# Does Competition Affect Firm Performance? Evidence from Georgian Panel Data

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### Abstract

The following paper tries to find out the causal relationship between competition and firm productivity in Georgia. The research is based on five year panel data of Georgian firms operating in manufacturing industry. The results of the research are as follows: The negative and significant relationship is found between foreign competition (measured as import penetration ratio) and firm productivity. In addition the results suggest that negative effect of import penetration is fiercer in privately owned firms compared to those under state ownership. On top of it the effect of foreign competition on firm performance was found to be non-monotonic: positive and significant at lower levels of competition and negative and significant for higher levels of competition. No significant effect of domestic market concentration was found on firm performance when competition was defined at national level, though positive effect was observed when defined at regional level for food manufacturing industry.

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# **Chapter 1. Introduction**

The belief that competition is a good thing comes from as yearly as 18<sup>th</sup> century when Adam Smith argued that "monopoly... is a great enemy to good management" (cited in Nickell, 1996). "[This] belief does not simply reflect the well-known result that a competitive economy generates an efficient allocation of resources. It is far more general. It is a belief that competition exerts a downward pressure on costs, reduces slack, provides incentives for the efficient organization of production and even drives innovation forward" adds Nickell (Nickell, 1996). Despite the theoretical disciplinary effect of competition on enterprises, there is still some controversy regarding the favorable effects of it on firm productivity, namely competition pressure may very well work the other way around on firm performance and ability to innovate. If we consider the effects of competition on the expenditures on R&D we might find out that due to big downward pressure of competition on profits, perfectly competitive enterprises may find it hard to put aside part of their cash flow for R&D, compared to the monopolistic ones (Shumpeter, 1950). From transition countries' perspective the negative effect of competitive pressure on firm productivity might be explained by the difficulty to finance the adjustment costs, most likely to be caused by the need of restructuring (Ickes, Ryterman and Tenev, 1995). According to Ickes et al (1995) competition creates incentives for the firms to restructure and adjust to the new environment, because if there is no adaptation to the market the probability of survival is modest. On the other hand, adjustment involves costs, arising from the need to cover them from the retained earnings in the absence of long term bank loans or difficulty to get them, which might cause a decline in performance.

Another possible explanation of the negative effect of foreign competition is suggested by Anderson et al (1999) who argue that competition has two opposite effects on productivity, through reducing prices and spurring productivity, among which price effect is usually quicker than the direct stimulation of productivity. So it is possible that the first effect dominates the second in the early years of transition and we observe the negative effects of competition on productivity, though the long run effect might be positive. To summarize, theoretical literature together with intuition is in favor of the positive effects of competition on firm efficiency though the causal relationship might not appear to be so clear and precise, especially if the country which is investigated belongs to the group of transition economies.

The purpose of the present study is to explore the effect of competitive pressure on firm productivity in Georgia, where the processes of privatization and market liberalization are not yet finalized, which makes the outcomes of the research even more interesting for policy analysis point of view. The study is based on the firm level panel data survey and covers timeframe from 2001 to 2005.

After the dissolution of the Soviet Union most of the transition economies were experiencing massive recessions, deflating GDP growth rates and increasing poverty levels. The principles of market economy were introduced in the countries which did not have the relevant institutions of corporate governance. Property rights were not always guaranteed by the courts. Notwithstanding, the existed and emerging enterprises were suddenly subject to the two new forces: competition and private ownership. When firms are suddenly exposed to these abrupt changes, it generates a good experiment for the researchers to explore the influence of competition and ownership on firm efficiency. This explains why many researchers are frequently focused on transition countries while studying privatization and competition.

