t) \right) L\,t + \alpha(t)\,(\phi\,t - L) \right) \left(\frac{\alpha(t)\,st}{L} \right)^{\phi} (-1 + \phi) \Big/ \left(\left(\frac{\partial}{\partial t} \alpha(t) \right) \left(L \left(\frac{\alpha(t)\,st}{L} \right)^{\phi} - t \right)^2 \left(\left(\frac{\alpha(t)\,st}{L} \right)^{\phi} \phi + 1 \right)^2 L \right)$$

Substituting value of t calculated above we get that $\frac{\partial}{\partial L} G < 0$.

Based on these, we can see that $0 < \frac{\partial}{\partial L} t$, $0 < \frac{\partial}{\partial K} t$, $\frac{\partial}{\partial \beta} t < 0$.

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III.9. Proof of Statement 9.

Statement 9. The optimal size of capital endowment enhancing policies for capital owners rises if exogenous effects increases labor endowment (L goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when capital endowment increaes (K goes up) or technology of labor sector improves (α goes down).

Proof - The utility function can in the decomposed way is

1. $u = (\mathrm{f}(t) - t)\,\mathrm{g}(t)$

2. $$\mathrm{f}(t) := L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}, \quad \mathrm{g}(t) := \frac{\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)}}{\alpha}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $$G := \frac{\left(1-\frac{L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)}{\mathrm{K}(t)}\right)\mathrm{K}(t)\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)}{\left(L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}-t\right)(1-\phi)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)} = 1$$

Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

As it is discussed in Supplement I.2.2. $0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t}\mathrm{g}(t)$

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4. $$\frac{\partial}{\partial t} g(t) = \frac{\left(1 + \left(\frac{\alpha K(t)}{\beta L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (1-\phi)\left(\frac{\alpha K(t)}{\beta L}\right)^{\phi}\left(\frac{\partial}{\partial t} K(t)\right)}{K(t)\left(1 + \left(\frac{\alpha K(t)}{\beta L}\right)^{\phi}\right)\alpha}$$

Now K(t) is substituted with K(K0,t) to se the effect of change in Capital endowment.

5. $$\frac{\partial^2}{\partial t\, \partial K0} K(K0, t) = 0$$

6.
$$\frac{\partial}{\partial K0} G = -\left(\frac{\partial}{\partial K0} K(K0, t)\right)\Bigg(\left(\phi^2 (L + t)\left(\frac{\partial}{\partial t} K(K0, t)\right) + K(K0, t)(1-\phi)\right) L \left(\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi}\right)^2 - K(K0, t)(2L\phi - L + t)\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi} + t\, K(K0, t)(-1+\phi)\Bigg) \Bigg/ \Bigg(\left(\frac{\partial}{\partial t} K(K0, t)\right) K(K0, t)\left(-L\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi} + t\right)^2 (-1+\phi)\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi}\Bigg)$$

After substituting the value of t that gives solution G=1

7.
$$t = \Bigg(-\left(\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi}\right)^2 \left(\frac{\partial}{\partial t} K(K0, t)\right) L + \left(K(K0, t) - \left(\frac{\partial}{\partial t} K(K0, t)\right)\phi L\right)\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi} + K(K0, t)\Bigg) \Bigg/ \Bigg(\left(\frac{\alpha K(K0, t)}{\beta L}\right)^{\phi}\left(\frac{\partial}{\partial t} K(K0, t)\right)(-1+\phi)\Bigg)$$

And omitting the trivially positive parts, we get dG2 that has identical sign with $\frac{\partial}{\partial K0} G$.

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8. $$dG2 := \left(\left(\frac{\alpha\, \mathrm{K}(x,\, t)}{\beta\, L}\right)^{\phi} + 1 - \phi\right) \mathrm{K}(x,\, t) - L\left(\left(\frac{\alpha\, \mathrm{K}(x,\, t)}{\beta\, L}\right)^{\phi}\right)^{2} \phi\left(\frac{\partial}{\partial t}\mathrm{K}(x,\, t)\right)$$

G>0, consequently

9. $$L\left(\frac{\alpha\, \mathrm{K}(x,\, t)}{\beta\, L}\right)^{\phi} \phi\left(\frac{\partial}{\partial t}\mathrm{K}(x,\, t)\right) < \mathrm{K}(x,\, t)$$

dG3 is got substituting left hand side of this equation for $\mathrm{K}(x,\, t)$ in the first multiplication of dG2, thus dG3<dG2.

10. $$dG3 = L\left(\frac{\alpha\, \mathrm{K}(x,\, t)}{\beta\, L}\right)^{\phi} \phi\left(\frac{\partial}{\partial t}\mathrm{K}(x,\, t)\right)(1 - \phi)$$

dG3>0, consequently $0 < \frac{\partial}{\partial K0} G$.

11. $$\frac{\partial}{\partial \beta} G =$$

$$\frac{\phi\left(\left(\phi\,(L + t)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right) - \mathrm{K}(t)\right) L\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2} - 2\, L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} \mathrm{K}(t) + \mathrm{K}(t)\, t\right)}{\beta\left(L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} - t\right)^{2}(-1 + \phi)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}}$$

Let's substitute into it value of t that gives solution for G=1

12. $$t = \frac{-\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right) L + \left(\mathrm{K}(t) - \left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\phi\, L\right)\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} + \mathrm{K}(t)}{\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)(-1 + \phi)}$$

We get

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13.

$$dG2 := \left(1 + \left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)\left(\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L + \mathrm{K}(t)\right)$$
$$\left(L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right) - \mathrm{K}(t)\right) \Big/ \left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)(-1+\phi)\right)$$

Substituting dG2 with G (G=1) we get dG3.

14. $$dG3 = \left(\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L + \mathrm{K}(t)\right)\left(L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} - t\right)$$

dG3>0, consequently $0 < \frac{\partial}{\partial \beta} G$.

15.

$$\frac{\partial}{\partial L} G = \left(-\left(\left(-L\,\phi^{2} - \phi\, t\,(-1+\phi)\right)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right) + \mathrm{K}(t)\,(-1+\phi)\right)L\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\right.$$
$$\left. - 2\left(\frac{1}{2}\phi\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)t + \left(\phi - \frac{1}{2}\right)\mathrm{K}(t)\right)L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} + \phi\, \mathrm{K}(t)\, t\right) \Big/ \left(\right.$$
$$\left.\left(L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} - t\right)^{2}(-1+\phi)\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L\right)$$

We get dG2 substitutin value of t that gives solution for G=1 into $\frac{\partial}{\partial L} G$ and omitting the straightforwardly positive parts

16. $$t = \frac{-\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L + \left(\mathrm{K}(t) - L\,\phi\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\right)\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} + \mathrm{K}(t)}{\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)(-1+\phi)}$$

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17. $$dG3 = \left(L\,(-1+\phi)\left(\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{2} - L\,\phi\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right) + \mathrm{K}(t)\,\phi$$

From t>0 comes that

18. $$\frac{\mathrm{K}(t)\left(1+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)}{L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\left(\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}+\phi\right)} < \frac{\partial}{\partial t}\mathrm{K}(t)$$

Because $L\,(-1+\phi)\left(\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{2} - L\,\phi\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi} < 0$, substituting left hand side for $\frac{\partial}{\partial t}\mathrm{K}(t)$ into dG3 we get dG4>dG3.

19. $$dG4 := \frac{\mathrm{K}(t)\,(-1+\phi)\left(\phi+\left(\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{2}+\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)}{\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}+\phi}$$

dG4<0, consequently $\frac{\partial}{\partial L}G < 0$.

20. $$\frac{\partial}{\partial\alpha}G = -\frac{\left(L\left(\phi\,(L+t)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)-\mathrm{K}(t)\right)\left(\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\right)^{2} - 2\,L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}\mathrm{K}(t)+\mathrm{K}(t)\,t\right)\phi}{\alpha\left(-L\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}+t\right)^{2}(-1+\phi)\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\left(\frac{\alpha\,\mathrm{K}(t)}{\beta\,L}\right)^{\phi}}$$

Omitting the trivially positive parts and substituting the value of t calculated above we get dG2 that has identical sign with $\frac{\partial}{\partial\alpha}G$.

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21.

$$dG2 := \left(1 + \left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)\left(\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L + \mathrm{K}(t)\right)$$
$$\left(\mathrm{K}(t) - L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)\right) \Big/ \left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)(-1+\phi)\right)$$

22. $$\frac{dG2}{G} = \left(\left(\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K}(t)\right)L + \mathrm{K}(t)\right)\left(-L\left(\frac{\alpha\, \mathrm{K}(t)}{\beta\, L}\right)^{\phi} + t\right)$$

Consequently dG2<0, $\frac{\partial}{\partial \alpha} G < 0$.

We could see that $0 < \frac{\partial}{\partial t} G$, $0 < \frac{\partial}{\partial K0} G$, $0 < \frac{\partial}{\partial \beta} G$, $\frac{\partial}{\partial L} G < 0$, $\frac{\partial}{\partial \alpha} G < 0$. Based on this implicit function theorem gives that $\frac{\partial}{\partial K0} t < 0$, $\frac{\partial}{\partial \beta} t < 0$, $0 < \frac{\partial}{\partial L} t$, $0 < \frac{\partial}{\partial \alpha} t$.

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III.10. Proof of Statement 10.

Statement 10. The optimal size of capital technology enhancing policies for capital owners rises if exogenous effects increases labor or capital endowment (L or K goes up) or improve technologies in capital sector (β goes down). Optimal size of this policy decreases when technology of labor sector improves (α goes down).

Proof - The utility function can in the decomposed way is

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi}$, $\mathrm{g}(t) := \frac{\left(1 + \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)^{\left(\frac{1-\phi}{\phi} \right)}}{\alpha}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := -\frac{\left(\beta(t) + L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \phi \left(\frac{\partial}{\partial t} \beta(t) \right) \right) \left(1 + \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)}{\left(-L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} + t \right) (-1 + \phi) \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \left(\frac{\partial}{\partial t} \beta(t) \right)} = 1$

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Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

As it is discussed in Supplement I.2.2. $0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} \mathrm{g}(t)$

4. $\frac{\partial}{\partial t} \beta(t) < 0$

5. $$\frac{\partial}{\partial t} g = \frac{\left(1 + \left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{\left(\frac{1-\phi}{\phi}\right)} (-1+\phi)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)}{\beta(t)\left(1 + \left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)\alpha}$$

Now $\beta(t)$ is substituted with $\beta(\beta 0, t)$ to see the effect of change in Capital endowment.

6. $$\frac{\partial^2}{\partial t\, \partial \beta 0}\beta(\beta 0, t) = 0$$

7. $$\frac{\partial}{\partial \beta 0} G := -\left(\frac{\partial}{\partial \beta 0}\beta(\beta 0, t)\right)\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)\left(L\left(\phi^2 (t+L)\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right) + \beta(\beta 0, t)(1+\phi)\right)\left(\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\right)^2 - \beta(\beta 0, t)(t - L - 2L\phi)\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi} - \beta(\beta 0, t)\, t\,(1+\phi)\right)$$

dG2 is calculated omitting the trivially positive parts and substituting t that solves G=1

8. $$dG2 = \left(-L\left(\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\right)^2 \phi\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right) + \beta(\beta 0, t)\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi} + \beta(\beta 0, t)(1+\phi)\right)\left(1 + \left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\right)\left(\beta(\beta 0, t) + L\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)\right) \Big/ \left(\left(\frac{\alpha K}{\beta(\beta 0, t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(\beta 0, t)\right)(-1+\phi)\right)$$

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9.

$$\frac{dG2}{G} = \left(L\left(\frac{\alpha K}{\beta(\beta 0,\, t)\, L}\right)^{\phi} - t \right)\Bigg(-L\left(\left(\frac{\alpha K}{\beta(\beta 0,\, t)\, L}\right)^{\phi}\right)^{2} \phi\left(\frac{\partial}{\partial t}\beta(\beta 0,\, t)\right) + \beta(\beta 0,\, t)\left(\frac{\alpha K}{\beta(\beta 0,\, t)\, L}\right)^{\phi} + \beta(\beta 0,\, t)\,(1+\phi) \Bigg)$$

The sign of $\frac{dG2}{G}$ is identical with sign of $\frac{\partial}{\partial \beta 0} G$, consequently $0 < \frac{\partial}{\partial \beta 0} G$.

10. $\frac{\partial}{\partial K} G =$

$$-\frac{\left(\left(\phi\,(L+t)\left(\frac{\partial}{\partial t}\beta(t)\right)+\beta(t)\right) L\left(\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\right)^{2} + 2\,\beta(t)\, L\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi} - \beta(t)\, t\right)\phi}{K\left(L\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi} - t\right)^{2}(-1+\phi)\left(\frac{\partial}{\partial t}\beta(t)\right)\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}}$$

dG2 is calculated omitting the trivially positive parts and substituting t that solves G=1

11. $t = \frac{-\left(\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\beta(t)\right) L + \left(-\beta(t) - L\,\phi\left(\frac{\partial}{\partial t}\beta(t)\right)\right)\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi} - \beta(t)}{\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)(-1+\phi)}$

12.

$$dg2 := \left(1+\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\right)\left(\left(\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\beta(t)\right) L - \beta(t)\right)\left(\beta(t) + L\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\beta(t)\right)\right) \Big/ \left(\left(\frac{\alpha K}{\beta(t)\, L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)(-1+\phi)\right)$$

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13. $$\frac{dg2}{G} = \left(\left(\left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)^{2} \left(\frac{\partial}{\partial t} \beta(t) \right) L - \beta(t) \right) \left(L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} - t \right)$$

The sign of $\frac{dg2}{G}$ is identical with $\frac{\partial}{\partial K} G$, consequently $\frac{\partial}{\partial K} G < 0$.

14.
$$\frac{\partial}{\partial L} G = \left(\left(\phi \left(\phi L + t \left(-1 + \phi \right) \right) \left(\frac{\partial}{\partial t} \beta(t) \right) + \beta(t) \left(-1 + \phi \right) \right) L \left(\left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)^{2} \right.$$
$$\left. - L \left(\phi \left(\frac{\partial}{\partial t} \beta(t) \right) t + \beta(t) \left(-2 \phi + 1 \right) \right) \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} - \phi \beta(t) t \right) \Big/ \left(\right.$$
$$\left. \left(L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} - t \right)^{2} \left(-1 + \phi \right) \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \left(\frac{\partial}{\partial t} \beta(t) \right) L \right)$$

dG2 is got after omitting trivially positive parts, substitution of t calculated above and division with G.

15. $$dG2 := \left(-L \left(-1 + \phi \right) \left(\left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)^{2} + L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \phi \right) \left(\frac{\partial}{\partial t} \beta(t) \right) + \beta(t) \phi$$

t>0, consequently

16. $$\frac{\partial}{\partial t} \beta(t) < \frac{\beta(t) \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} + \beta(t)}{-L \left(\left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \right)^{2} - L \left(\frac{\alpha K}{\beta(t) L} \right)^{\phi} \phi}$$

Substituting right hand side of this equation for $\frac{\partial}{\partial t} \beta(t)$ we get dG3>dG2.

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17. $$dG3 = \frac{\beta(t)\,(-1+\phi)\left(\phi+\left(\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{2}+\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)}{\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}+\phi}$$

dG3<0, consequently $\frac{\partial}{\partial L} G < 0$.

18. $$\frac{\partial}{\partial \alpha} G =$$

$$-\frac{\phi\left(\left(\phi\,(L+t)\left(\frac{\partial}{\partial t}\beta(t)\right)+\beta(t)\right)L\left(\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{2}+2\,L\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\beta(t)-\beta(t)\,t\right)}{\alpha\left(L\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}-t\right)^{2}(-1+\phi)\left(\frac{\partial}{\partial t}\beta(t)\right)\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}}$$

dG2 is got after omitting trivially positive parts, substitution of t calculated above and division with G.

19.

$$dG2 := \left(1+\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)\left(\left(\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\beta(t)\right)L-\beta(t)\right)$$
$$\left(L\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\phi\left(\frac{\partial}{\partial t}\beta(t)\right)+\beta(t)\right) \Big/ \left(\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\left(\frac{\partial}{\partial t}\beta(t)\right)(-1+\phi)\right)$$

20. $$\frac{dG2}{G} = \left(\left(\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}\right)^{2}\left(\frac{\partial}{\partial t}\beta(t)\right)L-\beta(t)\right)\left(L\left(\frac{\alpha K}{\beta(t) L}\right)^{\phi}-t\right)$$

The sign of $\frac{dg2}{G}$ is identical with $\frac{\partial}{\partial K} G$, consequently $\frac{\partial}{\partial \alpha} G < 0$.

We could see that $0 < \frac{\partial}{\partial t} G$, $\frac{\partial}{\partial K} G < 0$, $0 < \frac{\partial}{\partial \beta 0} G$, $\frac{\partial}{\partial L} G < 0$, $\frac{\partial}{\partial \alpha} G < 0$. Based on this implicit function theorem gives that $0 < \frac{\partial}{\partial K} t$, $\frac{\partial}{\partial \beta 0} t < 0$, $0 < \frac{\partial}{\partial L} t$, $0 < \frac{\partial}{\partial \alpha} t$.

