ESTIMATION OF THE SHADOW ECONOMY IN **R**USSIA

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Abstract

This thesis investigates measurement of the shadow economy in Russia. It first reviews the existing body of literature on subject and evaluates the developed approaches. Then it employs the most comprehensive one (mixed MIMIC and currency demand approach) with the latest data. It obtains a point estimate - 22,2% of GDP in 1995 - and then derives the dynamics of the shadow economy. Its trajectory is found to be upward trending, with an estimate of 70% of GDP in 2008. In the end policy implications are given based on the analysis of factors of growth of the shadow economy.

Keywords: shadow economy, estimation, MIMIC, currency demand, Russia

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Introduction

Effective management of a national economy is impossible without knowing its real parameters. Without knowing the scale of economic activity taking place outside of the official economy, governments are likely to be guided by false parameters when making decisions about economic policies. The shadow economy does not exist in isolation from an official economy; it influences most economic processes: formation and redistribution of an income, trade and investment, establishment of a tax system and economic growth in general. This is especially important for developing, transition and post-transition countries. Underground economy can serve as an indicator of some conflicts between citizens and state.

Over the last twenty years many economists have dedicated themselves to researching this field of economic theory (see, for example Adam and Ginsburgh (1985), Weiss (1987), Schneider & Enste (2000) and Lackó (2000)). They came up with several approaches and produced various estimations for different countries, and two main points have to be noted here. First, there is still no agreement on unified approach; they all have their strengths and weaknesses. Discussions and critiques are still going on. Second, the estimates of shadow economies even in the same countries even in the same time periods often do not exhibit convergence, so there is still uncertainty about dimensions of a 'shadow' problem.

Frey and Schneider (2000) describe some of the problems that can arise due to incorrect measurement or simple unawareness of the shadow economy size. First, underestimation of economic growth, due to underestimated growth rate in shadow sector, can falsely lead government to stimulation of an economic growth by expanding monetary aggregates and forcing demand (increased governmental expenditures, softening credit policy) when there is no need in such measures. And it can result in excessive inflation. Second, erroneous estimation of those employed in shadow economy leads to an incorrect appraisal of unemployment. It can result in excessive governmental expenditures in order to create working places, and then lack of available labor. Also social policies will be too excessive. Third, underestimation of GDP not accounting for goods and services in shadow sector leads to invalid determination of a money supply, required by economy. Fourth, tax revenue is lost leading to invalid budget accounting. And finally, social and economic conditions of individuals and households, and whole countries are evaluated in a biased way.

By estimating the size of a shadow economy and developing more precise methods the following goals can be achieved:

- Increased adequacy of GDP and other macro indicators, which are then adjusted in accordance with methodological requirements of SNA.
- Objective information about shadow economy is collected. It can be used then by government for devising efficient measures in effort to reduce shadow sector.
- Statistical authorities get additional possibility for quality balancing of statistical data in SNA framework.

The goal of this research is to review existing approaches and evaluate them, then choose the most appropriate one and employ it with the most recent available data (1995–2008) to produce actual estimates of a shadow economy scale in Russia, and its dynamics. The latest estimates that exist for Russia are for 2000 by Prokhorov (2001) and Masakova (2000). In the end a comparison of produced estimates is made with existing ones, and causal effects of Russian shadow economy are looked into.

In the first chapter a literature review is presented, with discussion of approaches to estimation and other aspects of shadow economy phenomenon. The second chapter describes chosen models, the data employed for estimation, and results of estimations. The thesis concludes with summary and policy implications.

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1. Literature review

There is a vast literature present on this topic, concerning different aspects of the shadow economy, and this review has to be structured. Let me start with a definition of object of interest, because there seems to be no unified, widely accepted definition, as well as agreement on whether shadow economy is good or bad.

In an attempt to measure shadow economy, all researchers face the problem of defining it (Schneider and Enste (2000), Feige and Urban (2008), OECD, ILO, IMF and CIS STAT (2002)). What is a shadow economy? There are three main ways to define it. It can be explained as (1) economic activity, contradictory to present legislation, i.e. aggregate of illegal economic activities, that feed felonies of different degrees (Popov, 1999). This definition is not suitable for the present research as it focuses on activities that are not subject to taxes or have to be accounted for in GNP. Another approach is to understand it as (2) production, exchange and distribution of goods which should be in national product but are not registered by official statistics (and uncontrolled by society) (Frey & Schneider, 2000). This definition is best for economic purposes, as it is quantitative. It also excludes activities that by convention are not part of GNP, for example household activities. And it does not include tax evasion, which is not value adding (but redistributional) activity. But accepting this definition does not rule out relation between tax evasion, tax burden and shadow activities. A third explanation of a shadow economy is (3) all kinds of activities targeted to formation and satisfaction of needs, cultivating vices in human (Popov, 1999).

All these definitions are correct and they serve different purposes; they define shadow economy from different point of view, thus dividing the shadow economy in three large blocks, where the first one is unofficial economy. It comprises legalized economic activities, where production of goods and services is not accounted for by official statistics, or hidden from taxation. The second block is fictitious economics. This includes doctored records, theft, speculative transactions, bribery and various frauds, relating to getting or giving money. And final, third is illegal economy, which means all kinds of economic activities, prohibited by law. This type of economy is not considered by Rosstat (Russian State Statistics Committee), as explained by Masakova (2000).

It is important to mention that the common notation of the size of a shadow economy is how it compares to official GDP, at percent. 'Shadow' and 'underground' terms will be used as synonyms further in this thesis, unless stated otherwise. Although many names are attributed to this phenomenon: "informal, unofficial, irregular, parallel, second, subterranean, hidden, invisible, unrecorded" (Frey & Schneider, 2000, pp. 1-2).

The next question about shadow economy is the reason for its existence. Analyzing existing works by Weiss (1987) and Schneider (2007) it is possible to highlight the following factors, determining scale and dynamics of a shadow economy.

The price that economic agents pay for public goods provided by the state (such as protection of ownership, contract enforcement) is **tax burden**. And if the state fails to provide them, or is asking price that is too high, firms can opt out by moving into the shadow or, as McMillan (2006) suggests, underreport their sales. It is important to note that social security contributions can be considered as a burden levied on households, like taxes which are levied on firms (Schneider & Enste, 2000). There is also a study (Schneider & Neck, 1993) that suggests that complexity of tax system, its schedule can serve as a driving factor for agents to decide to move into the shadow.