Testing the hypothesis that competition exerts a disciplinary effect on firm productivity in Georgia is the main goal of this paper. Looking ahead to the results a positive and significant effect of domestic competition, measured as domestic market concentration, on firm productivity is found only when competition is defined at regional level thus taking into consideration geographic constraints of the market. On the contrary the negative and significant relationship is observed between foreign competition, measured as import penetration ratio, and firm productivity. In addition, the results suggest that negative effect of import penetration is even more negative on privately owned firms compared to those under state ownership. This might be explained by the fact that "intense competition – measured as competition from imports from both the West and from formerly socialist economies decreases the likelihood that an enterprise decides to adjust" and that "privatized enterprises are less likely to decide to adjust than state owned enterprises "(Ickes, Ryterman and Tenev, 1995). Ickes et al (1995) give possible explanations of the result. On the one hand, perhaps time passed since privatization is not sufficiently enough to rip the benefits from it. "Privatization requires an investment of time and resources to senior managers into developing a strategy for privatization, leaving these managers with less time to invest in other activities, such as developing strategies for adjustment". So the authors conclude that it is highly possible that privatized enterprises might lag behind the state owned ones in the adjustment process. This conclusion does not imply that these effects will last long term. The reason that state seem to better handle the foreign competition pressure than private owners can also be the reflection of the fact that state has better access to the factors that might ease the processes of adjustment e.g. banks might evaluate the creditworthiness of the state more favorably than the private ones' due to the level of risk associated, which gives better access for the state owned companies to the long-term bank loans in the periods of adapting to the competitive markets. In summary, privately owned firms might come across higher barriers in the process of adjustment that can explain their relatively worse performance compared to the state owned ones.

The additional finding of the paper is a non-monotonic effect of foreign competition on firm performance. In particular, positive and significant effect of foreign competition was

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found for lower levels of competition and negative and significant effect on higher levels of competition. As Brown and Earle (2000) suggest the reason for possible non-monotonicity of competition can be the costs associated with decreasing the scale of operations for the firms, such as layoffs of workers, shedding of assets etc. "If the liberalization shock was very large for some firms...in the sense that they need to restructure and downsize, then such firms may exhibit lower productivity. This suggests that the effects of increased competition may be non-monotonic, positive at low levels but negative at higher ones" explain Brown and Earle (2000).

The paper is structured as follows. Chapter two describes the background of Georgia; chapter three overviews the relevant literature; chapter four explains the constitution of the data and the construction of the variables; chapter five presents the model to be used for the research; while the final section concludes and provides the recommendations.

## Chapter 2. Overview of the Economy of Georgia

Georgia, as an emerging economy, has been experiencing high real GDP growth rates during the last decade, ultimately reaching up to 12.5 % growth rate in 2006. GDP has tripled in about 10 years starting from 1994 to 2006 from USD 1.2 to USD 3.6 billion. The structure of GDP also changed dramatically, namely the share of agriculture in GDP went down from 43.6% ten years ago to 18.75 % in 2006. The industry sector evolved in an opposite direction constituting to one fourth of the total GDP of Georgia in 2006, to which manufacturing contributed about 8%. The service sector took the biggest part in the structure of GDP, summing up to more than 50%. Foreign direct investments increased from USD 3 million in 1996 to USD 2 billion in 2007, out of which 20 % went to industry sector. International trade also boosted in the last 12 years, namely imports increased from USD 489 million in 1995 to USD 5 billion in 2007 and exports from USD 155 million to USD 1 billion, respectively.

Georgia started to actively follow a policy of trade liberalization since the break up of the Soviet Union in 1990's. Several multilateral, bilateral and unilateral trade agreements have been signed since 1990. The most important advancement was the accession of Georgia to the World Trade Organization (WTO) in 2000. As a consequence, Georgia was granted special treatment in the framework of Generalized System of Preferences (GSP) by the other member countries of WTO, which gave the right to the country to export a predetermined amount of goods free (or smaller) of tariff to the other member countries. On the other hand Georgia was obliged to meet the requirements of WTO and dynamically reduce tariffs on imported goods to foster free trade and market liberalization.

In figure 1 we can see the evolution of average import tariffs from 2001 to 2006 for 97 categories of imports. There was a gradual decrease in the rates from the total average of 12% in 2001 to 2% in 2006.



Figure 1. Import tariffs in years (2001-2006)

*Source*: Website of the World Trade Organization (WTO)

As a consequence imports increased by 256% during this period (see Figure 2), suggesting that the goal of trade liberalization was partially reached in terms of increased volumes of trade.



Figure 2. Imports in years 2001-2006, deflated by PPI.

Source: Website of the Statistics Department of Georgia

From 1995 to 2005 domestic competition was regulated by the legal act on "Monopolistic Activity and Competition" (25/06/1996 N288) enforced by the Antimonopoly Agency of Georgia. According to this act the business unit was considered monopoly if it possessed 35% of the market of the relevant commodity. It would be interesting to look at the number of the cases filed to the court as violations of the act and the appropriate measures taken in order to check whether the anti-monopolistic laws were enforced in Georgia, though this information was not available to me.