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Appendix II. – Proof of statements in Chapter I.2.2.

IV.1. Proof of Statement 1.

Statement 1. Asset owners in the two sectors evaluate similarly the change of economic characteristics in general. Utility of economic actors increases if

- L1, L2, K1 or L2 rises
- $\alpha 1$, $\beta 1$, $\alpha 2$ or $\beta 2$ falls.

Proof - First order derivative of the utility functions gives these results.

1. $$u_{sector1} = \frac{L1\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{\alpha 1}$$

2. $$\frac{\partial}{\partial L1}u_{sector1} = \frac{\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)}{\sigma\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)\alpha 1}$$

3. $$0 < \frac{\partial}{\partial L1}u_{sector1}$$

4. $$\frac{\partial}{\partial K1}u_{sector1} = \frac{L1\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st(\sigma-1)\left(\frac{\alpha 1}{L1}\right)\right.}{(\sigma-1)\sigma K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)\alpha 1}$$

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5. $0 < \frac{\partial}{\partial K1} u_{sector1}$

6. $$\frac{\partial}{\partial \alpha 1} u_{sector1} = -\frac{L1 \left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)} \left(\left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} st \left(\sigma - 1 \right) \left(\frac{\alpha 1}{L1} \right.$$
$$\sigma \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right) \alpha 1^2$$

7. $\frac{\partial}{\partial \alpha 1} u_{sector1} < 0$

8. $$\frac{\partial}{\partial \beta 1} u_{sector1} = -\frac{L1 \left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)} \left(\left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} st \left(\sigma - 1 \right) \left(\frac{\alpha 1}{L1} \right.$$
$$\beta 1 \left(\sigma - 1 \right) \sigma \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right) \alpha 1$$

9. $\frac{\partial}{\partial \beta 1} u_{sector1} < 0$

10. $$\frac{\partial}{\partial st} u_{sector1} = \frac{L1 \left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)} \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)}}{\left(\sigma - 1 \right) \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right) \alpha 1}$$

11. $0 < \frac{\partial}{\partial st} u_{sector1}$

12. $$u_{sector2} = \frac{st \left(\frac{L1 \, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)}}{\alpha 1}$$

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13.

$$\frac{\partial}{\partial L1}u_{sector2}=\frac{st\left(\frac{L1\ \beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{K1\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{\sigma\ L1\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)\alpha1},$$

$$0<\frac{\partial}{\partial L1}u_{sector2}$$

14.

$$\frac{\partial}{\partial K1}u_{sector2}=\frac{st\left(\frac{L1\ \beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{K1\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{(\sigma-1)\ \sigma\ K1\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)\alpha1},$$

$$0<\frac{\partial}{\partial K1}u_{sector2}$$

15.

$$\frac{\partial}{\partial \alpha1}u_{sector2}=-\frac{st\left(\frac{L1\ \beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{K1\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{\beta1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{\sigma\ \alpha1^{2}\left(1+\left(\frac{\beta1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)},$$

$$\frac{\partial}{\partial \alpha1}u_{sector2}<0$$

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16.

$$\frac{\partial}{\partial \beta 1} u_{sector2} = -\frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}}{\beta 1\,(\sigma-1)\,\sigma\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\alpha 1},$$

$$\frac{\partial}{\partial \beta 1} u_{sector2} < 0$$

17.

$$\frac{\partial}{\partial st} u_{sector2} = \left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)}$$

$$\left(\sigma+\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st-1\right) \Big/ \left((\sigma-1)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\alpha 1\right),\ 0 < \frac{\partial}{\partial st} u_{sector2}$$

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IV.2. Proof of Statement 2.

Statement 2. - Both labor and capital owners' incomes increase if L1 rises (although in different pace). Income of actors in sector 2 is insensitive to other economic characteristics. Their income increases with $\alpha 1$, $\beta 1$, L2 and K2 and decreases with K1, $\alpha 2$, $\beta 2$.

Proof - First order derivative of the income functions gives these results.

1. $Inc_{sector1} = L1$, $Inc_{sector2} = st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$

2. $\frac{\partial}{\partial L1} Inc_{sector1} = 1$

3. $\frac{\partial}{\partial L1} Inc_{sector2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}}{\sigma\ L1}$

4. $\frac{\partial}{\partial K1} Inc_{sector2} = -\frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}}{\sigma\ K1}$

5. $\frac{\partial}{\partial \alpha 1} Inc_{sector2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} (\sigma - 1)}{\sigma\ \alpha 1}$

6. $\frac{\partial}{\partial \beta 1} Inc_{sector2} = \frac{st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}}{\sigma\ \beta 1}$

7. $\frac{\partial}{\partial st} Inc_{sector2} = \left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$

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IV.3. Proof of Statement 3.

Statement 3. The optimal size of policies that increase labor endowment in sector 1. rises for actors in sector 1. if exogenous effects increase capital endowment in sector one (K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

Proof - The utility function can in the decomposed way is

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$
2. $\mathrm{f}(t) := \mathrm{L1}(t)$, $\mathrm{g}(t) := \dfrac{\left(\dfrac{K1 \left(1 + \left(\dfrac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\dfrac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)}}{\alpha 1}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := \dfrac{\left(-1 + \left(\dfrac{\partial}{\partial t} \mathrm{L1}(t) \right) \right) \sigma\, \mathrm{L1}(t) \left(\left(\dfrac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(-\frac{\sigma - 1}{\sigma} \right)} \left(\dfrac{\beta 1}{K1} \right)^{\left(-\frac{1}{\sigma} \right)} + st \right)}{(\mathrm{L1}(t) - t) \left(\dfrac{\partial}{\partial t} \mathrm{L1}(t) \right) st} = 1$
4. $0 < \dfrac{\partial}{\partial t} \mathrm{L1}(t)$
5. $0 < -1 + \left(\dfrac{\partial}{\partial t} \mathrm{L1}(t) \right)$

Now comparative statics is used to reveal the effect of exogenous changes of economic characteristics.

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As it is discussed in Supplement I.2.2.

$$\frac{\partial}{\partial t} G < 0 \text{ because } \frac{\partial}{\partial t} g(t) < 0$$

6.

$$\frac{\partial}{\partial t} g = -\frac{\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t\right.}{\sigma\,\mathrm{L1}(t)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\alpha 1}$$

Now look at the effect economic characteristics on G!

7. $$\frac{\partial}{\partial K1} G = \frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\right)\mathrm{L1}(t)}{(\mathrm{L1}(t)-t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right) st\, K1}, \quad 0 < \frac{\partial}{\partial K1} G$$

8. $$\frac{\partial}{\partial \alpha 1} G = -\frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\right)\mathrm{L1}(t)\,(\sigma-1)}{(\mathrm{L1}(t)-t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right) st\,\alpha 1}, \quad \frac{\partial}{\partial \alpha 1} G < 0$$

9. $$\frac{\partial}{\partial \beta 1} G = \frac{\left(-1+\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\right)\mathrm{L1}(t)}{(-\mathrm{L1}(t)+t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right) st\,\beta 1}, \quad \frac{\partial}{\partial \beta 1} G < 0$$

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10. $$\frac{\partial}{\partial st} G = \frac{\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{L1}(t)\right)\right) \sigma \, \mathrm{L1}(t)}{(-\mathrm{L1}(t) + t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1}(t)\right) st^2}, \quad \frac{\partial}{\partial st} G < 0$$

We can see that $\frac{\partial}{\partial t} G < 0$ and $0 < \frac{\partial}{\partial K1} G$, $\frac{\partial}{\partial \alpha 1} G < 0$, $\frac{\partial}{\partial \beta 1} G < 0$, $\frac{\partial}{\partial st} G < 0$. Consequently implicit function theorem gives that $0 < \frac{\partial}{\partial K1} t$, $\frac{\partial}{\partial \alpha 1} t < 0$, $\frac{\partial}{\partial \beta 1} t < 0$, $\frac{\partial}{\partial st} t < 0$.

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IV.4. Proof of Statement 4.

Statement 4. The optimal size of policies that increase capital endowment in sector 1. rises for actors in sector 1 if exogenous effects increase labor endowment in sector one (L1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when capital endowment of sector 1 increases (K1 goes up) or sector 2 develops (st goes up).

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := L1$, $\mathrm{g}(t) := \dfrac{\left(\dfrac{\mathrm{K1}(t)\left(1 + \left(\dfrac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := \dfrac{(\sigma - 1)\, \sigma\, \mathrm{K1}(t) \left(1 + \left(\dfrac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{\left(\dfrac{\partial}{\partial t} \mathrm{K1}(t) \right) (L1 - t) \left(\left(\dfrac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\, (\sigma - 1) \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma \right)} = 1$

4. $0 < \dfrac{\partial}{\partial t} K1$

$0 < \dfrac{\partial}{\partial t} G$ because $0 < \dfrac{\partial}{\partial t} \mathrm{g}(t)$

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5.

$$\frac{\partial}{\partial t} g = \left(\frac{\mathrm{K1}(t) \left(1 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right) \Big/ \left((\sigma-1)\,\sigma\,\mathrm{K1}(t) \left(1 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right) \alpha 1 \right)$$

Now look at the effect economic characteristics on G!

6.

$$\frac{\partial}{\partial L1} G = -\mathrm{K1}(t)\,(\sigma-1) \left(\sigma\,L1 \left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 st^2\,(\sigma-1) \left(\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + 2\,st \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{1\,t}{2} + L1\,\sigma^2 - \frac{1\,\sigma\,t}{2} - \frac{1\,L1}{2} \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + L1\,\sigma^2 \right) \Big/ \left(L1\,(-L1+t)^2 \left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right)^2 \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \right)$$

Substitute t that gives solution for G=1.

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7.

$$t = \left(-\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1) \left(\sigma\,\mathrm{K1}(t) - L1 \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} - \sigma \left(-L1 \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) + \mathrm{K1}(t)\,(\sigma-1) \right) \right) \Big/ \left(\left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right) \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \right)$$

and we get dG2 that has identical sign with $\frac{\partial}{\partial L1} G$.

8.

$$dG2 = -\left(\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 st^2 \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\mathrm{L1}(x)\,(\sigma-1)^2\left(\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + 2\,st\,(\sigma-1)\left(\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\mathrm{L1}(x)\,\sigma + \frac{1\,\mathrm{K1}(t)\,(\sigma-1)}{2}\right)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma^2\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\mathrm{L1}(x)\right)\sigma\left(1+\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right) \Big/ \left(\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)\right)$$

dG2>0, consequently, $\frac{\partial}{\partial L1} G < 0$

To see effect of exogenous change in K1, K1(t) is substituted with K1(K10,t).

9.

$$\frac{\partial}{\partial K1} G = \left(\frac{\partial}{\partial K10}\mathrm{K1}(K10,\,t)\right)\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)\left(\sigma\left(\left(\frac{\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 st^2\,(\sigma-1)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + 2\left(\sigma+\frac{1}{2}\right)\left(\frac{\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\,st\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma^2\right)$$

10. $0 < \frac{\partial}{\partial K1} G$

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11. $$\frac{\partial}{\partial \alpha 1} G = -\frac{(\sigma-1)^2 \, \mathrm{K1}(t) \left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st}{\alpha 1 \left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)^2 (-L1+t)\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)}$$

12. $$0 < \frac{\partial}{\partial \alpha 1} G$$

13. $$\frac{\partial}{\partial \beta 1} G = -\frac{(\sigma-1)\,\mathrm{K1}(t) \left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st}{\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)^2 (-L1+t)\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\beta 1}$$

14. $$0 < \frac{\partial}{\partial \beta 1} G$$

15. $$\frac{\partial}{\partial st} G = -\frac{(\sigma-1)\,\sigma\,\mathrm{K1}(t) \left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}}{\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)^2 (-L1+t)\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)}$$

16. $$0 < \frac{\partial}{\partial st} G$$

We could see that $0 < \frac{\partial}{\partial t} G$ and $\frac{\partial}{\partial L1} G < 0$, $0 < \frac{\partial}{\partial K1} G$, $0 < \frac{\partial}{\partial \alpha 1} G$, $0 < \frac{\partial}{\partial \beta 1} G$, $0 < \frac{\partial}{\partial st} G$.

Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1} t$, $\frac{\partial}{\partial K1} t < 0$, $\frac{\partial}{\partial \alpha 1} t < 0$, $\frac{\partial}{\partial \beta 1} t < 0$, $\frac{\partial}{\partial st} t < 0$.

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IV.5. Proof of Statement 5.

Statement 5. The optimal size of policies that increase labor productivity in sector 1. rises for actors in sector 1. if exogenous effects increase labor or capital endowment in sector one (L1 or K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := L1$, $\mathrm{g}(t) := \dfrac{\left(\dfrac{K1\left(1 + \left(\dfrac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\dfrac{\alpha 1(t)}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)}}{\alpha 1(t)}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := \dfrac{\alpha 1(t)\, \sigma \left(1 + \left(\dfrac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\dfrac{\alpha 1(t)}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} st \right)}{\left(st \left(\dfrac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} (\sigma - 1) \left(\dfrac{\alpha 1(t)}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} + \sigma \right) (-L1 + t) \left(\dfrac{\partial}{\partial t} \alpha 1(t) \right)} = 1$

4. $\dfrac{\partial}{\partial t} \alpha < 0$

$0 < \dfrac{\partial}{\partial t} G$ because $0 < \dfrac{\partial}{\partial t} \mathrm{g}(t)$

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5.

$$\frac{\partial}{\partial t} g(t) = -\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1} \right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\partial}{\partial t}\alpha 1(t)\right)$$

$$\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right) \Big/ \left(\sigma\,\alpha 1(t)^2 \left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\right)$$

Now look at the effect economic characteristics on G!

6.

$$\frac{\partial}{\partial L1} G = \alpha 1(t)\left(\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 st^2\, L1\,\sigma(\sigma-1)\left(\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + 2\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(-\frac{1}{2}t\,\sigma + L1\,\sigma^2 - \frac{1}{2}L1 + \frac{1}{2}t\right) st\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + L1\,\sigma^2\right) \Big/ \left(\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)^2 (L1-t)^2\left(\frac{\partial}{\partial t}\alpha 1(t)\right) L1\right)$$

7. $-\frac{1}{2}t\,\sigma + L1\,\sigma^2 - \frac{1}{2}L1 + \frac{1}{2}t = \left(\sigma^2 - \frac{1}{2}\right)L1 - \frac{1}{2}t(\sigma-1)$

$$0 < \left(\sigma^2 - \frac{1}{2}\right)L1 - \frac{1\,t(\sigma-1)}{2}$$

Consequently, $\frac{\partial}{\partial L1} G < 0$

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8. $$\frac{\partial}{\partial K1} G = \frac{\alpha 1(t) \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st}{(L1 - t) \left(\frac{\partial}{\partial t} \alpha 1(t)\right) \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2 K1}$$

9. $$\frac{\partial}{\partial K1} G < 0$$

To see effect of exogenous change in $\alpha 1$, $\alpha 1(t)$ is substituted with $\alpha 1(\alpha 10, t)$.

10. $$\frac{\partial}{\partial \alpha 10} G = -\left(\sigma\, st^2 \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 (\sigma - 1) \left(\left(\frac{\alpha 1(\alpha 10, t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2 + 2\, st \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\sigma^2 - \frac{1}{2}\right) \left(\frac{\alpha 1(\alpha 10, t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma^2\right) \left(\frac{\partial}{\partial \alpha 10} \alpha 1(\alpha 10, t)\right) \Big/ \left((L1 - t) \left(\frac{\partial}{\partial t} \alpha 1(\alpha 10, t)\right) \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1(\alpha 10, t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2\right)$$

11. $$0 < \frac{\partial}{\partial \alpha 10} G$$

12. $$\frac{\partial}{\partial \beta 1} G = -\frac{\alpha 1(t) \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st}{\left(\frac{\partial}{\partial t} \alpha 1(t)\right) \beta 1 (L1 - t) \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2}$$

13. $$0 < \frac{\partial}{\partial \beta 1} G$$

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14. $$\frac{\partial}{\partial st} G = -\frac{\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\, \alpha 1(t)}{\left(\frac{\partial}{\partial t}\alpha 1(t)\right)(L1 - t)\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)^2}$$

15. $0 < \frac{\partial}{\partial st} G$

Results shows that $0 < \frac{\partial}{\partial t} g(t)$, $\frac{\partial}{\partial L1} G < 0$, $\frac{\partial}{\partial K1} G < 0$, $0 < \frac{\partial}{\partial \alpha 10} G$, $0 < \frac{\partial}{\partial \beta 1} G$ and $0 < \frac{\partial}{\partial st} G$. Based on these results and implicit function theorem we get that $0 < \frac{\partial}{\partial L1} t$, $0 < \frac{\partial}{\partial K1} t$, $\frac{\partial}{\partial \alpha 10} t < 0$, $\frac{\partial}{\partial \beta 1} t < 0$ and $\frac{\partial}{\partial st} t < 0$.

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IV.6. Proof of Statement 6.