Intensive regulations and restrictions might reduce choices available to individuals in the official economy, and they will go for the 'informal' freedom. McMillan also suggests that policies and **regulations** (entry barriers, for example, such as licensing costs for certain types of business) can drive business underground. In the shadow markets can be established for goods, which are usually regulated or prohibited and standardized by government. Another researcher (Epstein, 1994, p. 2162) suggests that excessive regulations can be viewed as "soothing excuses and rationalizations for illegal conduct" by society, that enforcement of the law after some point becomes counterproductive. Also regulations in the **labor market** can drive firms underground. If the government restricts maximum working hours to a certain level, it can drive both employers and employees into the shadow. Employers would want to sustain their sales and revenues level, so they will supply their products which will be produced in 'shadow' after official working hours. Also, employees on their own would get more spare time that they will divide between leisure and additional, informal employment.

On the other hand, if the government fails to prevent **illegal activities** or is unable to establish strong **rule of law**, then trust towards such a government is undermined and firms do not 'play by rules', because then actually new rules are established (illegal ones). In such an environment, where illegal activities are widespread, and thus perceived and accepted easier, it is more likely to witness more underground activities. Also the shadow economy can be seen as a means of contracting without law. In the shadow substituting institutes (for failing government) and norms are created, for example mafia and its protection of ownership. And it gives one important characteristic of shadow economy — it is very persistent, to get rid of shadow economy not only illegal activities have to be prevented, but emerged institutes have to be dismantled.

Profit. Market economy itself can set up conditions for the emergence of shadow activities. Profit serves as a fetish, income is worshipped, and some participants of market relations fall for this temptation, in order to snatch a larger sum. They do not take into account public interests anymore; they are not led by long-term considerations. And such behavior is more likely in such a society where moral norms that condemn violation of law are less developed. While the discussed factor works mostly for employers and firms, there is

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a similar factor that induces individuals to move to informal economy. If **personal income** is low in official economy, due to taxes, regulations or limitations of the individual himself, he might have an incentive to try his luck in shadow activities.

Social welfare transfers can serve as an incentive for people not to work officially, but to enjoy additional income from shadow employment. When receiving social transfers, an individual will have strong incentive not to work in the official economy and to dedicate all his possible time (besides leisure) for working in the shadow. Otherwise, he will have to give up social transfers and untaxed income from shadow for a taxed income from employment in official economy.

Unemployment can drive such resources of production as labor into the shadow economy. If agents cannot find job in the official economy, they will look for it in the unofficial one. In such case shadow economy can offer them relatively higher wage (because no taxes are paid), absence of regulations and certification standards, stability and sustainable income in times of crisis (like nowadays).

Corruption is very typical for countries with high levels of regulations, such as transition ones. Although the direction of the effect of corruption is unclear (Choi & Thum, 2002): does the firm go underground to avoid paying bribes or it goes underground when decides to pay a bribe?

One final factor is the **size of the economy**: the more economic agents there are on the market, the easier it is to get 'lost' or hide something.

Generalizing, it can be concluded that the prevalence of the shadow economy is determined by the state of the economy, living standard and governmental regulations. Also, having seen all possible factors it is easy to agree that "interdisciplinary analysis of the causes of the increase of the shadow economy seems necessary, since economic factors can only partly explain the increase" (Schneider & Enste, 2000, p. 82). Also if considered again, most

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of these causal factors — direct, indirect and social tax burden, government regulations and labor market regulations, criminal climate and weak rule of law, low personal income and corruption — are very characteristic for transition countries and are much interconnected.

Besides that, the Russian shadow economy, carrying legacy of transition is typified by several factors. First, the causes of shadow economy growth in Russia are institutional. In the transition period, when legislature was weak, when economic reforms (liberalization of prices, mass privatization, opening of economy to the world, heavy tax burden) were carried out public officers could make decisions without any control. This led to corruption and induced business to shift to shadow. Another driving force of existence of a shadow economy in Russia might be evacuation of capital, material and energy resources. Ispravnikov (1996) argues it to have reached 150 billion rubles in 1995 (trillion before denomination).

A thick source of the shadow economy in Russia is moonlighting. For example, consider different segments of people surviving for 5–6 years of reforms, having their income (by official statistics) below survival minimum. Rosstat reports (2008) that 33 to 29% of population had income below subsistence level in 1992–2000. Obviously they survived, and non-registered income was involved.

A study of tax evasion in industries in Russia in 1995 (Ivanenko, 2005) suggests that companies in oil and gas extraction industries are most likely to evade taxes. That is because on one hand, they enjoy higher profits than other industries, and being richer they achieve more success in lobbying their interests. On the other hand, it is because companies in mentioned industries face higher tax rates than in any other industry. Another result of the research mentioned above is that the hypothesis of employment and profitability being causes of evading taxes is proved. Thus, **higher profitability** and **enterprise scale** might serve as a driving factor for shadow activities also. Three examples of the functioning of shadow economy in Russia can be found in Yakovlev (2001). In first case, some enterprise registers a partnership with limited liability (or closed corporation) whose founders are managers of the original enterprise. Then procurement of resources and equipment is conducted through this partnership in such a way that the original enterprise is paying to the partnership more than a market price of those goods, while the partnership (managers of original enterprise) accumulates revenue. This is a symmetric scheme; it works the same in the reverse direction: a surplus of products is sold to the partnership at a lower price, and then the partnership sells them to the market at market prices.

Or it can be that some commercial entity rents production capacities from the original enterprise, and produces goods analogous to those produced by the original enterprise. The founders of that commercial entity are employees of a sales department of the original enterprise, and they divert the most profitable orders from the original enterprise to a 'parallel' enterprise.

Not only do market firms act in the shadow. A nonprofit organization or a research institute, getting funds from the state budget, can transfer these funds through some commercial entity from budget account to a deposit in commercial bank. When deposit contract expires and researches are finished, funds are 'cleaned out' — employees (who were working with delayed payments) get their salaries, and the interest earned is transferred to intermediary commercial entity.

It is uncertain whether the shadow economy is a disintegrating factor for society and morale, or just an indicator of a deficit of 'rule of law' and legality, regulating economic reality. The common knowledge about effects of shadow economy is summarized below.