As can be seen the foreign competition was fierce in the period of 2001-2006, tariffs on imported goods went down and the volume went up. The same cannot be said about the competition inside the country. Though the regulatory mechanisms for free competition were officially on the ground we can hardly see any measures taken against market concentration. The fact that the Antimonopoly Agency of Georgia was abolished in 2005 indicates the problems in this sphere. The previous establishment was replaced by the new Agency of Free Trade and Competition of Georgia in 2005.

## **Chapter 3. Literature Review**

Quite a numerous researches have been done to identify the effects of competition on firm performance, some of which found strong positive relationship between the two. Nickell (1996) based his research on the panel data of UK manufacturing companies. He utilized Cobb-Douglas production function (in the later studies he relaxed this assumption) and used market share and rents (as profits less capital expenditures) and import penetration ratio as the measures of domestic and foreign competition. He found a strong link between the higher rates of Total Factor Productivity (TFP) *growth* and competition measured by both increased number of competitors and by lower levels of rents.

Brown and Earle (2000) constructed Russian firm level panel data from different sources. The period they referred to was right after the start of transition which helped them to avoid some typical endogeneity problems related to competition variables to a greater extent. They used the measures of competition at the most disaggregated level possible in Russia. Taking into consideration Russia's specific geographic features they measured domestic competition at national and regional levels as well. On top of all they used local labor market competition measures as the alternative variable for measuring competition. They found both the domestic and foreign competitive forces to have a positive effect on total factor productivity of the Russian enterprises.

Anderson, Lee and Murrell (1999) measure the effects of competition and ownership on the performance of newly privatized Mongolian firms. They find nearly double effect of competition on perfectly competitive firm efficiency compared to the monopolistic ones. As for the ownership they find state ownership to be more efficient than other enterprises and explain it as a reflection of an environment where the government focuses on productivity more and institutions are of little help to the privately owned firms. Iscan (1997) also measures trade liberalization effect on firm productivity based on Mexican manufacturing firms. He finds positive evidence of foreign competition on the level of productivity of the Mexican firms but not on productivity growth.

Some researchers found the negative relationship between competition and firm efficiency. Ickes, Ryretman and Tenev (1995) conducted a qualitative analysis in transition context and suggested that "intense competition – measured as competition from imports from both the West and from formerly socialist economies – decreases the likelihood that an enterprise decides to adjust", which means that the adjustment to the new competitive market involves costs that are most likely financed by retained earning. The latter might cause a decline in the short term performance of the firms.

Earle and Estrin (1998) researched Russian firms in mid 1994's, but found insignificant effects of competition on firm performance. They used several alternative measures of domestic and foreign competition but found that only for one particular measure of domestic market concentration does competition have a negative impact on firm performance, while import penetration was never identified to have positive disciplinary effect on productivity. Some argued that in 1994 Russia when the first phase of "mass" privatization had just finished it was too early to identify any causal relationship between competition and firm performance. Though later Earle and Brown (2000) found positive and significant effect of competition on firm productivity in Russia during 1994-1998 as already discussed above.

Angelucci, Estrin, Konings and Zolkiewski (2002) while researching Romanian, Bulgarian and Polish enterprises found a positive effect of domestic market competition on firm productivity in Romania and Poland, but not in Bulgaria. The effect of import penetration was observed to be negative and significant on the performance of Bulgarian and Romanian firms, but positive for Polish ones. Jones, Klinedinst and Rock (1998) also found negative relationship of competition on Bulgarian firm productivity in the early periods of privatization.

## **Chapter 4. Data and Variables**

The Panel data used for this survey comes from the Department of Statistics of Georgia covering 5 years from 2001 through 2005. For the purpose of this research only the firms from manufacturing industry are included in the model i.e. firms from industry code 15 through 37 according to the NACE coding system. Total Number of Firm\*Year observations is 5787 among which cross section units are 1260. The output from my data constitutes to only around 80% of total output of the country according to the statistical information on the total output of the manufacturing industry in Georgia (see Table 1). The same coverage rate for employment is 65%. The size distribution of the firms according to the number of employment is represented in Figure 1. Firms which have employment above 100 are aggregated in the last bar of the Figure 1, in total 262.