Statement 6. The optimal size of policies that increase capital productivity in sector 1. rises for actors in sector 1 if exogenous effects increase labor or capital endowment in sector 1. (L1 or K1 goes up) or improve technologies in sector 1. ($\beta 1$ or $\alpha 1$ goes down). Optimal size of this policy decreases when sector 2 develops (st goes up).

1. $u = (\mathrm{f}(t) - t)\,\mathrm{g}(t)$

2. $\mathrm{f}(t) := L1$, $\mathrm{g}(t) := \dfrac{\left(\dfrac{K1\left(1 + \left(\dfrac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right)}{\beta 1(t)} \right)^{\left(\frac{1}{\sigma-1}\right)}}{\alpha 1}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := -\dfrac{(\sigma-1)\,\beta 1(t)\,\sigma \left(1 + \left(\dfrac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right)}{\left(\dfrac{\partial}{\partial t} \beta 1(t) \right)(L1 - t) \left(st \left(\dfrac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} (\sigma-1) \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right)} = 1$

4. $\dfrac{\partial}{\partial t} \beta 1 < 0$

$0 < \dfrac{\partial}{\partial t} G$ because $0 < \dfrac{\partial}{\partial t} \mathrm{g}(t)$

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5.

$$\frac{\partial}{\partial t} g = -\left(\frac{K1\left(1+\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1(t)} \right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\partial}{\partial t}\beta 1(t)\right)$$

$$\left(st\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right) \Big/ \left(\beta 1(t)\,(\sigma-1)\,\sigma \left(1+\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\alpha 1\right)$$

Now look at the effect economic characteristics on G!

6.

$$\frac{\partial}{\partial L1} G = -(\sigma-1)\,\beta 1(t)\left(-\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \sigma\, L1\, st^2\,(\sigma-1)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + st\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(-t+L1-2\,L1\,\sigma^2+\sigma\,t)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} - L1\,\sigma^2\right) \Big/ \left(\left(\frac{\partial}{\partial t}\beta 1(t)\right)\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^2 L1\,(-L1+t)^2\right)$$

7. $-t+L1-2\,L1\,\sigma^2+\sigma\,t=(1-2\,\sigma^2)\,L1+t\,(\sigma-1)$

$(1-2\,\sigma^2)\,L1+t\,(\sigma-1)<0$

Consequently, $\frac{\partial}{\partial L1} G < 0$

8. $$\frac{\partial}{\partial K1} G = -\frac{(\sigma-1)\,\beta 1(t)\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st}{K1\left(\frac{\partial}{\partial t}\beta 1(t)\right)\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^2 (-L1+t)}$$

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9. $\frac{\partial}{\partial K1} G < 0$

10. $$\frac{\partial}{\partial \alpha 1} G = -\frac{(\sigma - 1)^2 \beta 1(t) \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st}{\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2 (L1 - t) \left(\frac{\partial}{\partial t} \beta 1(t)\right) \alpha 1}$$

11. $0 < \frac{\partial}{\partial \alpha 1} G$

To see effect of exogenous change in $\beta 1$, $\beta 1(t)$ is substituted with $\beta 1(\beta 10, t)$.

12. $$\frac{\partial}{\partial \beta 10} G = \left(\frac{\partial}{\partial \beta 10} \beta 1(\beta 10, t)\right) \left(\left(\left(\frac{\beta 1(\beta 10, t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 st^2 \sigma (\sigma - 1) \left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2 + 2\left(-\frac{1}{2}\sigma + \sigma^2 + \frac{1}{2}\right)\left(\frac{\beta 1(\beta 10, t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma^2\right)(\sigma - 1) \Big/ \left(\right.$$
$$(-L1 + t)\left(\left(\frac{\beta 1(\beta 10, t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2 \left(\frac{\partial}{\partial t} \beta 1(\beta 10, t)\right)\Big)$$

13. $0 < \frac{\partial}{\partial \beta 10} G$

14. $$\frac{\partial}{\partial st} G = \frac{(\sigma - 1) \beta 1(t) \sigma \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}}{\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st (\sigma - 1) \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2 (-L1 + t) \left(\frac{\partial}{\partial t} \beta 1(t)\right)}$$

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15. $0 < \frac{\partial}{\partial st} G$

Results shows that $0 < \frac{\partial}{\partial t} g(t)$, $\frac{\partial}{\partial L1} G < 0$, $\frac{\partial}{\partial K1} G < 0$, $0 < \frac{\partial}{\partial \alpha 1} G$, $0 < \frac{\partial}{\partial \beta 10} G$ and $0 < \frac{\partial}{\partial st} G$. Based on these results and implicit function theorem we get that $0 < \frac{\partial}{\partial L1} t$, $0 < \frac{\partial}{\partial K1} t$, $\frac{\partial}{\partial \alpha 1} t < 0$, $\frac{\partial}{\partial \beta 10} t < 0$ and $\frac{\partial}{\partial st} t < 0$.

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IV.7. Proof of Statement 7.

Statement 7. The optimal size of policies that increase the level of endowments or improve prodctivity in sector 2. rises for actors in sector 1 if exogenous effects increase labor endowment in sector 1. (L1 up). Optimal size of this policy decreases when capital endowment in sector 1. raises (K1 goes up), technology of sector 1. improves ($\beta 1$ or $\alpha 1$ goes down) or sector 2 develops (st goes up).

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := L1$, $\mathrm{g}(t) := \dfrac{\left(\dfrac{K1 \left(1 + \left(\dfrac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\dfrac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \mathrm{st}(t) \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)}}{\alpha 1}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $G := -\dfrac{1\,(\sigma - 1) \left(\left(\dfrac{\alpha 1}{L1} \right)^{\left(-\frac{\sigma - 1}{\sigma} \right)} \left(\dfrac{\beta 1}{K1} \right)^{\left(-\frac{1}{\sigma} \right)} + \mathrm{st}(t) \right)}{(-L1 + t) \left(\dfrac{\partial}{\partial t} \mathrm{st}(t) \right)} = 1$

4. $0 < \dfrac{\partial}{\partial t} st$

$0 < \dfrac{\partial}{\partial t} G$ because $0 < \dfrac{\partial}{\partial t} \mathrm{g}(t)$

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5. $$\frac{\partial}{\partial t} g(t) = \frac{\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st(t)\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t} st(t)\right)}{(\sigma-1)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st(t)\right)\alpha 1}$$

Now look at the effect economic characteristics on G!

6. $$\frac{\partial}{\partial L1} G = -\frac{(\sigma-1)\left(L1\,\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st(t) + \sigma\, t + L1 - t\right)}{(-L1+t)^2\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t} st(t)\right)\sigma\, L1}$$

7. $$\frac{\partial}{\partial L1} G < 0$$

8. $$\frac{\partial}{\partial K1} G = \frac{-\sigma+1}{(-L1+t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t} st(t)\right)\sigma\, K1}$$

9. $$0 < \frac{\partial}{\partial K1} G$$

10. $$\frac{\partial}{\partial \alpha 1} G = \frac{(\sigma-1)^2}{(-L1+t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t} st(t)\right)\sigma\,\alpha 1}$$

11. $$\frac{\partial}{\partial \alpha 1} G < 0$$

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12. $$\frac{\partial}{\partial \beta 1} G = \frac{\sigma - 1}{(-L1 + t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\,\mathrm{st}(t)\right)\sigma\,\beta 1}$$

13. $$\frac{\partial}{\partial \beta 1} G < 0$$

To see effect of exogenous change in st, st(t) is substituted with st(st0,t).

14. $$\frac{\partial}{\partial st0} G = -\frac{(\sigma - 1)\left(\frac{\partial}{\partial st0}\,\mathrm{st}(st0, t)\right)}{(-L1 + t)\left(\frac{\partial}{\partial t}\,\mathrm{st}(st0, t)\right)}$$

15. $$0 < \frac{\partial}{\partial st} G$$

We could see that $0 < \frac{\partial}{\partial t} G$ and $\frac{\partial}{\partial L1} G < 0$, $0 < \frac{\partial}{\partial K1} G$, $\frac{\partial}{\partial \alpha 1} G < 0$, $\frac{\partial}{\partial \beta 1} G < 0$, $0 < \frac{\partial}{\partial st} G$.

Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1} t$, $\frac{\partial}{\partial K1} t < 0$, $0 < \frac{\partial}{\partial \alpha 1} t$, $0 < \frac{\partial}{\partial \beta 1} t$, $\frac{\partial}{\partial st} t < 0$.

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IV.8. Proof of Statement 8.

Statement 8. The optimal size of policies that increase the level of labor endowment in sector 1. rises for actors in sector 2 if exogenous effects improve situation of sector 2. (st goes up). Optimal size of this policy decreases when situation of sector 1.becomes better (L1 or K1 goes up, $\beta 1$ or $\alpha 1$ goes down) .

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $$\mathrm{f}(t) := st \left(\frac{\mathrm{L1}(t)\, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$$

3. $$\mathrm{g}(t) := \frac{\left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

4. $$G := -\left(\left(\frac{\beta 1}{K1} \right)^{\left(-\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(-\frac{\sigma - 1}{\sigma}\right)} + st \right) \left(-\alpha 1^{\left(\frac{1}{\sigma}\right)} \sigma\, \mathrm{L1}(t) + \alpha 1\, st \left(\frac{\mathrm{L1}(t)\, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) \right) \Big/ \left(\left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) st \left(-st \left(\frac{\mathrm{L1}(t)\, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1 + t\, \alpha 1^{\left(\frac{1}{\sigma}\right)} \right) \right) = 1$$

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5. $0 < \frac{\partial}{\partial t} L1$

$\frac{\partial}{\partial t} G < 0$ because $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$

6.

$$\frac{\partial}{\partial t} \mathrm{g}(t) = -\frac{\left(\frac{K1\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma-1}\right)} \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L}\right.}{\sigma\, \mathrm{L1}(t)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)\alpha 1}$$

Now look at the effect economic characteristics on G!

To see effect of exogenous change in L, L(t) is substituted with L(L0,t).

7.

$$\begin{aligned}\frac{\partial}{\partial L0} G = -\Bigg(st \Bigg(& st\, \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\left(\frac{\partial}{\partial t} \mathrm{L1}(L0, t)\right) t + \sigma\, \mathrm{L1}(L0, t)\,(\sigma-1)\right)\left(\frac{\mathrm{L1}(L0, t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \\ & - t\,\sigma^2\, \mathrm{L1}(L0, t)\Bigg)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(L0, t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \\ & - \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 \left(\frac{\partial}{\partial t} \mathrm{L1}(L0, t)\right) st^2\,(\sigma-1)\left(\left(\frac{\mathrm{L1}(L0, t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \\ & + 2\, st\left(\frac{1}{2}\left(\frac{\partial}{\partial t} \mathrm{L1}(L0, t)\right) t + \mathrm{L1}(L0, t)\,(\sigma-1)\right) \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma \left(\frac{\mathrm{L1}(L0, t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\end{aligned}$$

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$$-2\,\mathrm{L1}(L0,t)\,\sigma\left(\sigma-\frac{1}{2}\right)t\left(\frac{\partial}{\partial L0}\mathrm{L1}(L0,t)\right)\Bigg/\left(\left(\frac{\partial}{\partial t}\mathrm{L1}(L0,t)\right)\sigma\,\mathrm{L1}(L0,t)\left(st\left(\frac{\mathrm{L1}(L0,t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(L0,t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)^{2}$$

Substituting value of t that solves G=1 into $\frac{\partial}{\partial L0}G$ and dividing it with G we get dG2.

8.

$$t=\left(\sigma\,\mathrm{L1}(L0,t)+\sigma\,\mathrm{L1}(L0,t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(L0,t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st-st\left(\frac{\mathrm{L1}(L0,t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(L0,t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)\Bigg/\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(L0,t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(L0,t)\right)st\right)$$

9.

$$dG2=-\sigma\,\mathrm{L1}(x,t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x,t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st+st\left(\frac{\mathrm{L1}(x,t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(x,t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-\mathrm{L1}(x,t)\,(2\,\sigma-1)$$

t>0, consequently tn>0

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10.

$$tn = \sigma\,\mathrm{L1}(x,t) + \sigma\,\mathrm{L1}(x,t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x,t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st$$

$$- st\left(\frac{\mathrm{L1}(x,t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(x,t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}$$

11. $dG2 + tn = -\mathrm{L1}(L0,t)\,(\sigma - 1)$

Consequently, $\frac{\partial}{\partial L1} G < 0$.

12.

$$\frac{\partial}{\partial K1} G = \Bigg(-\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} st^2 \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(-\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)t + \sigma\,\mathrm{L1}(t)\right)\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

$$+ st^2\left(\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2$$

$$- 2\,st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\,\mathrm{L1}(t) + \sigma\,\mathrm{L1}(t)\,t\Bigg) \Bigg/ \Bigg(\sigma\,K1$$

$$\left(st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)^2 \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right) st\Bigg)$$

Substituting value of t that solves G=1 into $\frac{\partial}{\partial K1} G$, omitting the positive parts of this expression and dividing with G we get dG2 without changing sign.

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13.

$$t = \frac{\sigma\,\mathrm{L1}(t) + \sigma\,\mathrm{L1}(t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st - st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right.}}{\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)st}$$

14. $$dG2 = -\sigma\,\mathrm{L1}(t)\left(st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)$$

dG2<0, consequently, $\frac{\partial}{\partial K1}G < 0$.

15.

$$\frac{\partial}{\partial \alpha 1}G = -\Bigg(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st^2\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)t - \sigma\,\mathrm{L1}(t)\right)\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + st^2\left(\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 - 2\,st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\,\mathrm{L1}(t) + \sigma\,\mathrm{L1}(t)\,t\Bigg)(\sigma-1) \Bigg/ \Bigg(\sigma\,\alpha 1\left(st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)^2\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(t)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{L1}(t)\right)st\Bigg)$$

Substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \alpha 1}G$, omitting the positive parts of this expression and dividing with G we get dG2 without changing sign.

16. $$dG2 = \sigma\,\mathrm{L1}(t)\left(st\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)$$

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17. dG2>0, consequently, $0 < \frac{\partial}{\partial \alpha 1} G$.

18.

$$\frac{\partial}{\partial \beta 1} G = \left(st^2 \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(-t \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) + \sigma\, \mathrm{L1}(t) \right) \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} - st^2 \left(\left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + 2\, st \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\, \mathrm{L1}(t) - \sigma\, \mathrm{L1}(t)\, t \right) \Big/ \left(\sigma\, \beta 1 \left(st \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right)^2 \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) st \right)$$

Omitting the positive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \beta 1} G$, we get dG2 without changing sign.

19. $$dG2 = \sigma\, \mathrm{L1}(t) \left(st \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right)$$

20. dG2>0, consequently $0 < \frac{\partial}{\partial \beta 1} G$.

21. $$\frac{\partial}{\partial st} G = \frac{\sigma\, \mathrm{L1}(t) - \mathrm{st}(L0) \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}}{\left(\mathrm{st}(L0) \left(\frac{\mathrm{L1}(t)\,\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right) \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) st^2}$$

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22. $0 < \frac{\partial}{\partial st} G$

We could see that $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$ and $\frac{\partial}{\partial L1} G < 0$, $\frac{\partial}{\partial K1} G < 0$, $0 < \frac{\partial}{\partial \alpha 1} G$, $0 < \frac{\partial}{\partial \beta 1} G$, $0 < \frac{\partial}{\partial st} G$. Using implicit function theorem follows that $\frac{\partial}{\partial L1} t < 0$, $\frac{\partial}{\partial K1} t < 0$, $0 < \frac{\partial}{\partial \alpha 1} t$, $0 < \frac{\partial}{\partial \beta 1} t$,

$0 < \frac{\partial}{\partial st} t$.

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IV.9. Proof of Statement 9.

Statement 9. The optimal size of policies that increase the level of capital endowment in sector 1. rises for actors in sector 2 if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when situation of sector 1.becomes better (K1 goes up, $\beta 1$ or $\alpha 1$ goes down) .

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := st \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$

3. $\mathrm{g}(t) := \frac{\left(\frac{\mathrm{K1}(t) \left(1 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1}$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

4. $$G := -\frac{\left(\left(\frac{\beta 1}{K1} \right)^{\left(-\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(t)} \right)^{\left(-\frac{\sigma - 1}{\sigma}\right)} + st \right) \left(\alpha 1^{\left(\frac{1}{\sigma}\right)} \sigma\, \mathrm{L1}(t) - \alpha 1\, st \left(\frac{\mathrm{L1}(t)\, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{L1} \right. \right.}{\left(\frac{\partial}{\partial t} \mathrm{L1}(t) \right) st \left(st \left(\frac{\mathrm{L1}(t)\, \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1 - t\, \alpha 1^{\left(\frac{1}{\sigma}\right)} \right)}$$

$$= 1$$

5. $0 < \frac{\partial}{\partial t} K1$

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6. $\frac{\partial}{\partial t} G < 0$ because $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$

7.

$$\frac{\partial}{\partial t} \mathrm{g}(t) = \left(\frac{\mathrm{K1}(t) \left(1 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma-1}\right)}$$

$$\left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right) \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \Big/ \left((\sigma-1)\,\sigma\,\mathrm{K1}(t) \left(1 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} st \right) \alpha 1 \right)$$

Now look at the effect economic characteristics on G!