The presence of a shadow economy negatively affects national macroeconomics, and results in more obstructed achievement and maintaining of macroeconomic stability.

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Currency policy gets weaker, as the shadow economy has no connection with bank sector and financial markets. The shadow economy often employs barter and foreign currency as a means of exchange. Besides, official statistics are distorted by invalid indicators of macroeconomic activity. Presence of a shadow economy also distorts resource allocation. Hidden business gets obvious advantage on the labor market, as it is unaffected by labor laws and regulation, and it 'steals' demand from legal business, as it can offer lower prices to customers because it does not have to pay taxes. The shadow economy negatively affects aggregate national production, as resources will be distributed between sectors most affected by 'shadow' (examples are trade and service industry), and not in accordance with economic necessity. All this gives an important characteristic of shadow business — as it cannot get quick access to financial markets and has to hide from official transactions it becomes more short-term oriented, and neglects long-term investment.

As for social aspect of shadow economy, it can undermine the authority of government institutions and leads to societal disintegration. Also the tax base contracts, which results in increased tax burden on legal sector of economy. Competitiveness of legal economy is decreased, and this pushes more and more economic agents to move into the shadow. Resource provision of corruption increases, which induces further corruption expansion. Uncontrollable large financial resources are used to influence government policies, mass-media and election campaigns on different levels. Redistribution of national income towards elite groups takes place, and it is supported by corruption and criminal control over shadow economy. This leads to stratification of society and confrontation in it. Capitals flow abroad. Uncontrollable trade of low-quality (and even dangerous) uncertified products expands.

On the other hand, there are benefits of the shadow economy to consider. First, it supports economic activity, when corruption and profit seeking increase costs of production.

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One research (Choi & Thum, 2002) suggests that corruption induces entrepreneurs to flee to the shadow, and that renders officials unable to enjoy private gains in official economy. Then economic climate and activity in official economy improves, and in that sense the shadow economy is complementary to the official one. Second, the part of the money gained in shadow economy in the end is spent in the official economy, simply because the shadow economy cannot provide itself with all necessary goods and services (as ideal autarky) it has to buy some from official economy. Schneider (2000, p. 9) finds that "over 66% of the earnings in the shadow economy are rather immediately spent in the official sector". Here the shadow economy serves as a 'built-in stabilizer' for a legal economy, feeding it with part of own resources. Third, the shadow economy comprises competition to an official economy, creates new markets, accumulates assets and is a source of entrepreneurial experience, so much needed in transition countries. In this sense the shadow economy can also serve as economic 'grease' for smoothing economic fluctuations in times of crisis, serving as a life vest for official economy. This is very important point nowadays, when economies are in crisis, productive resources do not disappear, they get redistributed to shadow economy, and will return to legal economy after the 'storm'. Fourth there is a social benefit: shadow economy can be an employer for underprovided people. Summarizing, shadow economy might positively affect legal economy growth.

There is no definite resolution to this question, but common sense suggests that the overall effect of shadow economy is more negative than positive. Adam and Ginsburgh (1985) find that positive relationship exists between growth rates of official and shadow economy, although they impose assumption of very low entry costs into shadow economy. Another group of researchers (Nikopour, Shah Habibullah, & Schneider, 2008) finds that in the early stages of its development, the shadow economy affects official economy positively, but this effect reverses with development of informal sector. It is important for further

purposes of present thesis that national product and its dynamics can signal about shadow economy.

There exists a critical threshold (40-50%, although there is no common agreement by author on this), that the shadow economy can exceed, and after that its influence on economic activity becomes so obvious, that contradictions between legal and shadow lifestyles can be seen in all spheres of life activity. In this light the present research will help determine if Russia's shadow economy has reached this critical mass or not.

In the 1980s and 1990s many methodologies have emerged in an attempt to 'measure the invisible'. Three main groups can be derived: direct approaches, indirect or 'discrepancy' approaches and model approach.

Direct approaches include *surveys* and tax auditing. The first method gives a very detailed picture of the shadow economy, but it can be distorted by interviewees' unwillingness to disclose the fact of their illegal activity. Also, this method is very costly. The second method, *tax auditing*, requires a sample of tax payers, who are then threatened of sanctions for non-collaboration and scrutinized deeply. This auditing is conducted by tax collection authorities, and provides very detailed information on shadow activities. This method is best applied to self-employed, as they have best opportunities for hiding and underreporting their income. However, the limitation of this method is that it is only applicable to taxable activities. Both direct approaches lead to point estimates only, and it is their weakness. Estimates produced are biased downwards (as some activities are not 'captured'), and they lack dynamics. But again, detailed information produced by these methods is unique among all groups, as these are micro-level methods. This information is used for constructing input–output tables by Statistical Committees (Mosakova (2000), Suchkova (2000)), for further narrowing macro-, regional- or industry-level estimates from other approaches.

Indirect or discrepancy approaches are based on the fact that the shadow economy brings distortions to various markets, and can be traced by discrepancies in these markets. There are a number of methods dealing with *income-expenditure*, labor market, monetary market (3 methods) and physical inputs. The first method is looking at households (micro-level) or aggregate national accounts (macro-level). If a person is employed in the shadow sector, he can spend more than his officially registered income. The weakness of this method is that it is subject to measurement errors, or it can wrongly attribute higher expenditure to shadow activities, when simple credit took place.

Discrepancies in the *labor market* such as unusually low participation rate (compared to other countries) or decline in official statistics can signal about participation in shadow economy. At the same time that discrepancy can be due to other factors. The weakness of this method is that it doesn't account for people employed in both formal and informal sectors.

The third method was developed by Feige and Urban (2008). It is based on the assumption that certain volume of *transactions* can be attributed to a certain level of national product, and this relation is constant. Then Fisher's money quantity equation is employed together with assumptions about (1) velocity of money and (2) relation between total transactions and total (observed and unobserved) national product. However this method has two weaknesses: a base year without shadow economy has to be assumed and relationship between transactions and national product has to stay constant over time.