Years	Output From Data	Real Output	% Covered
2001	627,469,466.00	657,300,000.00	95%
2002	613,381,043.00	782,400,000.00	78%
2003	709,751,474.00	949,200,000.00	75%
2004	923,437,996.00	1,148,100,000.00	80%
2005	1,070,472,499.00	1,552,700,000.00	69%
Years	Employment from Data	Real Employment	% Covered
2001	37,807.00	58,738.00	64%
2002	35,134.00	54,135.00	65%
2003	34,885.00	51,619.00	68%
2004	34,800.00	52,649.00	66%
2005	32,905,00	61.692.00	53%

 Table 1. Total Output & Employment Coverage Rate

Source: Website of the Statistics Department of Georgia (www.statistics.ge)





All the monetary variables in the data are deflated by Producer Price Index at two digit level industry. Capital is deflated by the average PPI for machinery and equipment (DK, DL and DM according to NACE). From figure 2 we can see that total output increased sharply by 146% from 2001 to 2005, at the same time employment and capital decreased by 7.5% and 0.8% respectively, although the latter does not seem to be reliable, since we are missing 1148 values for fixed capital.







b) Employment





Note: the variables are deflated by PPI

Table 2 (refer to Appendix) lists the distribution of the firms across industries, ownership and location. As can be seen 53% of the observations belong to the food manufacturing industry. As for the ownership, the crude data contain very detailed division of ownership in total of 6 categories (panel b), but because the observations in most of the categories are quite few, it is meaningless to estimate separately the effect of each category, so I aggregate them in two groups: state and private ownership. We can see that in the whole sample 93% of the firms in manufacturing industry are run privately. And lastly, the capital city hosts 35% of the manufacturing industries contained in my survey.

To answer the research question of this study I am going to employ two measures of competition: domestic and foreign, the former measures the domestic market concentration level and the latter competitive pressure from imports. In constructing the measures of competition the most important and delicate issue is the definition of market. Too broad definition might bias our results, since it will not identify the true concentration of markets in case of domestic competition and true pressure on firms in case of foreign competition. This issue was also raised by Nickell in his research. His measure of market share uses three-digit industry, although he comments that "three-digit industry does not represent anything like the market" (Nickell, 1996). Angelucci et al (2002) also use three digit industry level (NACE) while constructing the variables of competition. Brown and Earle (2000) chose to use the

closer measure of the market, namely Russian five-digit industry classification, which represents the most disaggregated coding. In addition, they considered that appropriate definition of market might be geographically constrained in Russia, so they defined the variables also at the level of regions.

The four digit (NACE) level is the most disaggregated division of industry in my data, which can to some extent be identified as a market, though we should keep in mind other characteristics of the country. For example Georgia is located in a very mountainous region, where access is not very easy and cheap first of all, so it might be helpful to define the market also according to geographic location of the business. Although defining market by location might appear misleading. Namely, for food manufacturing it might be sensible to constrain the market by location, but for other types of industries like publishing, woods production, machinery etc where it is more likely that the customer can switch to a different supplier easily regardless the location then the geography is not a barrier anymore, thus business units in different locations might share the same market. Thus I will construct competition variables for food manufacturing industry also at regional level the number of which is 11 in my data sample, as an alternative check of the effects of competition of firm performance.

The domestic competition is measured by two commonly acknowledged indexes: the *two-firm concentration ratio* (CR2) and *Herfindahl-Hirschman Index* (HHI). The former is calculated as the ratio of the two largest (according to output) firms' output to the total output at 4 digit level industry; the latter is the sum of squared output shares of each firm in 4 digit industry output. These variables measure the level of market concentration domestically, the more the value of the variables the more concentrated the market is and consequently the less the competitive pressure. For the ease of interpretation I am going to use (1-HHI) and (1-CR2) in the estimation, the *higher* the estimate the more *positive* is the effect of domestic competition on firm productivity. Another measure of competition is import penetration ratio,

calculated as imports divided by output plus imports. The variable measures foreign competition pressure, the more is the value of it the more competitive is the environment in the specific industry. The product level data on imports in Georgia, received from the Department of Statistics, uses the coding system achieved under the World Customs Organization's internationally agreed "Harmonized System" (HS) for defining product categories at 6-digit codes. My data of imports is disaggregated at 4-digit product level. Since there was difficult to find conversion tables for NACE and HS coding systems I had to match 4 digit industries with 4 digit imports manually. The details of matching are provided in the Appendix, Table 3.