8.

$$\frac{\partial}{\partial L1} G = -(\sigma-1) \left(st^2\, \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1\,\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 (\sigma-1) \right.$$

$$\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) t \right) \left(\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + \left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\right.$$

$$st^2 \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) (\sigma-1) \left(\left(\frac{L1\,\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2$$

$$+ 3\,\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} st\,\sigma \left(\frac{1}{3} \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) t + \left(-\frac{2}{3} + \sigma \right) \mathrm{K1}(t) \right) \left(\frac{L1\,\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left. - \sigma\,\mathrm{K1}(t)\,t\,(\sigma-1) \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

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$$+\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\sigma\ \mathrm{K1}(t)+\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)t\right)\Bigg)st \Big/ \left(\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)L1\right.$$

$$\left.\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^{2}\left(st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^{2}\sigma\right)$$

Omitting the positive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial L1}G$, we get dG2 without changing sign.

9.

$$t=\left(-\sigma\ \mathrm{K1}(t)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right.$$

$$\left.+st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-\sigma\ \mathrm{K1}(t)\,(\sigma-1)\right) \Big/ \left(\right.$$

$$\left.\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\right)$$

10.

$$dG2=-\left(st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)\left(\right.$$

$$\left(st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}+\mathrm{K1}(t)\,(\sigma-1)\right)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)$$

$$\left.\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)st\,\sigma$$

dG2<0, consequently $\frac{\partial}{\partial L1}G<0$

To see effect of exogenous change in K1, K1(t) is substituted with K1(K10,t).

11. $\frac{\partial^2}{\partial t\,\partial K10}\mathrm{K1}(K10,t)=0$

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$$\frac{\partial}{\partial K10}G = \left(\left(\left(\frac{\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^{2}\left(\right.\right.$$

$$\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(t\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)+\sigma\,\mathrm{K1}(K10,\,t)\,(\sigma+1)\right)st\left(\frac{L1\,\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left.-t\,\sigma^{2}\,\mathrm{K1}(K10,\,t)\right)(\sigma-1)\,st^{2}\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^{2}+2\left(\frac{\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\right.$$

$$-\frac{1\left(\left(\frac{L1\,\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^{2}\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^{2}st^{2}}{2}+$$

$$\sigma\,\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(t\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)+\mathrm{K1}(K10,\,t)\left(\sigma^{2}+\frac{1\,\sigma}{2}-1\right)\right)st\left(\frac{L1\,\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left.-t\,\sigma\left(\sigma+\frac{1}{2}\right)(\sigma-1)\,\mathrm{K1}(K10,\,t)\right)st\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(\right.$$

$$\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(t\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)+\sigma\,\mathrm{K1}(K10,\,t)\,(\sigma+1)\right)st\left(\frac{L1\,\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left.-t\,\sigma^{2}\,\mathrm{K1}(K10,\,t)\right)\sigma\Bigg)(\sigma-1)\left(\frac{\partial}{\partial K10}\mathrm{K1}(K10,\,t)\right)\Big/\left(\sigma\left(\frac{\partial}{\partial t}\mathrm{K1}(K10,\,t)\right)\right.$$

$$\left(\left(\frac{\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)\mathrm{K1}(K10,\,t)$$

$$\left.\left(-st\left(\frac{L1\,\beta 1}{\mathrm{K1}(K10,\,t)}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}+t\right)^{2}\right)$$

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Omitting the postive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial K10} G$, we get dG2 without changing sign.

12.

$$dG2 = \left(st \left(\frac{L1\ \beta 1}{\mathrm{K1}(K10,\ t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right) \sigma \left(\right.$$

$$st^2 \left(\left(\frac{\beta 1}{\mathrm{K1}(K10,\ t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 \sigma\, \mathrm{K1}(K10,\ t)\, (\sigma - 1)^2 \left(\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2$$

$$+ 2 \left(\frac{\beta 1}{\mathrm{K1}(K10,\ t)} \right)^{\left(\frac{1}{\sigma}\right)} (\sigma - 1)^2\, st\, \mathrm{K1}(K10,\ t) \left(\sigma + \frac{1}{2} \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

$$+ st \left(\frac{L1\ \beta 1}{\mathrm{K1}(K10,\ t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{K1}(K10,\ t) \right) \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma^2\, \mathrm{K1}(K10,\ t)\, (\sigma - 1) \Bigg)$$

$$\left(\frac{\partial}{\partial K10} \mathrm{K1}(K10,\ t) \right)$$

13. dG2>0, consequently $0 < \frac{\partial}{\partial K1} G$.

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14.

$$\frac{\partial}{\partial \alpha 1} G = -(\sigma-1)^2 \left(\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 st^2 (\sigma-1) \right.$$

$$\left(\sigma\, \mathrm{K1}(t) + \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) t \right) \left(\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + 2 \left(\right.$$

$$-\frac{1}{2} \left(\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 st^2$$

$$\left. + \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\, st \left(\sigma\, \mathrm{K1}(t) + \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) t - \mathrm{K1}(t) \right) \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} + \frac{1}{2} \sigma\, \mathrm{K1}(t)\, t \right)$$

$$\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma \left(\sigma\, \mathrm{K1}(t) + \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) t \right) \Bigg) st$$

$$\Bigg/ \left(\alpha 1\, \sigma \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \left(-st \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + t \right) \right)^2$$

$$\left(\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} st\, (\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right)^2 \Bigg)$$

Omitting the postive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \alpha 1} G$, we get dG2 without changing sign.

15.

$$dG2 = \sigma\, (\sigma-1)$$

$$\left(-\left(\frac{\beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\, (\sigma-1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \mathrm{K1}(t) \right) \right)$$

$$\left(-st \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + t \right) st$$

Its sign is identical with sign of dG3

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$dG3 =$

16. $$\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\,(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} - \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)$$

t>0 gives that

17. $$0 < -\sigma\,\mathrm{K1}(t)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) \alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)} - \sigma\,\mathrm{K1}(t)\,(\sigma-1)$$

18. $$\frac{\sigma\,\mathrm{K1}(t)\,(\sigma-1)\left(1+\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)}} < \frac{\partial}{\partial t}\mathrm{K1}(t)$$

Replacing $\frac{\partial}{\partial t}\mathrm{K1}(t)$ with the left hand side of this equation indG3 we get dG3m>dG3.

19. $$dG3m := -\frac{(\sigma-1)\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)\mathrm{K1}(t)}{st}$$

dG3m<0, consequently $\frac{\partial}{\partial \alpha 1} G < 0$.

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20.

$$\frac{\partial}{\partial \beta 1} G = -(\sigma - 1)\left(st^2\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 (\sigma - 1)\right.$$

$$\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t\right)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + 2\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\right.$$

$$-\frac{1}{2} st^2\left(\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2$$

$$+ st\,\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\left(\sigma\,\mathrm{K1}(t) - \mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t\right)\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} + \frac{1}{2}\sigma\,\mathrm{K1}(t)\, t\Bigg)$$

$$\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t\right)\Bigg) st \Big/ \Bigg($$

$$\left(-st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + t\right)^2 \sigma\,\beta 1\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)$$

$$\left.\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\right)$$

Omitting the postive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \beta 1} G$, we get dG2 without changing sign.

21.

$$dG2 = \left(-st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + t\right)$$

$$\left(-\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\right)\sigma$$

$$st$$

Its sign is identical with sign of dG3

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22. $$dG3 = \left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} - \left(\frac{L1\,\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)$$

23.
$$0 < -\sigma\, st\,\mathrm{K1}(t)\left(\frac{\beta 1(x)}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} (\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + st\left(\frac{L1\,\beta 1(x)}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - \sigma\,\mathrm{K1}(t)\,(\sigma-1)$$

t>0, so

24.
$$0 < -\sigma\,\mathrm{K1}(t)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + st\left(\frac{L1\,\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - \sigma\,\mathrm{K1}(t)\,(\sigma-1)$$

25. $$\frac{\sigma\,\mathrm{K1}(t)\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\,\mathrm{K1}(t)\,(\sigma-1)}{st\left(\frac{L1\,\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}} < \frac{\partial}{\partial t}\mathrm{K1}(t)$$

Replacing $\frac{\partial}{\partial t}\mathrm{K1}(t)$ with the left hand side of this equation indG3 we get dG3m>dG3.

26. $$dG3m = -\frac{(\sigma-1)\left(st\left(\frac{\beta 1(x)}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} (\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)\mathrm{K1}(t)}{st}$$

dG3m<0, consequently $\frac{\partial}{\partial \beta 1} G < 0$.

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27.

$$\frac{\partial}{\partial st} G = -(\sigma - 1)\left(\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 st^2 (\sigma - 1)\right.$$

$$\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t\right)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2 + 2\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\left(\right.$$

$$-\frac{1}{2}\left(\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\left(\alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2 st^2$$

$$\left.+ \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} \sigma\, st\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t - \mathrm{K1}(t)\right)\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} + \frac{1}{2}\sigma\,\mathrm{K1}(t)\, t\right)$$

$$\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} \sigma\left(\sigma\,\mathrm{K1}(t) + \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right) t\right)\Bigg) \Bigg/ \Bigg($$

$$\left(\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)^2 \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)$$

$$\left.\left(-st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} + t\right)^2\right)$$

Omitting the postive denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial st} G$, we get dG2 without changing sign.

28.

$$dG2 = \sigma$$

$$\left(-\left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)\right)$$

$$\left(-st\left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} + t\right)$$

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Its sign is identical with sign of dG3

$$29.\ dG3 = \left(\frac{\beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{K1}(t)\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} - \left(\frac{L1\ \beta 1}{\mathrm{K1}(t)}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{K1}(t)\right)$$

dG3<0 as we could see investigating sign of $\frac{\partial}{\partial \alpha 1} G$, consequently $\frac{\partial}{\partial st} G < 0$.

We could see that $\frac{\partial}{\partial t} G < 0$ and $0 < \frac{\partial}{\partial L1} G$, $0 < \frac{\partial}{\partial K1} G$, $\frac{\partial}{\partial \alpha 1} G < 0$, $\frac{\partial}{\partial \beta 1} G < 0$, $\frac{\partial}{\partial st} G < 0$.

Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1} t$, $\frac{\partial}{\partial K1} t < 0$, $0 < \frac{\partial}{\partial \alpha 1} t$, $0 < \frac{\partial}{\partial \beta 1} t$, $0 < \frac{\partial}{\partial st} t$.

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IV.10. Proof of Statement 10.

Statement 10. The optimal size of policies that improve labor technology in sector 1. rises for actors in sector 2 if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or capital productivity of sector 1.becomes better (K1 goes up, $\beta 1$ goes down) .

1. $u = (\mathrm{f}(t) - t)\,\mathrm{g}(t)$

2. $$\mathrm{f}(t) := st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(t)^{\left(\frac{\sigma - 1}{\sigma}\right)}$$

3. $$\mathrm{g}(t) := \frac{\left(\frac{K1\left(1 + \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1(t)}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

4. $$G := \left(st\left(\frac{\partial}{\partial t}\alpha 1(t)\right)(\sigma - 1)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} - \alpha 1(t)^{\left(\frac{1}{\sigma}\right)}\sigma\right)\left(1 + \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)\alpha 1(t) \Big/ \left(\left(st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t) - t\,\alpha 1(t)^{\left(\frac{1}{\sigma}\right)}\right)\left(st\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma - 1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\right) = 1$$

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5. $\frac{\partial}{\partial t}\alpha 1(t) < 0$

$0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} g(t)$

6.

$$\frac{\partial}{\partial t} g = -\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)$$

$$\left(\frac{K1\left(1 + \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)}{\beta 1}\right)^{\left(\frac{1}{\sigma - 1}\right)} \left(\frac{\partial}{\partial t}\alpha 1(t)\right) \Big/ \left(\sigma\,\alpha 1(t)^2\right.$$

$$\left.\left(1 + \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)\right)$$

Now look at the effect economic characteristics on G!

7.

$$\frac{\partial}{\partial L1} G = st\left(\left((-\sigma\, t + t)\left(\frac{\partial}{\partial t}\alpha 1(t)\right) + \sigma\,\alpha 1(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(t)^{\left(\frac{\sigma - 1}{\sigma}\right)}\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2\right.$$

$$st^2\,(\sigma - 1)\left(\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2 + 3\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\right.$$

$$-\frac{1}{3}\left(\alpha 1(t)^{\left(\frac{\sigma - 1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\alpha 1(t)\right) st^2\,(\sigma - 1)^2\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2$$

$$+\sigma\left(-\frac{1}{3}\,t\,(\sigma - 1)\left(\frac{\partial}{\partial t}\alpha 1(t)\right) + \alpha 1(t)\left(\sigma - \frac{2}{3}\right)\right)\alpha 1(t)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left.-\frac{1}{3}\,\sigma\,\alpha 1(t)\,t\,(\sigma - 1)\right)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)}$$

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$$+\sigma\left((-\sigma\,t+t)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)+\sigma\,\alpha 1(t)\right)\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\Bigg) \Bigg/ \Bigg(\sigma$$

$$\left(st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^2\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^2$$

$$\left(\frac{\partial}{\partial t}\alpha 1(t)\right)L1\Bigg)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial L1}G$, we get dG2 without changing sign.

8.

$$dG2=-\Bigg(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(-\alpha 1(t)+st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\right)(\sigma-1)$$

$$\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\Bigg)st$$

$$\left(-st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}+t\right)\sigma$$

dG2<0, consequently $\frac{\partial}{\partial L1}G<0$

9.

$$\frac{\partial}{\partial K1}G=-st\Bigg(\left((-\sigma\,t+t)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)+\sigma\,\alpha 1(t)\right)st^2\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

$$\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2+2\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\Bigg($$

$$\frac{1}{2}\left(\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\alpha 1(t)\right)st^2(\sigma-1)\left(\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2$$

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$$+\sigma\,\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\,st\,(\sigma-1)\left(\alpha 1(t)-t\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\right)\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}+\frac{1}{2}\,\sigma\,\alpha 1(t)\,t\Bigg)$$

$$\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left((-\sigma\,t+t)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)+\sigma\,\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\sigma\Bigg)$$

$$\Bigg/\left(K1\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^{2}\right.$$

$$\left.\left(-st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}+t\right)^{2}\sigma\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial K1}G$, we get dG2 without changing sign.

10. $$dG2 := \sigma\,st\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\alpha 1(t)+\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)$$

$$\left(-st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}+t\right)$$

Its sign is identical with sign of dG3.

11. $$dG3 := -\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\alpha 1(t)-\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}$$

t>0, consequently

12. $$\sigma\,\alpha 1(t)+\sigma\,\alpha 1(t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st+st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\alpha 1(t)\right)$$

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13. $$\frac{\partial}{\partial t}\alpha 1(t) < -\frac{\sigma\,\alpha 1(t)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}}$$

Replacing $\frac{\partial}{\partial t}\alpha 1(t)$ with right hand side of this equation we get dG3m<dG3.

14. $$dG3m=\frac{\left(st\left(\frac{\beta 1}{\mathrm{K1}(x)}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)\alpha 1(t)}{st}$$

15. dG3m>0, consequently $0<\frac{\partial}{\partial K1}G$.

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16.

$$\frac{\partial}{\partial \beta 1} G = -\left(\left(t(\sigma-1)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)-\sigma\,\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2(\sigma-1)\,st^2\right.$$

$$\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2-\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\right.$$

$$st^2\left(\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\alpha 1(t)\right)(\sigma-1)\left(\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2$$

$$\left.-2\,st\,\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma(\sigma-1)\left(\left(\frac{\partial}{\partial t}\alpha 1(t)\right)t-\alpha 1(t)\right)\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}+\sigma\,\alpha 1(t)\,t\right)$$

$$\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(t(\sigma-1)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)-\sigma\,\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\sigma\Bigg)st$$

$$\Big/\left(\left(\left(-st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}+t\right)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\right)^2\right.$$

$$\left.\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)\beta 1\,\sigma\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \beta 1} G$, we get dG2 without changing sign.

17.

$$dG2 = \sigma\,st\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\alpha 1(t)+\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)$$

$$\left(st\left(\frac{L1\,\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)$$

It sign is indentical with sign of dG3.

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18. $$dG3 := \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \alpha 1(t) + \left(\frac{\partial}{\partial t}\alpha 1(t)\right) \alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}$$

t>0, consequently

19.

$$\sigma\ \alpha 1(t) + \sigma\ \alpha 1(t) \left(\frac{\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st$$

$$+ st \left(\frac{L1\ \beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\alpha 1(t)\right)$$

20. $$\frac{\partial}{\partial t}\alpha 1(t) < -\frac{\sigma\ \alpha 1(t)\left(1 + \left(\frac{\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} st\right)}{st\left(\frac{L1\ \beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}}$$

Replacing $\frac{\partial}{\partial t}\alpha 1(t)$ with right hand side of this equation we get dG3m>dG3.

21. $$dG3m := -\frac{\alpha 1(t)\left(\left(\frac{\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)}{st}$$

dG3m<0, consequently $\frac{\partial}{\partial \beta 1} G < 0$.