A fourth approach is to look at discrepancies in *currency demand*. It has been developed by Tanzi (1983) and then criticized by various authors, and further improved by Giles (1998). It is based on the assumption that shadow transactions are conducted in cash (to avoid leaving traces, history such as for example when wiring money through bank or printing receipt at cash desk — using cash gives anonymity). The strong side of this method is that data is available easily, currency amount is well documented, and the regression is

elegant. Estimates of shadow economy can be derived by comparing currency development when tax burden (as main factor of shadow economy) is held at lowest possible level and when it is held at current (higher) level, although assumption that unofficial transactions are serviced only in cash is weak. Some shadow economy agents employ barter, some go electronic. Also the amount of currency in circulation depends on exogenous factors, unrelated to shadow economy. For example, it is common knowledge that the United States dollar is widely held all around the world, and its demand fluctuates depending on exchange rates, oil prices and so on. There is another weakness: this method doesn't account for the possibility that velocity of cash is different in formal and informal economies. The main point of criticism of this method, when applied to transition countries, is that transition economies exhibit "intensive financial and technical innovation during transition" and currency velocity is bound to be very unstable (Hanousek & Palda, 2006, p. 708). Nevertheless, this is most often applied method (consider Pickhardt & Sarda Pons (2006), Tanzi (1983)). It is important to keep in mind that Russian economy, being highly dollarized (in transition people substituted rubles with US dollars to avoid costs of inflation) might produce biased estimates using currency demand method.

There is also very similar method, which looks at *cash-deposit ratio*. It was developed by Gutmann (1977), and did not employ any statistical procedures. Gutmann simply looked at the ratio between currency and deposits over a span of years.

Summarizing currency methods, one main result has to be noted for further purpose of present thesis — *currency demand, its level and dynamics can signal about presence and scales of the shadow economy.*

The last indirect or discrepancy method is based on physical inputs, *electricity use* in particular. The main contributors in this method are Lackó (2000) and Kaufmann and Kaliberda (1996). It is based on assumption that shadow activities require use of electricity

(which is not always true). One variant is to calculate how much electricity would be necessary to produce total national product, and then attribute excess demand of electricity to shadow economy. Another variant is to compare growth rates of electricity consumption and national production, and if electricity consumption grows faster, then it can signal about shadow activities. Again the strong side of this method is that it is pretty straightforward and data is readily available, but the weakness is in assumption that all shadow activities require electricity and it does not account for technical progress (assuming that people don not change manner in which they use electricity), and it does not allow making cross-country comparisons. Also, Hanousek and Palda (2006, p. 708) criticize this method, when applied to transition economy (they employ Czech example), because it does not account for the fact that "price deregulation and the introduction of long-overdue technologies move electricity demand in ways that are difficult to attribute to underground economy growth". Feige and Urban (2008, p. 3) report that when they tried to replicate and update earlier estimates (Kaufmann & Kaliberda, 1996) they found that electricity consumption method is highly sensitive to initial conditions and sometimes produced "seemingly anomalous negative shares of unrecorded income", even after modifying the method to allow for electricity price changes.

Summarizing, indirectness of all these methods results in imprecise estimates, where even the direction of bias is hard to determine, because many factors get 'into the picture' and some important are left out, and rather strong assumptions are made. Also it is necessary to assume one base year for all discrepancy methods, when there is no shadow economy, or to have a benchmark value already.

The third approach, the **model approach** focuses on the underlying factors of shadow economy and its influence on observable variables. A specific econometric technique (structural equation modeling) for latent variable (shadow economy) is employed (MIMIC —

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Multiple Indicators MultIple Causes), and it relies on data available about causes of latent variable and indicators, that signal about size of latent variable. This is the most comprehensive approach, as it takes behavioral factors into account. It uses the fact that effects of shadow economy can be seen in production, labor and money markets rather simultaneously. The weaknesses of this approach are that it requires a lot of data (which is often unavailable for transition countries) and it exhibits some instability (results vary strongly with changes in specification or data). Dynamic version of this model is called DYMIMIC, and it is characterized by including lagged latent variable in structural equation. Special attention is required when dealing with time series to account for nonstationarity and possible cointegration. Although many researches employ dynamical version of this model, they still reference to it as MIMIC. In the present thesis dynamical version will be referenced in general way as MIMIC. Also, if Lackó's (2000) approach is considered, many similarities can be seen between these two methods; thus MIMIC application to the shadow economy estimation can be seen as an extension and further development of Lackó method. A review of all approaches is assembled into Table 1.

Approach and comments	Method	Strong and weak sides
Direct	Survey	– costly
 only point estimates 	Tax audit	 only taxable activities
 downward biased 		
+ very detailed		
Indirect or Discrepancy	Income-Expenditure	+ various levels
 imprecise due to mixed nature 		 measurement error
of factors	Labor market	 not considers employed in
– need a base year		both sectors
 undetermined bias 	Transactions	 have to assume constant ratio
		of transactions to GNP
	Currency demand	+ elegant, data present
		– only cash
	Cash deposit ratio	– very simple
		 no technical progress
	Physical inputs (Electricity use)	+ easy data
		 strong assumptions
		 no technical progress
Model	(DY)MIMIC	+ comprehensive
– unstable		 requires lots of data

Table 1. Estimation appro	aches and methods	comparison
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It is explicitly noted in many survey papers (see Schneider (2000), Schneider and Enste (2000), and Gërxhani (2004)) that all methods exhibit "disturbing lack of convergence" (Feige & Urban, 2008, p. 1) of estimates, especially when applied to transition economies (Hanousek & Palda, 2006). Besides that there is no one 'best' approach to measuring shadow economy scale, but as the latest work by Pickhardt and Sarda Pons (2006) suggests, some modifications can be done to currency demand method, and then it can be joined with MIMIC approach to produce better estimates. This joint approach will be employed in the present thesis, and described in detail in the next chapter, as well as modification applied to currency demand method.

Also, in 2002, a consortium of national and international statistical agencies (OECD, ILO, IMF, CIS STAT (2002, p. 3)) produced a handbook on measuring 'non-observed economy', to offer a "systematic strategy for achieving exhaustive estimates of gross national product". In general, this handbook promotes micro-level data gathering techniques to account for missing activities to correct macro-level national accounts. It is important to understand that only state statistical committees can afford such costly and detailed methods. This handbook is a result of work done at a workshop held at Sochi with support of Rosstat, and authors acknowledge Rosstat input (Masakova (2000) and Kosarev (2000)) along with Italian National Statistics Institute and Statistics Netherlands. These three national statistics offices reported on techniques they employ to estimate non-observed component within GDP, and it is striking that they were similar. SNA93 is taken as a reference point by all these offices and compilation of national accounts is done by production approach disaggregating from macro- to micro-level. These techniques have been advised as the basis for developing mentioned handbook (Colledge, 2000). All these national offices exclude illegal activities from computations, which is indeed logical, as (1) in the end illegal activities do not have to be reported and taxed and (2) there exist other governmental structures for dealing with illegal activities, because "measuring illegal event is problematic, otherwise if it is measured, it is no longer illegal as it is persecuted" (Kosarev, 2000, p. 3).