Table 4. Dynamics of Competition						
VARIABLES	2001	2002	2003	2004	2005	
CR2	0.52	0.50	0.50	0.48	0.50	
	(0.27)	(0.28)	(0.29)	(0.30)	(0.29)	
HHI	0.24	0.23	0.24	0.23	0.23	
	(0.22)	(0.23)	(0.25)	(0.23)	(0.23)	
Import Penetration	0.34	0.32	0.35	0.41	0.47	
	(0.34)	(0.33)	(0.33)	(0.33)	(0.30)	

*Note*: The values in parentheses are standard deviations.

Table 4 gives the dynamics of competition variables over the five years. We can see that the mean values of domestic competition stay the same over the years or changes very slightly, whereas the measure of foreign competition - import penetration ratio - is increasing over all the years except for 2002, showing a stable increase of the foreign competitive pressure. One additional thing to mention about the data is that the minimum value of the two firm concentration ratio at national level is 0.13. The distribution of observations according to the levels of CR2 is listed in table 5. As can be seen the most of the observations i.e. 26% fall in the range of 80%-100%. Table 6 lists the summary statistics of all the variables (see in Appendix).

	No. Of	% of
Bins	Obs.	<u>Total</u>
<20%	1328	23%
20%-40%	1172	20%
40%-60%	1202	21%
60%-80%	603	10%
>80%	1482	26%
	5787	100%
<50%	3336	58%
50%-75%	756	13%
>75%	1695	29%
Total	5787	100%

Table 5. Distribution of Firms according to CR2

One of the biggest flaws of the data used for this research is missing information on some variables. The most unreliable measure is fixed capital. The reason is that components of capital are inherited from the socialist era and they are mostly measured in book values and are not corrected for inflation and depreciation. The problem about this variable might also be that some types of capital lie idle or become obsolete in production process, thus the variable can not be able to convey the true contribution of capital to the production process. In total we are missing 1148 observations for capital. The raised problem might be the explanation for the negative elasticities on capital input for some industries reported in Table 7 (refer to Appendix).

The other disadvantage of the data may come from the sample itself. If for example we are missing big participants of the market for some industries than the measure of market competition which is imputed from the data will not be correct. Although the Department of Statistics of Georgia claims that there is no tendency of excluding any type of firms from the sample, but since we know that the data covers only about 80% of the output and 65% of employment, there is still some probability that the market concentration measure is overvalued. But even if this is true we will still be able to get the closer to the true direction of

the effect of domestic competition on firm productivity, since the measure still identifies firms' shares relative to each other. Though the size of the magnitude of the estimate will be arbitrary and make it difficult to interpret.

### **Chapter 5. Econometric model**

I estimate log linear transformation of Cobb-Douglas production function. I relax the common assumption of constant returns to scale and allow the elasticities of factors of production to vary for all the 20 industries by interacting them with each other. The basic model I focus on is the following:

$$y_{it} = \alpha_{i} + \alpha_{t} + \beta_{0} + \beta_{1} \times k_{it} + \beta_{2} \times l_{it} + \beta_{3} \times (1 - hhi)_{\lambda t} + \beta_{4} \times m_{\lambda t} + \sum_{1}^{20} d_{ij} \times k_{it} + \sum_{1}^{20} d_{ij} \times l_{it} + \sum_{1}^{5} \sum_{1}^{20} t_{n} d_{ij} + \varepsilon_{it}$$

 $y_{it}$  stands for the logarithm of the output for firm *i* in year *t*,  $\alpha_i$  represents firm specific fixed effects i.e. allowing a separate intercept for each firm. The variable contains all the time invariant characteristics that are specific to individual firms and that eventually affects the decision of a firm regarding output and the factors of production,  $\alpha_t$  represents time fixed effects, which accounts for the economy wide shocks facing all the firms.  $k_u$  is log of capital and  $l_{it}$  is log of labor inputs for firm *i* in year *t*.  $(1-hhi)_{it}$  stands for a measure of domestic market concentration calculated at four digit industry level,  $\lambda$  represents four digit industry *t* – years. Two similar regressions will be estimated for both measures of domestic competition (1-HHI) and (1-CR2).  $m_{it}$  is import penetration ratio calculated at four digit industry level, again  $\lambda$  stands for four digit industry *t* for years.  $d \times k$  and  $d \times l$  interaction terms are industry and input interaction terms, *j* stands for 2-digit industry. This is necessary to allow different shares of factors of production for each industry.  $t \times d$  stands for industry-year interaction term for each year and industry to account for the fact that each industry might experience specific demand or other shocks each year. And finally,  $\varepsilon_h$  is an error term capturing all the other shocks to the firm productivity. The model assumes that the error term is serially uncorrelated.