22.

$$\frac{\partial}{\partial st} G = -\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(t\,(\sigma-1)\left(\frac{\partial}{\partial t}\alpha 1(t)\right) - \sigma\ \alpha 1(t)\right)(\sigma-1)\ \alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)} st^2\right.$$

$$\left.\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \left(\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + 2\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right($$

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$$-\frac{1}{2}st^2\left(\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\alpha 1(t)\right)(\sigma-1)\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2$$
$$+\sigma\ st\ \alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\left(\frac{\partial}{\partial t}\alpha 1(t)\right)t-\alpha 1(t)\right)(\sigma-1)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}-\frac{1}{2}\sigma\ \alpha 1(t)\ t\Bigg)$$
$$\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(t(\sigma-1)\left(\frac{\partial}{\partial t}\alpha 1(t)\right)-\sigma\ \alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\Bigg)$$
$$\Bigg/\ \left(\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^2\right.$$
$$\left.\left(st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^2\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial st}G$, we get dG2 without changing sign.

23.

$$dG2=\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\alpha 1(t)+\left(\frac{\partial}{\partial t}\alpha 1(t)\right)\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)\sigma$$
$$\left(st\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)$$

t>0, consequently

24.

$$\sigma\ \alpha 1(t)+\sigma\ \alpha 1(t)\left(\frac{\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st$$
$$+st\left(\frac{L1\ \beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\alpha 1(t)\right)$$

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25. $$\frac{\partial}{\partial t}\alpha 1(t) < -\frac{\sigma\,\alpha 1(t)\left(1+\left(\frac{\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{st\left(\frac{L1\;\beta 1(x)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(t)^{\left(\frac{\sigma-1}{\sigma}\right)}}$$

Replacing $\frac{\partial}{\partial t}\alpha 1(t)$ with right hand side of this equation we get dG3m>dG3.

26. $$dG3m = -\frac{\alpha 1(t)\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\mathrm{st}(x)\,(\sigma-1)\left(\frac{\alpha 1(t)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)}{\mathrm{st}(x)}$$

dG3m<0, consequently $\frac{\partial}{\partial st}G < 0$.

We could see that $0 < \frac{\partial}{\partial t}G$ and $\frac{\partial}{\partial L1}G < 0$, $0 < \frac{\partial}{\partial K1}G$, $\frac{\partial}{\partial \beta 1}G < 0$, $\frac{\partial}{\partial st}G < 0$. Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1}t$, $\frac{\partial}{\partial K1}t < 0$, $0 < \frac{\partial}{\partial \beta 1}t$, $\frac{\partial}{\partial st}t < 0$.

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IV.11. Proof of Statement 11.

Statement 11. The optimal size of policies that improve capital technology in sector 1. rises for actors in sector 2. if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or labor productivity of sector 1.becomes better (K1 goes up, $\alpha 1$ goes down) .

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $$\mathrm{f}(t) := st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$$

3. $$\mathrm{g}(t) := \frac{\left(\frac{K1\left(1 + \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)}{\beta 1(t)}\right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

4. $$G := (\sigma - 1)\left(1 + \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)$$
$$\left(\alpha 1\ st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\beta 1(t)\right) - \alpha 1^{\left(\frac{1}{\sigma}\right)} \sigma\, \beta 1(t)\right) \Big/ \left(\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)\left(st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1 - t\,\alpha 1^{\left(\frac{1}{\sigma}\right)}\right)\left(\frac{\partial}{\partial t}\beta 1(t)\right)\right) = 1$$

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5. $\frac{\partial}{\partial t}\beta 1 < 0$

$0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} g(t)$

6.

$$\frac{\partial}{\partial t} g = -\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\right)\left(\frac{\partial}{\partial t}\beta 1(t)\right)$$

$$\left(\frac{K1\left(1 + \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)}{\beta 1(t)}\right)^{\left(\frac{1}{\sigma - 1}\right)} \Big/ \left(\beta 1(t)\,(\sigma - 1)\,\sigma\right.$$

$$\left.\left(1 + \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st\right)\alpha 1\right)$$

Now look at the effect economic characteristics on G!

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7.

$$\frac{\partial}{\partial L1}G = -(\sigma-1)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} st^2\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2(\sigma-1)\right.$$

$$\left(-\sigma\,\beta 1(t)+\left(\frac{\partial}{\partial t}\beta 1(t)\right)t\right)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2+\left(\right.$$

$$\left(\frac{\partial}{\partial t}\beta 1(t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 st^2(\sigma-1)\left(\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2$$

$$+\left(\left(\frac{\partial}{\partial t}\beta 1(t)\right)t+\beta 1(t)(-3\sigma+2)\right)st\,\sigma\,\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}$$

$$\left.+\sigma\,\beta 1(t)\,t(\sigma-1)\right)\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

$$\left.+\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\sigma\left(-\sigma\,\beta 1(t)+\left(\frac{\partial}{\partial t}\beta 1(t)\right)t\right)\right)st \Big/ \left(L1\right.$$

$$\left(\frac{\partial}{\partial t}\beta 1(t)\right)\left(st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^2$$

$$\left.\left(st\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^2\sigma\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial L1}G$, we get dG2 without changing sign.

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8.

$$dG2 = st\left((\sigma - 1)\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\beta 1(t)\right) \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + \beta 1(t)\,(-\sigma + 1)\right)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\beta 1(t)\right)\right) \sigma \left(st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right)$$

dG2<0, consequently $\frac{\partial}{\partial L1} G < 0$.

9.

$$\frac{\partial}{\partial K1} G = -(\sigma - 1)\left(-\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} st^2 \left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \right)^2 (\sigma - 1) \left(-\sigma\,\beta 1(t) + \left(\frac{\partial}{\partial t}\beta 1(t)\right) t\right) \left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + \left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \right)^2 \left(\frac{\partial}{\partial t}\beta 1(t)\right) \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 st^2 - 2\,st\,\sigma \left(\left(\frac{\partial}{\partial t}\beta 1(t)\right) t + \beta 1(t)\,(-\sigma + 1)\right) \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} + \sigma\,\beta 1(t)\,t \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} - \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \sigma \left(-\sigma\,\beta 1(t) + \left(\frac{\partial}{\partial t}\beta 1(t)\right) t\right) \Big) st \Big/ \left(\left(\frac{\partial}{\partial t}\beta 1(t)\right) \left(st\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} (\sigma - 1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right)^2 \sigma\, K1 \left(st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right)^2 \right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial K1} G$, we get dG2 without changing sign.

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10. $$dG2 = -st \left(\left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \beta 1(t) (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} \left(\frac{L1\ \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \beta 1(t) \right) \right) \left(st \left(\frac{L1\ \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} - t \right) \sigma$$

Its sign is identical with dG3's.

11. $$dG3 = -\left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \beta 1(t) (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} - \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} \left(\frac{L1\ \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \beta 1(t) \right)$$

Solving G=1 we get

12. $$t = \left(st\, \sigma \left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \beta 1(t) (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + st \left(\frac{L1\ \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \beta 1(t) \right) \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma\, \beta 1(t) (\sigma - 1) \right) \Big/ \left(\left(\frac{\partial}{\partial t} \beta 1(t) \right) \left(st \left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} + \sigma \right) \right)$$

t>0, conssequently

13. $$\frac{\partial}{\partial t} \beta 1(t) < - \frac{\sigma\, \beta 1(t) (\sigma - 1) \left(1 + \left(\frac{\beta 1(t)}{\mathrm{K1}(x)} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} st \right)}{st \left(\frac{L1\ \beta 1(t)}{\mathrm{K1}(x)} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}}$$

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Replacing $\frac{\partial}{\partial t}\beta 1(t)$ with right hand side of this equation we get dG3m<dG3.

14. $$dG3m = \frac{\left(\left(\frac{\beta 1(t)}{\mathrm{K1}(x)}\right)^{\left(\frac{1}{\sigma}\right)} st\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma\right)(\sigma-1)\,\beta 1(t)}{st}$$

dG3m>0, consequently $0 < \frac{\partial}{\partial K1} G$.

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15.

$$\frac{\partial}{\partial \alpha 1} G = (\sigma - 1)^2 \, st \left(-\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} st^2 \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 (\sigma - 1) \right.$$

$$\left(-\sigma \, \beta 1(t) + \left(\frac{\partial}{\partial t} \beta 1(t) \right) t \right) \left(\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 + \left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\right.$$

$$\left(\left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \right)^2 \left(\frac{\partial}{\partial t} \beta 1(t) \right) \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^2 st^2$$

$$- 2 \, st \, \sigma \, \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\left(\frac{\partial}{\partial t} \beta 1(t) \right) t + \beta 1(t) \, (-\sigma + 1) \right) \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} + \sigma \, \beta 1(t) \, t \Bigg)$$

$$\left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} - \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \sigma \left(-\sigma \, \beta 1(t) + \left(\frac{\partial}{\partial t} \beta 1(t) \right) t \right) \Bigg) \Big/ \left(\right.$$

$$\left(\frac{\partial}{\partial t} \beta 1(t) \right) \left(st \left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \sigma \right)^2$$

$$\left(st \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right)^2 \sigma \, \alpha 1 \Bigg)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \alpha 1} G$, we get dG2 without changing sign.

16.

$$dG2 = (\sigma - 1)$$

$$\left(\left(\frac{\beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \beta 1(t) \, (\sigma - 1) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\partial}{\partial t} \beta 1(t) \right) \right) st$$

$$\left(st \left(\frac{L1 \, \beta 1(t)}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t \right) \sigma$$

Its sign is identical with dG3's.

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17.

$$dG3 = \beta 1(t)\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\beta 1(t)\right)$$

t>0, consequently

18. $$\frac{\partial}{\partial t}\beta 1(t) < -\frac{\sigma\,\beta 1(t)\,(\sigma-1)\left(1+\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{st\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)}}$$

Replacing $\frac{\partial}{\partial t}\beta 1(t)$ with right hand side of this equation we get dG3m>dG3.

19. $$dG3m = -\frac{\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)(\sigma-1)\,\beta 1(t)}{st}$$

dG3m<0, consequently $\frac{\partial}{\partial \alpha 1}G < 0$.

20.

$$\frac{\partial}{\partial st}G = \left(-\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}st^2\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2(\sigma-1)\left(-\sigma\,\beta 1(t)+\left(\frac{\partial}{\partial t}\beta 1(t)\right)t\right)\left(\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2+\left(\left(\frac{L1\ \beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2\left(\frac{\partial}{\partial t}\beta 1(t)\right)\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 st^2$$

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$$-2\left(\left(\frac{\partial}{\partial t}\beta 1(t)\right)t+\beta 1(t)\,(-\sigma+1)\right)\sigma\, st\,\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}+\sigma\,\beta 1(t)\,t\Bigg)$$

$$\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}-\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\left(-\sigma\,\beta 1(t)+\left(\frac{\partial}{\partial t}\beta 1(t)\right)t\right)\Bigg)$$

$$(\sigma-1)\Bigg/\left(\left(st\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^{2}\left(\frac{\partial}{\partial t}\beta 1(t)\right)\right.$$

$$\left.\left(st\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)^{2}\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial st}G$, we get dG2 without changing sign.

21.

$$dG2=\sigma\left(st\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)$$

$$\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\beta 1(t)\,(\sigma-1)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\beta 1(t)\right)\right)$$

Its sign is identical with dG3's.

22.

$$dG3=\beta 1(t)\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

$$+\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\beta 1(t)\right)$$

t>0, consequently

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23. $$\frac{\partial}{\partial t}\beta 1(t) < -\frac{\sigma\,\beta 1(t)\,(\sigma-1)\left(1+\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}st\right)}{st\left(\frac{L1\;\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1(x)^{\left(\frac{\sigma-1}{\sigma}\right)}}$$

Replacing $\frac{\partial}{\partial t}\beta 1(t)$ with right hand side of this equation we get dG3m>dG3.

24. $$dG3m = -\frac{\left(\left(\frac{\beta 1(t)}{K1}\right)^{\left(\frac{1}{\sigma}\right)}st\,(\sigma-1)\left(\frac{\alpha 1(x)}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}+\sigma\right)(\sigma-1)\,\beta 1(t)}{st}$$

dG3m<0, consequently $\frac{\partial}{\partial st}G < 0$.

We could see that $0 < \frac{\partial}{\partial t}G$ and $\frac{\partial}{\partial L1}G < 0$, $0 < \frac{\partial}{\partial K1}G$, $\frac{\partial}{\partial \alpha 1}G < 0$, $\frac{\partial}{\partial st}G < 0$. Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1}t$, $\frac{\partial}{\partial K1}t < 0$, $\frac{\partial}{\partial \alpha 1}t < 0$, $0 < \frac{\partial}{\partial st}t$.

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IV.12. Proof of Statement 12.

Statement 12. The optimal size of policies that improve capital technology in sector 1. rises for actors in sector 2 if exogenous effects increase labor endowment in sector 1. (L1 goes up) or improve situation of sector 2. (st goes up). Optimal size of this policy decreases when capital level or productivity of sector 1.becomes better (K1 goes up, $\alpha 1$, $\beta 1$ goes down) .

1. $u = (\mathrm{f}(t) - t)\, \mathrm{g}(t)$

2. $\mathrm{f}(t) := \mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma}\right)}$,

$$\mathrm{g}(t) := \frac{\left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma}\right)} \mathrm{st}(t) \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1}\right)}}{\alpha 1}$$

Supplement I.2.2. discusses the Second Order Condition.

The First Order Condition is satisfied if

3. $$G := -\frac{(\sigma - 1) \left(\left(\frac{\beta 1}{K1} \right)^{\left(-\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1} \right)^{\left(-\frac{\sigma - 1}{\sigma}\right)} + \mathrm{st}(t) \right) \left(\alpha 1^{\left(\frac{1}{\sigma}\right)} - \alpha 1 \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \right)}{\left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \left(-\mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma}\right)} \alpha 1 + t\, \alpha 1^{\left(\frac{1}{\sigma}\right)} \right)} = 1$$

4. $0 < \frac{\partial}{\partial t} st$

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5. $0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} \mathrm{g}(t)$

6. $$\frac{\partial}{\partial t} g = \frac{\left(\frac{K1 \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \mathrm{st}(t) \right)}{\beta 1} \right)^{\left(\frac{1}{\sigma - 1} \right)} \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right)}{(\sigma - 1) \left(1 + \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \mathrm{st}(t) \right) \alpha 1}$$

Now look at the effect economic characteristics on G!

7. $$\frac{\partial}{\partial L1} G = -(\sigma - 1) \left(-\left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \mathrm{st}(t) \left(-\mathrm{st}(t) + \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) t \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} + \left(\alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \right)^2 \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \mathrm{st}(t) (\sigma - 1) \left(\left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \right)^2 - \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \sigma\, t + \mathrm{st}(t) (-2 + \sigma) \right) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} + (\sigma - 1)\, t \Bigg) \Bigg/ \left(\left(\mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} - t \right)^2 \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \sigma\, L1 \right) \left($$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial L1} G$, we get dG2 without changing sign.

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8.

$$dG2 := -\left(\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)\left(\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t) + (\sigma-1)\left(-\sigma+1+\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\right)\right)$$

Its sign is identical with dG3's.

9.

$$dg3 := \left(-\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t) - (\sigma-1)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\right)\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right) - (\sigma-1)(-\sigma+1)$$

The value of t that solves G=1

10.

$$t = \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{st}(t)\left(-\sigma+1+\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} \sigma\right)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + (\sigma-1)\left(-1+\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)\right) \Big/ \left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\right)$$

t>0, consequently

11.

$$\frac{(\sigma-1)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t)\right)}{\left(\frac{\mathrm{L1}(x)\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t) + \sigma - 1\right)} < \frac{\partial}{\partial t}\mathrm{st}(t)$$

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Replacing $\frac{\partial}{\partial t}\mathrm{st}(t)$ with right hand side of this equation we get dG3m>dG3.

12.

$$dG3m = -(\sigma - 1)\left(\sigma\left(\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \mathrm{st}(t)^2\left(\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 + \sigma + \sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t) - 1 \right) \Big/ \left(\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{\mathrm{L1}(x)}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \mathrm{st}(t) + \sigma - 1\right)$$

dG3m<0, consequnelty $\frac{\partial}{\partial L1} G < 0$.

13.

$$\frac{\partial}{\partial K1} G = -(\sigma - 1)\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \mathrm{st}(t)\left(-\mathrm{st}(t) + \left(\frac{\partial}{\partial t}\mathrm{st}(t)\right) t\right)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2 \left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2 \mathrm{st}(t) - 2\,\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} + t \right) \Big/ \left(\left(\left(\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)^2 \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} \left(\frac{\partial}{\partial t}\mathrm{st}(t)\right) \sigma\ K1 \right) \right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial K1} G$, we get dG2 without changing sign.

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14.

$$dG2 = \left(\left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \sigma \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \mathrm{st}(t) + \sigma - 1 \right)$$
$$\left(\mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} - t \right)$$

dG2>0, consequently $0 < \frac{\partial}{\partial K1} G$.