Furthermore, in 2006 a declaration was signed about estimates of the unrecorded economy and national accounts by Intersecretariat Working Group on National Accounts, which rejects "macro-model methods because these methods suffer from serious problems that cast doubt on their utility for any purpose in which accuracy is important" (Eurostat, IMF, OECD, UN and World Bank) (2006, p. 1).

Finally, it is interesting to see which estimates of Russian shadow economy exist (but they are mostly for 1990s period). Below, in Figure 1, existing estimates are summarized and their sources are described. Researchers who have contributed to this task are: Schneider and Enste (2000), Schneider (1998), Prokhorov (2001) (only growth path, no estimates), Lackó (2000), Johnson, Kaufmann and Shleifer (1997), Feige and Urban (2008) and Rosstat (Masakova, 2000).



Figure 1. Existing estimates of Russian shadow economy

It can be seen that during the transition period, by all available estimates the shadow economy in Russia was growing. Also all estimates can be divided into two groups — moderate (10–25% in 1990s) and striking (30–45% in late 1990s). Besides that, discrepancy methods produce higher estimates (Kaufmann & Kaliberda (1996), Lackó (2000), Schneider (2007)). It can be explained by the fact that in transition period former socialist Russia has inherited power-consuming, nonoptimal technologies, and thus relatively higher electricity consumption could be falsely attributed to shadow economy. In the next chapter new estimates of the shadow economy in Russia are derived and their dynamics are explored.

2. Estimation

As it was mentioned in the literature review, the joint model approach was chosen in this thesis. Currency demand model will be used to obtain point estimates of shadow economy size. Then this benchmark estimate will be plugged into the MIMIC model to estimate the dynamics of the shadow economy, and to look into causes and effects of shadow economy. First, consider some summary comments on data.

The most recent macro data was mostly provided by Rosstat (<u>http://gks.ru</u>), statistical portal of Russian High School of Economics (<u>http://stat.hse.ru</u>), and the Central Bank of Russia (<u>http://cbr.ru</u>). Special attention was paid to methodology descriptions, to avoid including series which have already been corrected for presence of shadow economy by statistical department of authority.

Rosstat's data has been criticized (Khanin & Suslov, 1999, p. 1433), but at the same time authors acknowledge that Rosstat has switched between different techniques, and this shift was done when government "has given up its former control and when the shadow economy acquired tremendous momentum". Feige and Urban (2008) stress that reliance on data provided by authorities in transition countries is undermined by two factors. The first is switching from Material Product System of accounting to SNA standard. And second is, that existing unobserved economy distorts statistics already before the switch. Rosstat has been criticized (Popov, 1999) for recalculating and updating number, but it can be seen as a signal that methodology is not perfect and is getting improved. But, Rosstat admits (Suchkova, 2000) that numbers have been updated, and publishes reports on its website to explain why was it done and how.

Despite all these remarks and rejection of macro methods by international organizations, researchers have to deal with what is available. After all they started this

crusade for shadow economy size. In the next subsection Currency demand model is estimated, and benchmark level of shadow economy size is obtained.

2.1 Currency demand model and data

To obtain benchmark level of shadow economy, a currency demand model is employed following Pickhardt and Sardá (2006) and Mauleón and Sardá (2000). Their model is constructed in such way that it *does not require existing observation* of shadow economy. Another advantage of this model is that it *does not assume same velocity of cash* circulation in observed and hidden economy.

The currency demand equation in this model is specified in log-linear terms:

$$\log(M0_t) = \alpha_0 + \alpha_1 \cdot \log(GDP_t) + \alpha_2 \cdot \log(CPI_t) + \alpha_3 \cdot TAX_t + \alpha_4 \cdot IRATE_t + u_t$$
(1)

where M0 is currency demand, GDP is observed legal income in terms of national product, CPI is price index, TAX is a measure of fiscal pressure, IRATE is nominal interest rate, α_{0-4} are parameters to be estimated and u is an error term. Subscript t denotes time of observation. When logarithms are reversed in (1), following is obtained:

$$M0_t = GDP_t^{\alpha_1} \cdot CPI_t^{\alpha_2} \cdot \exp(\alpha_0 + \alpha_3 \cdot TAX_t + \alpha_4 \cdot IRATE_t + u_t)$$
(2)

If we assume that tax burden affects currency demand related to shadow economy, then currency demand related to total income, observed GDP and unobserved GDP^H if there are no taxes is:

$$M0_t = (GDP_t + GDP_t^H)^{\alpha_1} \cdot CPI_t^{\alpha_2} \cdot \exp(\alpha_0 + \alpha_4 \cdot IRATE_t + u_t)$$
(3)

Notice, that tax burden in (3) is set to zero. Now equating (2) and (3) yields:

$$GDP_t^{\alpha_1} \cdot \exp(\alpha_0 + \alpha_3 \cdot TAX_t + \alpha_4 \cdot IRATE_t + u_t)$$

$$= (GDP_t + GDP_t^H)_1^{\alpha} \cdot \exp(\alpha_0 + \alpha_4 \cdot IRATE_t + u_t)$$
(4)

Then, rearranging (4) ratio of unobserved to observed income in terms of national product is obtained:

$$\frac{GDP_t^H}{GDP_t} = \exp\left(\alpha_3 \cdot \frac{TAX_t}{\alpha_1}\right) - 1 \approx \alpha_3 \cdot \frac{TAX_t}{\alpha_1}$$
(5)

Two things have to be noted here. First, whenever other variables like IRATE is included on the right-hand side (for example, investment), they cancel each other out in (4). Second, only estimates of α_3 and α_1 are needed and any one observation of TAX to get an estimate of shadow economy in that period.

Table 2 summarizes all variables and data sources used for the estimation. Transformations are carried out on variables according to model specification.

Variable	Description	Source
M0	Currency in circulation nominal, million rubles	CBR
GDP	Real GDP, in million 1995 rubles	Rosstat
СРІ	Consumer Price Index, with 100 being 1995 base year	HSE
ТАХ	Total tax contributions as a fraction of GDP in percent used to account for tax burden/fiscal pressure	Rosstat
IRATE	Interest rate used to account for 'price' of holding cash	CBR
PUTIN	Number of quarters when Putin is in power (starts in 1 st quarter of 2000) used to account for changes in economy (of so-called Putin's Russia)	OWN
TRANS	Dummy, equals 1 before 1999 used to mark transition-years of rapid inflation	OWN
CRIS98	Dummy, equals 1 after 2 nd quarter of 1998 used to account for structural break in macro time-series, more precisely for shock devaluation of national currency	OWN

Table 2. Currency demand variables description

Note: CBR, Rosstat, HSE and OWN respectively stands for Central Bank of Russia, Russian State Statistics Committee, Statistics portal of High School of Economics of Russia and own calculations

Consider that *GDP*, *CPI* and *TAX*, TRANS are expected to have positive partial effect, while *IRATE*, representing 'price' of holding cash is expected to have negative coefficient. It is not certain which sign should CRIS98 and PUTIN have. 56 observations were used in the model, starting with the 1^{st} quarter of 1995 and ending with the 4^{th} quarter of 2008. In the

next subsection estimation results are presented and discussed. One important note is that in the body of reviewed literature on currency demand approach for the purpose of present research, no author dealt with unit root problem. This question might be the subject of further research.

2.2 Currency demand estimation and results

Several specifications were run, and the final model is presented in Table 3, where variables that proved insignificant were excluded (crisis of 1998 dummy, time trend and quarterly dummies). During initial estimation with variables in 1^{st} power RESET test suggested misspecification, which was resolved by including *PUTIN*² variable. The output of Eviews 6.1 OLS estimation (Heteroskedasticity-robust standard errors were used) is shown in Table 3. (The workfile with data is accessible at <u>sharapenko.ru/shadow</u>.)

Variable	Coefficient	t-statistics
Constant (α_0)	2.110	(2.64)**
log GDP (α_1)	0.403	(5.50)*
log CPI (α_2)	0.710	(10.02)*
TAX (α_3)	0.758	(2.07)***
IRATE (α_4)	-0.002	(-5.09)*
PUTIN	0.039	(6.55)*
PUTIN ²	-0.0003	(-3.90)*
TRANS	0.380	(7.23)*
R ²	0.99	
Adj. R ²	0.99	
F	3996.154	
s.e.	0.05	
RESET	0.05	
DW	1.82	

 Table 3. Currency demand regression output

Note: Dependent variable is log M0. *,** and *** respectively indicate significance at 1, 5 and 10% level for a one-sided *t*-test

First, in the Table 3 all variables are significant at the 1% level, except for Tax burden, which is significant at the 10% level. Second, all variables have expected signs and magnitudes, except for elasticity of currency demand to income (GDP) and to prices (CPI), which is not unity, but close to 0.4 and 0.7 respectively. It might be the case that Tax burden is accounting for small fraction of partial effects of GDP and CPI or it might signal about small number of observations or coefficients on GDP and CPI account for some hidden activity not affected by tax system. Looking at PUTIN variables it can be concluded that Putin's rule has the turning point, so the marginal positive effect of his rule is wearing off over time, but very slowly. Fourth, Durbin-Watson statistic (1.82, not 2) shows weak serial correlation, but including lags of left-hand side variable did not improve the situation. ρ coefficient is then 0.09, which is not a concern, considering limited number of observations. Fifth, in final specification the RESET test failed to reject null-hypothesis of misspecification. Finally, it is important to note that the coefficients on variables are not informative when talking about shadow economy, as currency demand was estimated.

Figure 2 below shows the predicted shadow economy size by this model in comparison to Rosstat (Masakova, 2000) and rather 'bald' Schneider (2007) estimates, however this must not be considered as final result.



Figure 2. Shadow economy estimation by currency demand

From the estimated coefficients $\hat{\alpha}_1$ and $\hat{\alpha}_3$ and tax burden observations, an estimate for the shadow economy is obtained for the beginning of observed period (22.2% of GDP), which will be used in the next subsection in the estimation of MIMIC model.

2.3 MIMIC model and data

Although currency demand model focuses only on one factor indicating underground activities (here it is tax burden) its results are used in MIMIC model to produce better estimates of dynamic shadow economy size in next subsection.

In this subsection a dynamic version of 'multiple indicators-multiple causes' model is employed, following Pickhardt and Sardá (2006), to construct estimates of dynamics of a latent variable – size of shadow economy. This model allows for multiple left-hand side variables, which serve as indicators of latent variable, and multiple causal variables in structural relationship explaining latent variable. However MIMIC approach has received certain criticism (Breusch, 2005, pp. 7, 27) for its strong assumptions "apart from the scale and some independent measurement errors, the indicators [...] are supposed to be alternative measures of the same thing, namely the unobserved quantity" and "given the causes [...] and the latent variable, the indicators [...] are mutually uncorrelated". Indeed these propositions are strong assumptions. But there exist works by Dell'Anno (2003), Prokhorov (2001), and Schneider (2007, p. 135) that promote this method as best available (acknowledging its limitations) and suggest improving it or joining it with some other: "[authors] agree that is (still) problematical to apply this methodology to an economic dataset and to specify macroeconomic model through MIMIC framework" but "they point out the importance of estimating the shadow economy and call researchers to develop better estimation methods to overcome critiques made by Breusch (2005)." For example Schneider (2007) employs it together with currency demand method to estimate shadow economy in 145 countries over 6 years.