15.

$$\frac{\partial}{\partial \alpha 1} G = (\sigma - 1)^2 \left(\right.$$
$$\left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \mathrm{st}(t) \left(-\mathrm{st}(t) + \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) t \right) \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)}$$
$$+ \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \left(\left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \right)^2 \left(\alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \right)^2 \mathrm{st}(t) - 2\ \mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} + t \Bigg)$$
$$\Big/ \left(\left(\left(\mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} - t \right)^2 \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \sigma\ \alpha 1 \right.$$
$$\left. \right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \alpha 1} G$, we get dG2 without changing sign.

16.

$$dG2 = -(\sigma - 1)$$
$$\left(\left(\frac{\partial}{\partial t} \mathrm{st}(t) \right) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} \sigma \left(\frac{\beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \left(\frac{\alpha 1}{L1} \right)^{\left(\frac{\sigma - 1}{\sigma} \right)} \mathrm{st}(t) + \sigma - 1 \right)$$
$$\left(\mathrm{st}(t) \left(\frac{L1\ \beta 1}{K1} \right)^{\left(\frac{1}{\sigma} \right)} \alpha 1^{\left(\frac{\sigma - 1}{\sigma} \right)} - t \right)$$

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dG2<0, consequently $\frac{\partial}{\partial \alpha 1} G < 0$.

17.

$$\frac{\partial}{\partial \beta 1} G = -(\sigma - 1)\left(\right.$$
$$\mathrm{st}(t)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(-\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)t + \mathrm{st}(t)\right)\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$
$$-\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\right)^2\left(\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)^2\mathrm{st}(t) + 2\,\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\Bigg)$$
$$\Bigg/\ \left(\left(\left(\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\sigma\ \beta 1\right.\right.$$
$$\left.\left.\right)\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial \beta 1} G$, we get dG2 without changing sign.

18.

$$dG2 = -\left(\left(\frac{\partial}{\partial t}\mathrm{st}(t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\mathrm{st}(t) + \sigma - 1\right)$$
$$\left(\mathrm{st}(t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)} - t\right)$$

dG2<0, consequently $\frac{\partial}{\partial \beta 1} G < 0$.

To see effect of exogenous change in st, st(t) is substituted with st(st0,t).

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19.

$$\frac{\partial}{\partial st0}G = \left(\frac{\partial}{\partial st0}\mathrm{st}(st0,t)\right)\left(-1+\left(\frac{\partial}{\partial t}\mathrm{st}(st0,t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\right)$$
$$\left(\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}t\right)(\sigma-1) \Big/ \left(\left(\frac{\partial}{\partial t}\mathrm{st}(st0,t)\right)\right.$$
$$\left.\left(\mathrm{st}(st0,t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)^{2}\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right)$$

Omitting the absolute value of the denominator and substituting value of t that solves G=1 (calculated above) into $\frac{\partial}{\partial st0}G$, we get dG2 without changing sign.

20.

$$dG2 = -\left(\frac{\partial}{\partial st0}\mathrm{st}(st0,t)\right)\left(-\sigma+1+\left(\frac{\partial}{\partial t}\mathrm{st}(st0,t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma\right)$$
$$\left(\mathrm{st}(st0,t)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}-t\right)\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}$$

Its sign is idnetical with dG3's.

21. $$dG3 = \sigma - 1 - \left(\frac{\partial}{\partial t}\mathrm{st}(st0,t)\right)\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\sigma$$

t>0, consequently

22. $$\frac{(\sigma-1)\left(1+\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\mathrm{st}(st0,t)\right)}{\left(\frac{L1\ \beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\alpha 1^{\left(\frac{\sigma-1}{\sigma}\right)}\left(\sigma\left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)}\left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\mathrm{st}(st0,t)+\sigma-1\right)} < \frac{\partial}{\partial t}\mathrm{st}(st0,t)$$

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Replacing $\frac{\partial}{\partial t}\mathrm{st}(st0, t)$ with left hand side of this equation we get dG3m>dG3.

23. $$dG3m = \frac{-\sigma + 1}{\sigma \left(\frac{\beta 1}{K1}\right)^{\left(\frac{1}{\sigma}\right)} \left(\frac{\alpha 1}{L1}\right)^{\left(\frac{\sigma - 1}{\sigma}\right)} \mathrm{st}(st0, t) + \sigma - 1}$$

dG3m<0, consequently $\frac{\partial}{\partial st0} G < 0$.

We could see that $0 < \frac{\partial}{\partial t} G$, $\frac{\partial}{\partial L1} G < 0$, $0 < \frac{\partial}{\partial K1} G$, $\frac{\partial}{\partial \alpha 1} G < 0$, $\frac{\partial}{\partial \beta 1} G < 0$, $\frac{\partial}{\partial st0} G < 0$.

Using implicit function theorem follows that $0 < \frac{\partial}{\partial L1} t$, $\frac{\partial}{\partial K1} t < 0$, $0 < \frac{\partial}{\partial \alpha 1} t$, $0 < \frac{\partial}{\partial \beta 1} t$, $0 < \frac{\partial}{\partial st} t$.

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Appendix III – Proofs of Statements in Chapter I.3.1.

III.1. Proof of Statement 1.

Statement 1. Labor owners utility increases when labor endowment increases or any of the sectors develops. Utility of capital owners increases if labor endowment increases or their sector develops and their utility decreases if the other sector develops.

Proof - First order derivatives of utility functions gives the result.

1. $u_{labor} = \frac{L\,\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\sigma-1}$

2. $\frac{\partial}{\partial L}u_{labor} = \frac{\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\sigma-1},\ 0 < \frac{\partial}{\partial L}u_{labor}$

3. $\frac{\partial}{\partial a}u_{labor} = \frac{L\,\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{(\sigma-1)^2\,(a+b)},\ 0 < \frac{\partial}{\partial a}u_{labor}$

4. $\frac{\partial}{\partial b}u_{labor} = \frac{L\,\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{(\sigma-1)^2\,(a+b)},\ 0 < \frac{\partial}{\partial b}u_{labor}$

The status of the two sectors are symmetric, so it is enough to investigate one of them.

5. $u_{sector1} = \frac{L\,\sigma\,(a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\left(\frac{b}{a}+1\right)(\sigma-1)^2\,n_{capital1}}$

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6. $$\frac{\partial}{\partial L} u_{sector1} = \frac{1 \sigma (a+b)^{\left(\frac{1}{\sigma-1}\right)}}{\left(\frac{b}{a}+1\right)(\sigma-1)^2 n_{capital1}}$$

7. $$\frac{\partial}{\partial a} u_{sector1} = \frac{L \sigma (a+b)^{\left(\frac{1}{\sigma-1}\right)} (b\sigma - b + a)}{(a+b)^2 (\sigma-1)^3 n_{capital1}}$$

8. $$\frac{\partial}{\partial b} u_{sector1} = -\frac{L a \sigma (a+b)^{\left(\frac{1}{\sigma-1}\right)} (\sigma-2)}{(a+b)^2 (\sigma-1)^3 n_{capital1}}$$

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III.2. Proof of Statement 2.

Statement 2. The optimal size of policy to increase labor endowment is independent of economic characteristics for labor owners.

Proof

1. $u = (\mathrm{L}(t) - t)\,(a+b)^{\left(\frac{1}{\sigma - 1}\right)}$

2. $\frac{\partial}{\partial t} u = \left(\left(\frac{\partial}{\partial t}\mathrm{L}(t)\right) - 1\right)(a+b)^{\left(\frac{1}{\sigma - 1}\right)}$

3. $\frac{\partial^2}{\partial t^2} u = \left(\frac{\partial^2}{\partial t^2}\mathrm{L}(t)\right)(a+b)^{\left(\frac{1}{\sigma - 1}\right)}$

It is smaller than zero because $\frac{\partial^2}{\partial t^2} L < 0$.

4. $\frac{\partial}{\partial t} u$ has maximum value if G=1

5. $G := \frac{\partial}{\partial t}\mathrm{L}(t)$

Look at comparative statics!

6. $\frac{\partial}{\partial t} G = \frac{\partial^2}{\partial t^2}\mathrm{L}(t)$, $\frac{\partial}{\partial t} G < 0$

7. $\frac{\partial}{\partial L} G = 0$, $\frac{\partial}{\partial a} G = 0$, $\frac{\partial}{\partial b} G = 0$

Results show that $\frac{\partial}{\partial L} t = 0$, $\frac{\partial}{\partial a} t = 0$, $\frac{\partial}{\partial b} t = 0$.

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III.3. Proof of Statement 3.

Statement 3. The optimal size of policies to develop economic sectors rises for labor owners if labor endowment increases (L goes up). Labor owners do not modify the optimal size of these policies when sectoral characteristics change.

Proof - It is satisfactory to prove it for sector 1. because there is no qualitative difference between the two sectors.

1. $u(t) := (L - t)\,(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}$

2. $0 < \frac{\partial}{\partial t} a(t)$

3. $$\frac{\partial^2}{\partial t^2} u(t) = -2\,(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)} \left(\frac{1\,(-L + t)\,(\sigma - 1)\,(a(t) + b)\left(\frac{\partial^2}{\partial t^2} a(t)\right)}{2} + \left(-\frac{1\,(-L + t)\,(\sigma - 2)\left(\frac{\partial}{\partial t} a(t)\right)}{2} + (\sigma - 1)\,(a(t) + b) \right)\left(\frac{\partial}{\partial t} a(t)\right) \right) \Big/ ((\sigma - 1)^2 (a(t) + b)^2)$$

$\frac{\partial^2}{\partial t^2} u(t) < 0$ because $\frac{\partial^2}{\partial t^2} a(t) < 0$ and $2 < \sigma$.

$\frac{\partial}{\partial t} u$ has maximum value if G=1

4. $G = \frac{1\,(\sigma - 1)\,(a(t) + b)}{(L - t)\left(\frac{\partial}{\partial t} a(t)\right)}$

Look at comparative statics!

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5. $$\frac{\partial}{\partial t}\mathrm{G}(t) = -\frac{\left((\mathrm{a}(t)+b)\,(L-t)\left(\frac{\partial^2}{\partial t^2}\mathrm{a}(t)\right)-\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)\left((L-t)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)+\mathrm{a}(t)+b\right)\right)(\sigma-1)}{(L-t)^2\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)^2}$$

6. $$0 < \frac{\partial}{\partial t}\mathrm{G}(t)$$

7. $$\frac{\partial}{\partial L}G = -\frac{1\,(\sigma-1)\,(\mathrm{a}(t)+b)}{(-L+t)^2\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)},\ \frac{\partial}{\partial L}G < 0$$

To see the effect of change in a a(t) is replaced with a(a0,t)

8. $$\frac{\partial^2}{\partial t\,\partial a0}\mathrm{a}(a0,t) = 0$$

9. $$\frac{\partial}{\partial a0}G = \frac{1\,(\sigma-1)\left(\frac{\partial}{\partial a0}\mathrm{a}(a0,t)\right)}{(L-t)\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)},\ 0 < \frac{\partial}{\partial a}G$$

10. $$\frac{\partial}{\partial b}G = \frac{\sigma-1}{(L-t)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)},\ 0 < \frac{\partial}{\partial b}G$$

$0 < \frac{\partial}{\partial t}\mathrm{G}(t)$, $\frac{\partial}{\partial L}G < 0$, $0 < \frac{\partial}{\partial a}G$, $0 < \frac{\partial}{\partial b}G$ consequently $0 < \frac{\partial}{\partial L}t$, $\frac{\partial}{\partial a}t < 0$, $0 < \frac{\partial}{\partial b}t$.

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III.4. Proof of Statement 4.

Statement 4. The size of optimal policy to increases labor endowment decreases for actors of sector 1. if exogenous shock improves the situation in any of the economic sectors (a or b goes up). The optimal size of this policy is not modified if labor endowment changes.

Proof

1. $u = \left(\frac{\mathrm{L}(t)}{\frac{b}{a} + 1} - t \right) (a + b)^{\left(\frac{1}{\sigma - 1} \right)}$

2. $0 < \frac{\partial}{\partial t} \mathrm{L}(t)$

3. $\frac{\partial^2}{\partial t^2} u = \frac{\left(\frac{\partial^2}{\partial t^2} \mathrm{L}(t) \right) a \, (a + b)^{\left(\frac{1}{\sigma - 1} \right)}}{a + b}$

$\frac{\partial^2}{\partial t^2} u < 0$ because $\frac{\partial^2}{\partial t^2} \mathrm{L}(t) < 0$.

$\frac{\partial}{\partial t} u$ has maximum value if G=1

4. $G := \frac{\frac{\partial}{\partial t} \mathrm{L}(t)}{\frac{b}{a} + 1}$

Look at comparative statics!

5. $\frac{\partial}{\partial t} G = \frac{\frac{\partial^2}{\partial t^2} \mathrm{L}(t)}{\frac{b}{a} + 1}$, $\frac{\partial}{\partial t} G < 0$

To see the effect of change in L, L(t) is replaced with L(L0,t)

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6. $\frac{\partial}{\partial L0} G = \frac{\frac{\partial^2}{\partial t \, \partial L0} \mathrm{L}(L0, t)}{\frac{b}{a} + 1}$, $\frac{\partial^2}{\partial t \, \partial L0} \mathrm{L}(L0, t) = 0$, $\frac{\partial}{\partial L0} G = 0$.

7. $\frac{\partial}{\partial a} G = \frac{\left(\frac{\partial}{\partial t} \mathrm{L}(t)\right) b}{\left(\frac{b}{a} + 1\right)^2 a^2}$, $0 < \frac{\partial}{\partial a} G$

8. $\frac{\partial}{\partial b} G = -\frac{\frac{\partial}{\partial t} \mathrm{L}(t)}{\left(\frac{b}{a} + 1\right)^2 a}$, $\frac{\partial}{\partial b} G < 0$

Results show that $\frac{\partial}{\partial t} G < 0$, $\frac{\partial}{\partial L0} G = 0$, $0 < \frac{\partial}{\partial a} G$, $\frac{\partial}{\partial b} G < 0$. Consequently, $0 = \frac{\partial}{\partial L} t$, $\frac{\partial}{\partial a} t < 0$, $0 < \frac{\partial}{\partial b} t$.

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III.5. Proof of Statement 5.

Statement 5. The size of optimal policy to develop sector1. increases for actors of this sector if exogenous shocks increase labor endowment (L goes up) and size of optimal policy decreases if actors experience development of their own sector (a goes up). The development of the other sector (b goes up) motivates to propose policy expansion if actors' sector is sufiiciently developed ($\frac{(\sigma-1)\,b}{\sigma-3} < \mathrm{a}(t)$) and policy contraction is demanded if the other sector is sufficiently developed ($\mathrm{a}(t) < \frac{(\sigma-1)\,b}{\sigma-2}$).

Proof

1. $u := \left(\frac{L}{\frac{b}{\mathrm{a}(t)}+1} - t \right) (\mathrm{a}(t)+b)^{\left(\frac{1}{\sigma-1}\right)}$

2. $0 < \frac{\partial}{\partial t}\mathrm{a}(t)$

3. $0 < \frac{L}{\frac{b}{\mathrm{a}(t)}+1} - t\,,\ 0 < (L-t)\,\mathrm{a}(t) - t\,b$

4. $\frac{\partial^2}{\partial t^2} u = (\mathrm{a}(t)+b)^{\left(\frac{1}{\sigma-1}\right)} \left((\mathrm{a}(t)+b)\,(\sigma-1)\,((L-t)\,\mathrm{a}(t) + (L\,\sigma - L - t)\,b) \left(\frac{\partial^2}{\partial t^2}\mathrm{a}(t) \right) \right.$
$\left. - 2 \left(\left(\left(-\frac{1\,t}{2} + \frac{1\,L}{2} \right) \mathrm{a}(t) + \left(L\,\sigma - \frac{1\,t}{2} - L \right) b \right) (-2+\sigma) \left(\frac{\partial}{\partial t}\mathrm{a}(t) \right) + (\mathrm{a}(t)+b)^2\,(\sigma-1) \right) \left(\frac{\partial}{\partial t}\mathrm{a}(t) \right) \right) \Big/ ((\mathrm{a}(t)+b)^3\,(\sigma-1)^2)$

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$\frac{\partial^2}{\partial t^2} u < 0$ because $\frac{\partial^2}{\partial t^2} \mathrm{L}(t) < 0$ and $2 < \sigma$.

$\frac{\partial}{\partial t} u$ has maximum value if G=1

5. $$G = \frac{\left(-L\, b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) + (\mathrm{a}(t) + b)^2\right)(\sigma - 1)}{((L - t)\,\mathrm{a}(t) + t\, b)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)}$$

G>0 , thus $L\, b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) < (\mathrm{a}(t) + b)^2$

$0 < \frac{\partial}{\partial t}\mathrm{G}(t)$ because $0 < \frac{\partial}{\partial t}\mathrm{g}(t)$ (see Supplement I.2.2. of the previous chapter).