In standard MIMIC model formulation the growth rate of shadow economy is defined as η , a latent variable. Causes and indicators are represented by vectors, $\mathbf{y}' = (y_1, y_2, ..., y_p)$ and $\mathbf{x}' = (x_1, x_2, ..., x_q)$, respectively. The vectors of parameters are λ ($p \times 1$) and γ ($q \times 1$), $\boldsymbol{\epsilon}$ is a ($p \times 1$) random error vector, ξ is a scalar random error. Both errors are assumed to be normal, mutually uncorrelated and $var(\xi) = \psi$ and $cov(\boldsymbol{\epsilon}) = \boldsymbol{\theta}_{\boldsymbol{\epsilon}}$. Then the model is specified as:

$$y_t = \lambda \eta_t + \epsilon_t, \tag{6}$$

$$\eta_t = \boldsymbol{\gamma}' \boldsymbol{x_t} + \boldsymbol{\xi_t} \tag{7}$$

Substituting η_t in (6) gives

$$y_t = \Pi x_t + z_t \tag{8}$$

where:

$$\boldsymbol{\Pi} = \boldsymbol{\lambda} \boldsymbol{\gamma}' \tag{9}$$

$$\mathbf{z}_t = \boldsymbol{\lambda}\boldsymbol{\xi}_t + \boldsymbol{\epsilon}_t \tag{10}$$

and:

$$cov(\mathbf{z}) = \boldsymbol{\lambda}\psi\boldsymbol{\lambda}' + \boldsymbol{\Theta}_{\boldsymbol{\epsilon}} \tag{11}$$

The regressor matrix Π , for the multivariate regression model consisting of p equations, has rank equal to 1. Also, the error covariance matrix, cov(z) is constrained. Hence, a normalization of one of the elements of λ to some arbitrary value is required prior to estimation. This normalization is discussed below when describing variable. Estimates of the elements of Π can be obtained through restricted Maximum Likelihood estimation, and thus estimates of elements of λ and γ' will be obtained.

Then, values of latent variable can be obtained from (7) assuming the error is zero. After obtaining these values of growth rate, they must be converted to some cardinal value, to build the dynamic path of a size of the shadow economy. This is where results of currency demand estimation will be used. It is important that this cardinal value is obtained from external source other than MIMIC model itself, because it will not be constrained by assumptions of MIMIC model, so MIMIC allows experiments with estimates produced by other approaches.

Indicator and cause variables are chose for MIMIC estimation, according with findings of literature review on factors driving the shadow economy and indicating it. In Table 4 below, selected indicators and causes are discussed.

Table 4.	MIMIC	variables	description
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Indicators	Description	Transf. used	Source
GDP	Real GDP, in million 1995 rubles (real GDP per capita as alternative) Dynamics of GDP should signal about development of shadow economy. It is ambiguous in which way, so in this thesis 'negative' direction is assumed and coefficient on this indicator is set to negative unity	∆ log GDP	Rosstat
M0	Demand for currency in nominal, million rubles (currency per capita as alternative) is expected to indicate underground activity	$\Delta \log M0$	CBR
Causes			
UE	Unemployment rate	UE	HSE
ΤΑΧ	Real total tax contributions, in million 1995 rubles as a measure of fiscal pressure and incentive to move into the shadow	ΔTAX	Rosstat
CRIMES	Number of crimes with economic aim registered (theft, robbery and extortion) in dynamics serves as a measure of climate of illegality where people might be more likely to hide their income	ΔCRIMES	Rosstat
G	Real government expenditures, in million 1995 rubles serve as a proxy for regulation	ΔG	Rosstat
OIL	Nominal oil barrel price (Brent) in US dollars serves as a proxy for possible profitability from speculating	$\Delta \log OIL$	Finam
SUBSIST	Fraction of population whose income is lower than subsistence level, rate as a proxy for prevalence of low-income population segment	SUBSIST	Rosstat
SOC	Fraction of personal income constituted of social transfers, rate as a proxy to measure incentive to be employed unofficially when receiving social transfers	SOC	Rosstat
CORR	Transparency international Corruption perception index, scale 0 to 10 with 10 meaning no corruption, to account for presence of corruption which is found to be complementary to shadow economy in transition countries	CORR	TI
ROL	Constructed rule of law indicator, number of people condemned for crimes with economic aim to total number of such crimes registered to be used as a measure of Rule of law, respect of people towards the state, legislature development and rights protection	ROL	OWN

Note: CBR, Rosstat, HSE, TI, Finam and OWN respectively stands for Central Bank of Russia, Russian State Statistics Committee, Statistics portal of High School of Economics of Russia, Transparency International, Investment Holding Finam and own calculations

Some further explanation of the setup of the model is necessary. First, normalization of effect on GDP to negative unity is supported by findings of Dell'Anno (2003) and Nikopour, Shah Habibullah and Schneider (2008) that (1) in transition economies the size of

the shadow economy is greater than in developed ones and (2) developed shadow economy exerts negative influence on growth rate of official economy, while 'young' shadow economy provides impulse to official one (Giles, Tedds, & Werkneh, 2002) and (3) assumption that shadow economy in Russia is developed enough to affect observed national income negatively. A measure of rule of law was constructed, as existing governance indicators of rule of law, provided by international organizations such as world bank is computed annually, while this thesis deals with quarterly data.

Second, talking about directions of effect, it is necessary to mention expected signs of partial effects. Coefficients on *M*0, *CRIMES*, *G*, *OIL*, *SUBSIST* and *SOC* are expected to be positive to be in accordance with findings about driving factors of shadow economy during literature review. Negative coefficients are expected on *CORR* and *ROL* variables, because of the way these proxies for causes are constructed, and uncertainty is present about direction of effect of unemployment.

Prior to tests and transformations all series were deseasonalized by X11 filter, as visual examination proved seasonality and quarterly fluctuations. All macro-level time series were found to have unit root (Augmented Dickey Fuller test at 5% significance level) and integrated of order one. Because of this and due to model specification (1) first differencing was applied, and the test was run again to make sure no serial correlation in series was left and (2) number of used observations became 55 (from 1995Q2 to 2008Q4).

2.4 MIMIC estimation and results

The following system of equations was estimated in Eviews 6.1 using state space method:

$$\mathbf{y}_t = \lambda \eta_t + \boldsymbol{\epsilon}_t \tag{12}$$

$$\eta_t = \gamma' x_t + \xi_t \tag{13}$$

Several specifications were run following Dell'Anno's (2003) suggestion that maximum of 5-6 causes should be used together with 2-3 indicators. The output of regression of final model is presented in Table 5, where only significant variables were kept. (The work file with data is accessible at <u>sharapenko.ru/shadow</u>.)

Indicators	Coefficient	z-statistics
$\Delta \log GDP$	-1.000	(-)
$\Delta \log M0$	36.391	(11.25)*
Causes		
Lagged latent variable	0.999	(63.05)*
UE	-0.136	(-9.77)*
ΔTAX	0.020	(7.18)*
$\Delta CRIMES$	0.070	(10.72)*
ΔG	0.017	(10.29)*
$\Delta \log OIL$	-0.018	(-0.47)
SUBSIST	0.628	(0.99)
SOC	0.000	(-)
CORR	0.000	(-)
ROL	-0.076	(-10.47)*
<i>p</i> -value	0.0000	
RMSEA	0.0000	
$\log \mathcal{L}$	-2817.39	

 Table 5. MIMIC regression output

Note: * indicates significance at 1% for a maximum likelihood *z*-test

Results of a regression are somewhat surprising. First, variables *SOC* and *CORR* had to be excluded as insignificant and distorting the final specification. The only possible explanation is that these variables (and series behind them) do not add any information and possible catch effects of other variables. Indeed, the problem is caused by some observations constant over time (1998–1998 and 2003–2004 for *CORR* and 2001–2002 for *SOC*), while employed model requires variation in series. Second, *SUBSIST* has expected sign but not enough significance to make any further conclusions relying on it. Third, two variables – *UE*

and *OIL* have unexpected signs, with *UE* being also significant. The negative effect of unemployment on shadow economy can be explained only by high development and penetration of the shadow economy itself, such that individuals employed in official economy are already implicitly employed in the shadow. The negative effect of oil prices (although insignificant) can be explained by higher regulation of energy industry, and if firm or individual wants to participate in this profit-sharing, then it has to become open and official. Fourth, coefficients on indicators can only be interpreted relative to each other: sensitivity of speed of change in currency demand to 1% change in the size of the shadow economy is \sim 36 times stronger, than sensitivity of speed of change in national income. Because of required normalization it is hard to imply any absolute values in case of indicators. Fifth, coefficient on lagged endogenous variable (close to 1) suggests that shadow economy in Russia is very persistent, and it is driven by its own size, besides other factors.

When interpreting magnitudes it is important to note that a one percent increase in unemployment will lead to a 0.13 percent decrease in the size of a shadow economy, and a ten percent increase in growth of real tax burden is predicted to increase shadow economy by 0.2 percent; if growth rate of number of crimes increases by just one percent, then shadow economy will increase by 0.07 percent; government expenditures (as a proxy for regulations) have effect slightly weaker than taxes – and it is understandable, as it's two sides of one coin. Interestingly, rule of law (as a proxy for efficiency of judiciary system) has strongest partial effect on shadow economy size: a one percent increase in rule of law indicator (a ratio of number of condemned for economic crimes to total number of registered economic crimes) is expected to lead to 0.076 percent decrease in shadow economy size. All these coefficients suggest that shadow economy in Russia is very robust to common measures that it has developed robustness and entrenched itself in everyday life.

It must be noted again, despite MIMIC model being best available option, its estimates might suffer from limitations of the model itself.

Using smoothed forecast process in Eviews 6.1, a dynamic path of size of the shadow economy was constructed using coefficients from MIMIC model. A value of 22.2% was used as a base, and trajectory built from it is presented in Figure 3.



Figure 3. Dynamic path of shadow economy

The estimation of the size of shadow economy nowadays in Russia according to the results of this thesis is ~70% of GDP and it has been developing over last 15 years. However if we consider higher base estimate — 41% in 1995 (Schneider, 2007), then prediction is striking with final point of almost 140% nowadays. So, the bigger the shadow economy is, the more it is accelerating. This result is extra reminder — the worse the starting situation is the worse the ending, and preventing measures have to be changed from subjunctive declension to active voice.

Despite these results it must be considered that model possesses three weaknesses. First, it is unstable with smallest variations in data. Second, it assumes multinormality of error terms. Three, it assumes non-covariance of indicators and causes.

Conclusions and implications

In this thesis it was estimated that Russian shadow economy amounted to ~25% of GDP in 1995 and was steadily and persistently growing over one and a half decade reaching 70% of GDP in 2008. This result has been obtained by using best available tools for that purpose, and still no convergence with other estimates was witnessed. Even if estimates are obtained, it is not clear how to interpret them — how much is critical mass, after which shadow economy dictates everyday life and what is a necessary, healthy level of shadow economy that should be maintained. Even further question – does shadow economy evolve as GDP, and what is the direction of the effect between them, and which factors determine it (Feige & Urban, 2008).

Using factor analysis part of MIMIC method it was learned that two points of interest exist which could trigger decrease of a shadow economy in Russia — subsistence level (personal income) and rule of law (efficacy of judicial system and trust towards state). It was also learned during this research that shadow economy goes together with corruption in transition countries, so measures against corruption could be third direction of attack.

The joint use of modified currency demand and MIMIC model is acknowledged as a best available option in subject area. Three further directions of research can be suggested: (1) dealing with unit roots and (2) holdings of foreign currency in currency demand model and (3) allowing for changing effect over time in MIMIC, i.e. nonlinear relationships, between variables.

Two possible improvements are on the horizon: proposed interdisciplinary approach is, since it has been determined that not only economic factors drive shadow economy, and costly micro methods, which can only be conducted by state offices.

Finally, a complex set of policies is necessary targeting legalization of capital, which should be based on following general principles. First, changes in economic conditions (tax policy, privatization, non-economic activity) should be favorable for business, but at the same time preemptive to strengthening of punishment measures. Second, strict separation of criminal capital and shadow capital and accounting of this separation should be defined in legislature targeted at reducing organized crime and corruption. The new president of Russia in the beginning of his duty in 2008 put fight with corruption on top of agenda. Third, a strengthening of the trust towards government is necessary, assuming as one of the measures the demonstration of effective protection of people from financial frauds, protection of savings, capitals and whole institute of private property. This point is supported by factor analysis findings in present thesis.

My understanding is that shadow economy emerged in Russia in 1990s on the wave of liberalization, but in highly criminalized environment. And this accounts for its specificity. Then shadow economy established its own institutes for contract enforcement, and being an institutional trap only developed them further over last 15 years. Thus for any change to happen, policies should focus on delivering reliable contract enforcement alternative. This can be achieved through improving efficacy of judicial system together with prosecution system.

'Rules of the game' have to be clear and concise for everyone. In this aspect there is another policy suggestion that follows from analysis of existing works for purposes of present thesis: a tax schedule (system) has to be simple and easy to follow, otherwise it can drive economic agents into the shadow. This implication is more achievable than, for example setting tax burden to a certain level. Alarmingly high size of the shadow economy in Russia is calling for action.

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