6. $$\frac{\partial}{\partial t}\mathrm{g}(t) = \frac{(\mathrm{a}(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)}{(\sigma - 1)\,(\mathrm{a}(t) + b)}$$

7. $$\frac{\partial}{\partial L} G = \frac{(\sigma - 1)\,(\mathrm{a}(t) + b)\left(b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) t - \mathrm{a}(t)\,(\mathrm{a}(t) + b)\right)}{((-L + t)\,\mathrm{a}(t) + t\, b)^2\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)}$$

Substituting value of t that gives solution for G=1

8. $$t = \frac{(\mathrm{a}(t) + b\,(\sigma - 1))\, L\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) - (\mathrm{a}(t) + b)^2\,(\sigma - 1)}{\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)(\mathrm{a}(t) + b)}$$

into

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9. $b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)t-\mathrm{a}(t)\,(\mathrm{a}(t)+b)$

We get dG2.

10. $dG2=\frac{\left(L\,b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)-(\mathrm{a}(t)+b)^2\right)(\mathrm{a}(t)+b\,(\sigma-1))}{\mathrm{a}(t)+b}$

dG2<0 because $L\,b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)<(\mathrm{a}(t)+b)^2$. Consequnelty, $\frac{\partial}{\partial L}G<0$.

11. $\frac{\partial}{\partial a0}G=-\left(L\,b\,(-L+t)\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)+((-L+t)\,\mathrm{a}(a0,t)+b\,(t+L))\,(\mathrm{a}(a0,t)+b)\right)\left(\frac{\partial}{\partial a0}\mathrm{a}(a0,t)\right)(\sigma-1)\;\Big/\;\left(\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)((-L+t)\,\mathrm{a}(a0,t)+t\,b)^2\right)$

Substituting t (calculated above) into the numerator of $\frac{\partial}{\partial a0}G$ we get dG2.

12. $dG2=(\sigma-1)\left(L\,b\,(-2+\sigma)\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)+(\mathrm{a}(a0,t)+b)^2\,(\sigma-1)\right)\left(\frac{\partial}{\partial a0}\mathrm{a}(a0,t)\right)\left(-L\,b\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)+(\mathrm{a}(a0,t)+b)^2\right)\;\Big/\;\left(\left(\frac{\partial}{\partial t}\mathrm{a}(a0,t)\right)(\mathrm{a}(a0,t)+b)\right)$

dG2>0 bacause $L\,b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)<(\mathrm{a}(t)+b)^2$, consequently $0<\frac{\partial}{\partial a}G$.

13. $\frac{\partial}{\partial b}G=\frac{\left(\mathrm{a}(t)\,L\,(-L+t)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)-((-2\,L+t)\,\mathrm{a}(t)+t\,b)\,(\mathrm{a}(t)+b)\right)(\sigma-1)}{\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)((-L+t)\,\mathrm{a}(t)+t\,b)^2}$

Substituting t (calculated above) into the numerator of $\frac{\partial}{\partial a0}G$ we get dG2.

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14. $$dG2 = \frac{\left(L\, b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) - (\mathrm{a}(t)+b)^2\right)\left(L\,\mathrm{a}(t)\,(-2+\sigma)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) - (\mathrm{a}(t)+b)^2\,(\sigma-1)\right)}{\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)(\mathrm{a}(t)+b)}$$

$L\, b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) < (\mathrm{a}(t)+b)^2$, so sign of dG3 is identical with sign of dG2.

15. $$dG3 = -L\,\mathrm{a}(t)\,(\sigma-2)\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) + (\mathrm{a}(t)+b)^2\,(\sigma-1)$$

t>0, conseqiently

16. $$t = \frac{(\mathrm{a}(t)+b\,(\sigma-1))\,L\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) - (\mathrm{a}(t)+b)^2\,(\sigma-1)}{\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right)(\mathrm{a}(t)+b)}$$

17. $$\frac{(\mathrm{a}(t)+b)^2\,(\sigma-1)}{L\,(\mathrm{a}(t)+b\,\sigma-b)} < \frac{\partial}{\partial t}\mathrm{a}(t)$$

Substituting left hand side of this inequality to replace $\frac{\partial}{\partial t}\mathrm{a}(t)$ in dG3 we get dG3m>dG3.

18. $$dG3m = -\frac{(\sigma-1)\,(\mathrm{a}(t)+b)^2\,((\sigma-3)\,\mathrm{a}(t)+b\,(-\sigma+1))}{\mathrm{a}(t)+(\sigma-1)\,b}$$

19. dG3m<0 if $\frac{(\sigma-1)\,b}{\sigma-3} < \mathrm{a}(t)$.

Consequently $\frac{\partial}{\partial b}G < 0$ if $\frac{(\sigma-1)\,b}{\sigma-3} < \mathrm{a}(t)$.

As we could see As we could see $L\, b\left(\frac{\partial}{\partial t}\mathrm{a}(t)\right) < (\mathrm{a}(t)+b)^2$ because G>0. Consequently

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20. $\frac{\partial}{\partial t}\,\mathrm{a}(t) < \frac{(\mathrm{a}(t)+b)^2}{L\,b}$

Substituting right hand side of this inequality to replace $\frac{\partial}{\partial t}\,\mathrm{a}(t)$ in dG3 we get dG3m2<dG3.

21. $dG3m2 = -\frac{(\mathrm{a}(t)+b)^2\,(\mathrm{a}(t)\,\sigma - 2\,\mathrm{a}(t) - b\,\sigma + b)}{b}$

22. $0 < dG3m2$ if $\mathrm{a}(t) < \frac{(\sigma-1)\,b}{\sigma-2}$.

Consequently $0 < \frac{\partial}{\partial b}\,G$ if $\mathrm{a}(t) < \frac{(\sigma-1)\,b}{\sigma-2}$.

Analysis shows that $0 < \frac{\partial}{\partial t}\,\mathrm{g}(t)$, $\frac{\partial}{\partial L}\,G < 0$, $0 < \frac{\partial}{\partial a}\,G$, $\frac{\partial}{\partial b}\,G < 0$ if $\frac{(\sigma-1)\,b}{\sigma-3} < \mathrm{a}(t)$ and $0 < \frac{\partial}{\partial b}\,G$ if $\mathrm{a}(t) < \frac{(\sigma-1)\,b}{\sigma-2}$. Consequently, $0 < \frac{\partial}{\partial L}\,t$, $\frac{\partial}{\partial a}\,t < 0$ and

23. $0 < \frac{\partial}{\partial b}\,t$ if $\frac{(\sigma-1)\,b}{\sigma-3} < \mathrm{a}(t)$, $\frac{\partial}{\partial b}\,t < 0$ if $\mathrm{a}(t) < \frac{(\sigma-1)\,b}{\sigma-2}$.

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III.6. Proof of Statement 6.

Statement 6. The size of optimal policy to develop sector 2. increases for actors in sector 1. if exogenous shocks increase labor endowment and the optimal size of this policy decreases if sector 2. becomes more developed. Development of sector 1. motivates actors to propose policy contraction if a>b and to promote policy expansion if $a < \frac{\mathrm{b}(t)\,(\sigma - 2)}{\sigma - 1}$.

Proof

1. $$u := \left(\frac{L}{\frac{\mathrm{b}(t)}{a} + 1} - t \right) (a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}$$

2. $$\frac{\partial}{\partial t} u = - \frac{\left((t\,\mathrm{b}(t) + a\,(L\,\sigma - 2\,L + t)) \left(\frac{\partial}{\partial t} \mathrm{b}(t) \right) + (a + \mathrm{b}(t))^2\,(\sigma - 1) \right) (a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}}{(a + \mathrm{b}(t))^2\,(\sigma - 1)}$$

3. $$\frac{\partial}{\partial t} b < 0$$

4. $$\frac{\partial}{\partial t} \mathrm{b}(t) < - \frac{(a + \mathrm{b}(t))^2\,(\sigma - 1)}{t\,\mathrm{b}(t) + a\,(\sigma\,L - 2\,L + t)}$$

5. $$\frac{\partial^2}{\partial t^2} u = - \left((a + \mathrm{b}(t))\,(\sigma - 1)\,(t\,\mathrm{b}(t) + a\,(\sigma\,L - 2\,L + t)) \left(\frac{\partial^2}{\partial t^2} \mathrm{b}(t) \right) - \left(\frac{\partial}{\partial t} \mathrm{b}(t) \right) \right.$$
$$\left. \left((\sigma - 2)\,(t\,\mathrm{b}(t) + a\,(2\,\sigma\,L - 3\,L + t)) \left(\frac{\partial}{\partial t} \mathrm{b}(t) \right) - 2\,(a + \mathrm{b}(t))^2\,(\sigma - 1) \right) \right)$$
$$(a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)} \Big/ ((a + \mathrm{b}(t))^3\,(\sigma - 1)^2)$$

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$\frac{\partial^2}{\partial t^2} u < 0$ because $0 < \frac{\partial^2}{\partial t^2} \mathrm{b}(t)$ and $2 < \sigma$.

6. $$G := \frac{\left(L\, a \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) + (a + \mathrm{b}(t))^2\right)(\sigma - 1)}{(-t\, \mathrm{b}(t) + a\,(L - t))\left(\frac{\partial}{\partial t} \mathrm{b}(t)\right)}$$

f(t)>0, consequently $0 < \frac{-t\, \mathrm{b}(t) + a\,(L - t)}{a + \mathrm{b}(t)}$. Thus, $L\, a \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) + (a + \mathrm{b}(t))^2 < 0$

Look at the details of comparative statics!

$\frac{\partial}{\partial t} \mathrm{G}(t) < 0$ because $\frac{\partial}{\partial t} \mathrm{g}(t) < 0$ (see Supplement I.2.2. of the previous chapter).

7. $$\frac{\partial}{\partial t} \mathrm{g}(t) = \frac{(a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)} \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right)}{(\sigma - 1)\,(a + \mathrm{b}(t))}$$

8. $$\frac{\partial}{\partial L} G = -\frac{a\,(\sigma - 1)\,(a + \mathrm{b}(t))\left(a + \mathrm{b}(t) + \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) t\right)}{(t\, \mathrm{b}(t) - a\,(L - t))^2 \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right)}$$

Replacing t that solves G=1 into the absolute value of numerator of $\frac{\partial}{\partial L} G$ we get dG2.

9. $$t = \frac{-L\, a\,(\sigma - 2)\left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) - (a + \mathrm{b}(t))^2\,(\sigma - 1)}{\left(\frac{\partial}{\partial t} \mathrm{b}(t)\right)(a + \mathrm{b}(t))}$$

10. $$dG2 = -(\sigma - 2)\,(\sigma - 1)\, a \left(L\, a \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) + (a + \mathrm{b}(t))^2\right)$$

dG2>0 because $L\, a \left(\frac{\partial}{\partial t} \mathrm{b}(t)\right) + (a + \mathrm{b}(t))^2 < 0$. Consequently, $0 < \frac{\partial}{\partial L} G$.

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11. $$\frac{\partial}{\partial a} G = -\frac{\left(\mathrm{b}(t)\, L \left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) t + ((L+t)\,\mathrm{b}(t) + a\,(t-L))\,(a+\mathrm{b}(t))\right)(\sigma-1)}{(t\,\mathrm{b}(t) + a\,(t-L))^2 \left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}$$

Substituting t (calculated above) into the absolute value of numerator of $\frac{\partial}{\partial a} G$ we get dG2.

12. $$dG2 = -\frac{\left(L\,a\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) + (a+\mathrm{b}(t))^2\right)\left(\mathrm{b}(t)\, L\,(\sigma-2)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) + (a+\mathrm{b}(t))^2\,(\sigma-1)\right)}{\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)(a+\mathrm{b}(t))}$$

Sign of dG2 is identical with the sign of dG3.

13. $$dG3 = -\left(\mathrm{b}(t)\, L\,(\sigma-2)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) + (a+\mathrm{b}(t))^2\,(\sigma-1)\right)$$

t>0, consequently

14. $$-\frac{(\mathrm{a}(x)+\mathrm{b}(t))^2\,(\sigma-1)}{L\,\mathrm{a}(x)\,(\sigma-2)} < \frac{\partial}{\partial t}\mathrm{b}(t)$$

Substituting left hand side of this equation into dG3 we get dG3m>dG3.

15. $$dG3m = \frac{(a+\mathrm{b}(t))^2\,(\sigma-1)\,(\mathrm{b}(t)-a)}{a}$$

dG3m<0 if b<a, consequently $\frac{\partial}{\partial a} G < 0$ if b<a.

16. $L\,a\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) + (a+\mathrm{b}(t))^2 < 0$, consequently $\frac{\partial}{\partial t}\mathrm{b}(t) < -\frac{(\mathrm{a}(x)+\mathrm{b}(t))^2}{L\,\mathrm{a}(x)}$

Substituting right hand side of this equation we get dG3m2<dG3.

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17. $dG3m2 = \frac{(a + \mathrm{b}(t))^2 (\mathrm{b}(t)\,\sigma - 2\,\mathrm{b}(t) - a\,\sigma + a)}{a}$

dG3m2>0 andsoforth $0 < \frac{\partial}{\partial a} G$ if $a < \frac{\mathrm{b}(t)\,(\sigma - 2)}{\sigma - 1}$.

18. $\frac{\partial}{\partial b} G = \frac{\left(\frac{\partial}{\partial b0}\mathrm{b}(b0, t)\right)\left(\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right) a\,L\,t - (a + \mathrm{b}(b0, t))\,((t - 2\,L)\,a + t\,\mathrm{b}(b0, t))\right)(\sigma}{\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right)((-L + t)\,a + t\,\mathrm{b}(b0, t))^2}$

Its sign is identical with sign of dG

19. $dG = \left(-L\,a\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right) + (a + \mathrm{b}(b0, t))^2\right) t - 2\,(a + \mathrm{b}(b0, t))\,L\,a$

Substituting t that solves G=1 into it we get dG2.

20. $dG2 = \left(L\,a\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right) + (a + \mathrm{b}(b0, t))^2\right)$
$\left(L\,a\,(\sigma - 2)\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right) - (a + \mathrm{b}(b0, t))^2\,(\sigma - 1)\right) \Big/ \left(\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right)\right.$
$\left.(a + \mathrm{b}(b0, t))\right)$

dG2<0 because $L\,a\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right) + (a + \mathrm{b}(b0, t))^2$, Consequently $\frac{\partial}{\partial b} G < 0$.

We could see that $\frac{\partial}{\partial t}\mathrm{G}(t) < 0$, $0 < \frac{\partial}{\partial L} G$, $\frac{\partial}{\partial a} G < 0$ if b<a., $0 < \frac{\partial}{\partial a} G$ if $a < \frac{\mathrm{b}(t)\,(\sigma - 2)}{\sigma - 1}$, $\frac{\partial}{\partial b} G < 0$. Consequently $0 < \frac{\partial}{\partial L} t$, $\frac{\partial}{\partial a} t < 0$ if b<a, $0 < \frac{\partial}{\partial a} t$ if $a < \frac{\mathrm{b}(t)\,(\sigma - 2)}{\sigma - 1}$, $\frac{\partial}{\partial b} t < 0$.

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Appendix IV. – Proof of statements in Chapter I.3.2.

IV.1. Proof of Statement 1.

Statement 1. Optimal development policy (either to develop sector 1, sector 2 or both of them) increases for actors in sector 1. if exogenous shocks improve the situation of their sector (a goes up). They contract optimal size of policy if the other sector develops (b goes up.). The optimal size of this policy increases with general economic development (similar rise of a and b) if sector 2. is sufficiently more developed than sector 1. ($a(x, t) < b(x) + 2\,t$).

Proof - Comparaitve statics is used separately for policies developing sector 1., sector 2. or both sectors.

Proof for policy to develop sector 1.

1. $u := (a(t) - t)\,(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}$

2. $\frac{\partial}{\partial t} u = \frac{\left((\sigma\, a(t) + \sigma\, b - b - t)\left(\frac{\partial}{\partial t} a(t)\right) - (\sigma - 1)\,(a(t) + b)\right)(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}}{(\sigma - 1)\,(a(t) + b)}$

3. $0 < (\sigma\, a(t) + \sigma\, b - b - t)\left(\frac{\partial}{\partial t} a(t)\right) - (\sigma - 1)\,(a(t) + b)$

4. $0 < \frac{\partial}{\partial t} a(t)$

Second order condition is satisfied if policy is sufficiently efficient as it is discussed in Supplement I.2.2.

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5. $\frac{\partial}{\partial t} u$ gets its maximum if G=1

6. $$G := \frac{\left(\left(\frac{\partial}{\partial t} \mathrm{a}(t)\right) - 1\right) (\sigma - 1) (\mathrm{a}(t) + b)}{(-\mathrm{a}(t) + t)\left(\frac{\partial}{\partial t} \mathrm{a}(t)\right)}$$

Look at details of comparative statics!

$0 < \frac{\partial}{\partial t} G$ because $0 < \frac{\partial}{\partial t} g$. (following the logic discussed in Supplement I.2.2).

a(t) is replaced with a(a0,t) to see the effect of exogenous change in a.

7. $$\frac{\partial^2}{\partial t \, \partial a0} G = 0$$

8. $$\frac{\partial}{\partial a0} G = \frac{\left(\frac{\partial}{\partial a0} \mathrm{a0}(a0, t)\right)\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{a0}(a0, t)\right)\right) (t + b) (\sigma - 1)}{\left(\frac{\partial}{\partial t} \mathrm{a0}(a0, t)\right) (-\mathrm{a0}(a0, t) + t)^2}$$

9. $$\frac{\frac{\partial}{\partial a0} G}{G} = \frac{\left(\frac{\partial}{\partial a0} \mathrm{a0}(a0, t)\right) (t + b)}{(-\mathrm{a0}(a0, t) + t) (\mathrm{a0}(a0, t) + b)}$$

10. $\frac{\frac{\partial}{\partial a0} G}{G} < 0$, consequently $\frac{\partial}{\partial a0} G < 0$.

11. $$\frac{\partial}{\partial b} G = \frac{\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{a0}(t)\right)\right) (\sigma - 1)}{(-\mathrm{a0}(t) + t)\left(\frac{\partial}{\partial t} \mathrm{a0}(t)\right)}$$

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12. $\frac{\frac{\partial}{\partial b} G}{G} = \frac{1}{\mathrm{a0}(t) + b}$

13. $0 < \frac{\frac{\partial}{\partial b} G}{G}$, consequently $0 < \frac{\partial}{\partial b} G$.

To see effect of general economic progress a(t) is replaced with a(x,t) and b is replaced with b(x). I assume that $\frac{\partial}{\partial x} \mathrm{a}(x, t) = \frac{\partial}{\partial x} \mathrm{b}(x)$, $0 < \frac{\partial}{\partial x} \mathrm{b}(x)$ and $\frac{\partial^2}{\partial x \, \partial t} \mathrm{a}(x, t) = 0$.

14. $\frac{\partial}{\partial x} G =$

$$-\frac{\left((-\mathrm{b}(x) - t)\left(\frac{\partial}{\partial x} \mathrm{a}(x, t)\right) + \left(\frac{\partial}{\partial x} \mathrm{b}(x)\right)(\mathrm{a}(x, t) - t)\right)\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{a}(x, t)\right)\right)(\sigma - 1)}{\left(\frac{\partial}{\partial t} \mathrm{a}(x, t)\right)(\mathrm{a}(x, t) - t)^2}$$

Its sign is identical with sign of dG2.

15. $dG2 = -\mathrm{b}(x) - 2\,t + \mathrm{a}(x, t)$

Consequently $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x, t) < \mathrm{b}(x) + 2\,t$.

Results show that, $0 < \frac{\partial}{\partial t} g$, $\frac{\partial}{\partial a0} G < 0$, $0 < \frac{\partial}{\partial b} G$, $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x, t) < \mathrm{b}(x) + 2\,t$.

Consequently, $0 < \frac{\partial}{\partial a0} t$, $\frac{\partial}{\partial b} t < 0$ and $0 < \frac{\partial}{\partial x} t$ if $\mathrm{a}(x, t) < \mathrm{b}(x) + 2\,t$.

Proof for policy to develop sector 2.

16. $u := (a - t)\,(a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}$

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17. $\frac{\partial}{\partial t} u = 0$ if G=1.

18. $G = -\frac{(\sigma - 1)\,(a + \mathrm{b}(t))}{(-a + t)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}$

19. $0 < \frac{\partial}{\partial t}\mathrm{b}(t)$

It is assumed that policy is sufficiently efficient to satisfy SOC as it is discussed in Supplement I.2.2.

Look at the details of comparative statics!

$0 < \frac{\partial}{\partial t}\mathrm{G}(t)$ because $0 < \frac{\partial}{\partial t}\mathrm{g}(t)$ (following the logic of Supplement I.2.2).

20. $\frac{\partial}{\partial t}\mathrm{g}(t) = \frac{(a + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}{(\sigma - 1)\,(a + \mathrm{b}(t))}$

21. $\frac{\partial}{\partial a} G = -\frac{(\sigma - 1)\,(\mathrm{b}(t) + t)}{(-a + t)^2\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}$, $\frac{\partial}{\partial a} G < 0$

To see the effect of exogenous change in b b(t) is replaced with b(b0,t)

22. $\frac{\partial^2}{\partial t\,\partial b0} G = 0$

23. $\frac{\partial}{\partial b} G = \frac{(\sigma - 1)\left(\frac{\partial}{\partial b0}\mathrm{b}(b0, t)\right)}{(a - t)\left(\frac{\partial}{\partial t}\mathrm{b}(b0, t)\right)}$

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24. $0 < \frac{\partial}{\partial b} G$

To see effect of general economic progress a is replaced with a(x) and b is replaced with b(x,t). I assume that $\frac{\partial}{\partial x} \mathrm{a}(x) = \frac{\partial}{\partial x} \mathrm{b}(x, t)$, $0 < \frac{\partial}{\partial x} \mathrm{b}(x)$ and $\frac{\partial^2}{\partial x \, \partial t} \mathrm{b}(x, t) = 0$.

25. $$\frac{\partial}{\partial x} G = \frac{(\sigma - 1)\left((\mathrm{a}(x) - t)\left(\frac{\partial}{\partial x} \mathrm{b}(x, t)\right) - \left(\frac{\partial}{\partial x} \mathrm{a}(x)\right)(t + \mathrm{b}(x, t))\right)}{\left(\frac{\partial}{\partial t} \mathrm{b}(x, t)\right)(\mathrm{a}(x) - t)^2}$$

Its sign is identical with sign of dG2.

26. $dG2 = \mathrm{a}(x) - 2\, t - \mathrm{b}(x, t)$

Consequently, $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x) < 2\, t + \mathrm{b}(x, t)$.

Results show that $0 < \frac{\partial}{\partial t} \mathrm{G}(t)$, $\frac{\partial}{\partial a} G < 0$, $0 < \frac{\partial}{\partial b0} G$, $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x) < 2\, t + \mathrm{b}(x, t)$.

Consequently, $0 < \frac{\partial}{\partial a} t$, $\frac{\partial}{\partial b0} t < 0$ and $0 < \frac{\partial}{\partial x} t$ if $\mathrm{a}(x, t) < \mathrm{b}(x) + 2\, t$.

Proof for policy to develop both of the sectors

27. $u := (\mathrm{a}(t) - t)\,(\mathrm{a}(t) + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}$

$0 < \frac{\partial}{\partial t} u$, $\frac{\partial}{\partial t} u$ gets its maximum if G=1

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28. $$G := \frac{\left(-1 + \left(\frac{\partial}{\partial t}\,\mathrm{a}(t)\right)\right)(\sigma - 1)\,(\mathrm{a}(t) + \mathrm{b}(t))}{(-\mathrm{a}(t) + t)\left(\left(\frac{\partial}{\partial t}\,\mathrm{a}(t)\right) + \left(\frac{\partial}{\partial t}\,\mathrm{b}(t)\right)\right)}$$

Second order condition is satisfied if policy is sufficiently efficient as it is discussed in Supplement I.2.2.

Look at the details of comparative statics!

$0 < \frac{\partial}{\partial t}\,\mathrm{G}(t)$ because $0 < \frac{\partial}{\partial t}\,\mathrm{g}(t)$ (following the logic of Supplement I.2.2).

29. $$\frac{\partial}{\partial t}\,\mathrm{g}(t) = \frac{(\mathrm{a}(t) + \mathrm{b}(t))^{\left(\frac{1}{\sigma - 1}\right)}\left(\left(\frac{\partial}{\partial t}\,\mathrm{a}(t)\right) + \left(\frac{\partial}{\partial t}\,\mathrm{b}(t)\right)\right)}{(\sigma - 1)\,(\mathrm{a}(t) + \mathrm{b}(t))}$$

a(t) is replaced with a(a0,t) to see the effect of exogenous change in a.

30. $$\frac{\partial^2}{\partial t\,\partial a0}\,G = 0$$

31. $$\frac{\partial}{\partial a0}\,G = \frac{(\sigma - 1)\left(\frac{\partial}{\partial a0}\,\mathrm{a}(a0, t)\right)\left(-1 + \left(\frac{\partial}{\partial t}\,\mathrm{a}(a0, t)\right)\right)(t + \mathrm{b}(t))}{\left(\left(\frac{\partial}{\partial t}\,\mathrm{a}(a0, t)\right) + \left(\frac{\partial}{\partial t}\,\mathrm{b}(t)\right)\right)(-\mathrm{a}(a0, t) + t)^2}$$

32. $$\frac{\frac{\partial}{\partial a0}\,G}{G} = -\frac{\left(\frac{\partial}{\partial a0}\,\mathrm{a}(a0, t)\right)(t + \mathrm{b}(t))}{(\mathrm{a}(a0, t) - t)\,(\mathrm{a}(a0, t) + \mathrm{b}(t))}$$

33. $\frac{\frac{\partial}{\partial a0}\,G}{G} < 0$, consequently $\frac{\partial}{\partial a0}\,G < 0$.

b(t) is replaced with b(b0,t) to see the effect of exogenous change in b.

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34. $\frac{\partial^2}{\partial t\,\partial b0} G = 0$

35. $\frac{\partial}{\partial b0} G = \frac{\left(\frac{\partial}{\partial b0} \mathrm{b}(b0, t)\right)(\sigma - 1)\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{a}(t)\right)\right)}{\left(\left(\frac{\partial}{\partial t} \mathrm{a}(t)\right) + \left(\frac{\partial}{\partial t} \mathrm{b}(b0, t)\right)\right)(-\mathrm{a}(t) + t)}$

36. $\frac{\frac{\partial}{\partial b0} G}{G} = \frac{\frac{\partial}{\partial b0} \mathrm{b}(b0, t)}{\mathrm{a}(t) + \mathrm{b}(b0, t)}$

$0 < \frac{\frac{\partial}{\partial b0} G}{G}$, consequently $0 < \frac{\partial}{\partial b} G$.

To see effect of general economic progress a(t) is replaced with a(x,t) and b is replaced with b(x,t). I assume that $\frac{\partial}{\partial x} \mathrm{a}(x, t) = \frac{\partial}{\partial x} \mathrm{b}(x, t)$, $0 < \frac{\partial}{\partial x} \mathrm{b}(x, t)$ and $\frac{\partial^2}{\partial x\,\partial t} \mathrm{b}(x, t) = 0$, $\frac{\partial^2}{\partial x\,\partial t} \mathrm{a}(x, t) = 0$.

37. $\frac{\partial}{\partial x} G = \frac{\left(-1 + \left(\frac{\partial}{\partial t} \mathrm{a}(x, t)\right)\right)(\sigma - 1)\left((t + \mathrm{b}(x, t))\left(\frac{\partial}{\partial x} \mathrm{a}(x, t)\right) + \left(\frac{\partial}{\partial x} \mathrm{b}(x, t)\right)(-\mathrm{a}(x, t) +\right.}{\left(\left(\frac{\partial}{\partial t} \mathrm{a}(x, t)\right) + \left(\frac{\partial}{\partial t} \mathrm{b}(x, t)\right)\right)(-\mathrm{a}(x, t) + t)^2}$

38. $\frac{\frac{\partial}{\partial x} G}{G} = \frac{(t + \mathrm{b}(x, t))\left(\frac{\partial}{\partial x} \mathrm{a}(x, t)\right) + \left(\frac{\partial}{\partial x} \mathrm{b}(x, t)\right)(-\mathrm{a}(x, t) + t)}{(-\mathrm{a}(x, t) + t)\,(\mathrm{a}(x, t) + \mathrm{b}(x, t))} =$

39. $\frac{\frac{\partial}{\partial x} G}{G} = \frac{\left(\frac{\partial}{\partial x} \mathrm{a}(x, t)\right)(-2\,t - \mathrm{b}(x, t) + \mathrm{a}(x, t))}{(\mathrm{a}(x, t) - t)\,(\mathrm{a}(x, t) + \mathrm{b}(x, t))}$

Consequently,

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40. $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x, t) < 2\,t + \mathrm{b}(x, t)$.

Results show that $0 < \frac{\partial}{\partial t} \mathrm{G}(t)$, $\frac{\partial}{\partial a0} G < 0$, $0 < \frac{\partial}{\partial b0} G$, $\frac{\partial}{\partial x} G < 0$ if $\mathrm{a}(x, t) < 2\,t + \mathrm{b}(x, t)$.

Consequently, $0 < \frac{\partial}{\partial a} t$, $\frac{\partial}{\partial b0} t < 0$ and $0 < \frac{\partial}{\partial x} t$ if $\mathrm{a}(x, t) < \mathrm{b}(x, t) + 2\,t$.

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IV.2. Proof of Statement 2.

Statement 2. Actors in sector 1. decrease their optimal size of policy to develop sector 2. if sector 3. develops (c increases).

Proof - If there are not two but three company groups,.the core of utility function of actors in sector 1. is.

1. $u = (a - t)\,(a + \mathrm{b}(t) + c)^{\left(\frac{1}{\sigma - 1}\right)}$

It is assumed that policy is sufficiently efficient to satisfy SOC as it is discussed in Supplement I.2.2. $\frac{\partial}{\partial t} u = 1$ if G=1.

2. $G := \frac{(\sigma - 1)\,(a + \mathrm{b}(t)) + c}{(a - t)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}$

3. $$\frac{\partial}{\partial t} G = \left((-a + t)\,((\sigma - 1)\,\mathrm{b}(t) + \sigma\, a + c - a)\left(\frac{\partial^2}{\partial t^2}\mathrm{b}(t)\right) - \left((\sigma - 1)\,(-a + t)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right) + (-\sigma + 1)\,\mathrm{b}(t) - \sigma\, a - c + a\right)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)\right) \Big/ \left((-a + t)^2\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)^2 \right)$$

4. $0 < \frac{\partial}{\partial t} G$

5. $\frac{\partial}{\partial c} G = \frac{1}{(a - t)\left(\frac{\partial}{\partial t}\mathrm{b}(t)\right)}$

6. $0 < \frac{\partial}{\partial c} G$

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7. $0 < \frac{\partial}{\partial t} G$ and $0 < \frac{\partial}{\partial c} G$, consequently $\frac{\partial}{\partial c} t < 0$.

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IV.3. Proof of Statement 3.

Statement 3. If elasticity of substitution is higher then two ($2 < \sigma$) any economic actor propose higher spending on public activity to develop his sector than the intervention level proposed by actors from the other sector.

Proof - The utility function of sector a, the first order condition and the level of development of sector a are given in the following equations.

1. $u_{sector1} := (a(t) - t)(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}$

2. $du_b := \dfrac{(a(t_a) + b)^{\left(\frac{1}{\sigma - 1}\right)} \left((\sigma\, a(t_a) + \sigma\, b - b - t_a) \left(\dfrac{\partial}{\partial t_a} a(t_a) \right) - (\sigma - 1)\,(a(t_a) + b) \right)}{(\sigma - 1)\,(a(t_a) + b)}$

3. $t_{sector1} = \left(\sigma - \dfrac{\sigma - 1}{\dfrac{\partial}{\partial t} a(t)} \right) (a(t) + b) - b$

The utility function of sector b, the first order condition and the level of development of sector a are given in the following equations

4. $u_{sector2} = (b - t)\,(a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}$

5. $\dfrac{\partial}{\partial t} u_{sector2} = - \dfrac{\left((-b + t) \left(\dfrac{\partial}{\partial t} a(t) \right) + (\sigma - 1)\,(a(t) + b) \right) (a(t) + b)^{\left(\frac{1}{\sigma - 1}\right)}}{(\sigma - 1)\,(a(t) + b)}$

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6. $$t_{sector2} = b - \frac{(\sigma - 1)\,(a(t) + b)}{\frac{\partial}{\partial t} a(t)}$$

If $t_{sector2} < t_{sector1}$, then $\frac{\partial}{\partial sector1} a(t_{sector1}) < \frac{\partial}{\partial sector2} a(t_{sector2})$ and $a(t_{sector2}) < a(t_{sector1})$

In this case if

7. $$b - \frac{(\sigma - 1)\,(a(t_{sector2}) + b)}{\frac{\partial}{\partial t_{sector2}} a(t_{sector2})} < \left(\sigma - \frac{\sigma - 1}{\frac{\partial}{\partial t_{sector1}} a(t_{sector1})}\right)(a(t_{sector1}) + b) - b$$

then

8. $$2\,b < \left(\sigma - \frac{\sigma - 1}{\frac{\partial}{\partial t_{sector1}} a(t_{sector1})}\right)(a(t_{sector1}) + b) + \frac{(\sigma - 1)\,(a(t_{sector2}) + b)}{\frac{\partial}{\partial t_{sector2}} a(t_{sector2})}$$

This statement is true if

9. $$2\,b < \left(\sigma - \frac{\sigma - 1}{\frac{\partial}{\partial t_{sector2}} a(t_{sector2})}\right)(a(t_{sector1}) + b) + \frac{(\sigma - 1)\,(a(t_{sector1}) + b)}{\frac{\partial}{\partial t_{sector2}} a(t_{sector2})}$$

because $\frac{\partial}{\partial sector1} a(t_{sector1}) < \frac{\partial}{\partial sector2} a(t_{sector2})$ and $a(t_{sector2}) < a(t_{sector1})$

Simplifying it we get

10. $$2\,b < (a(t_b) + b)\,\sigma$$

It is always true if $2 < \sigma$ or a>b.

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