While estimating production functions big care should be taken to avoid possible endogeneity problems involved. The source of endogeneity might be various unobservable variables - productivity shocks or characteristics of the firms - that stay in the error term and affect both the output of the firm and the inputs. Fixed effects estimation method will difference away the time invariant firm specific factors like technology levels, managerial efficiency, input quality, etc, which exist in the specific firm. However, there is still left a space for other types of endogeneity. The most typical one – the simultaneity problem - arises due to the fact that, as Griliches and Mairesse (1998) state, there are some forces in production process which are known only to the producer and not the economists, e.g. some technological shocks that usually stay in the error term of the regression. These shocks are directly transmitted to the producer's choice of labor (freely variable input) and with a little delay to capital (more stable input). Once the shocks are realized manager can easily adjust freely variable inputs. Thus estimating production functions by OLS may bring biased estimates because of the correlation between the error term and the independent variables (factors of production). If we assume that these productivity shocks are positively correlated to the inputs, OLS estimation method will most probably bring upward biased results, since labor and capital will take up the effects of the shock.

The researchers propose alternative methods to combat the distorting effect of the simultaneity problem, namely Olley-Pakes (OP) investment proxy estimator, intermediate input proxy estimator (LP) and Generalized Method of Moments (GMM) estimators. The GMM estimation method is based on instrumenting endogenous input variables by the lags of the same variables. The idea of OP estimator lies in the force of investment to catch the effect of the mentioned productivity shocks since the Olley and Pakes (1996) claim that firms

respond to productivity shocks by changing investments *immediately*. Thus by using investment as a proxy variable for those shocks we will be able to control for the correlation arising between the factors of production and the unobserved productivity shocks. Intermediate input as a proxy estimator for the productivity shocks was proposed by Levinson and Petrin (2002) (LP estimator). In response to Olley and Pakes, Levinson and Petrin suggested that intermediate inputs are even more efficient in catching the correlation between productivity shocks and factors of production, since they can be adjusted much quicker to the shocks, whereas it may take some time for investments to be changed. So they claim that using intermediate inputs as a proxy variable for the productivity shocks solves the simultaneity problem in production function estimation. GMM method requires a long panel; Olley and Pakes method needs data containing investment of the firms, none of which are met in the data used for this research. I am leaving Levinson and Petrin estimation method for the future research since the focus of the paper is competition and not the estimation of production function.

Another important source of endogeneity in the survey lies in the competition variables which in the long run are not independent from the firm's performance but rather there can exist reverse causality between the two i.e. those firms which are better performers in the long run might gain higher market position, which will decrease competition in the market. The reverse causality might make it difficult to evaluate the true effects of competition on firm's performance. To solve the abovementioned problem Brown and Earle (2000) use the values from 1992 (base values) of competition variables as instruments. 1992 is interesting as long as the massive liberalization of enterprises started since 1992 in Russia. The authors consider that imports and other competition variables are more likely to be exogenous right after the first liberalization of the market, since competition was randomly allocated to the firms. Due to not having data covering the beginning of market liberalization I am unable to use these

instruments. Even without the instrument, if we get *positive* relationship between productivity and domestic competition we can argue that the true relationship can be even stronger. The logic is that the reverse causality described above has the opposite sign i.e. the effect of productivity growth on competition is negative, if the firm is growing it might become dominant in the market, thus *reduce* the competition. So if the reverse causality is present it will be consumed by the error term and will be negatively correlated to the competition variable as already explained. Thus if we get a positive estimate on competition we can argue that this estimate is downward biased and then we might conclude that the true effect of competition is even higher. In this case we will not be able to interpret the magnitude of the effect precisely but we can argue that the direction of the effect is close to the true one.

## **Chapter 6. Results**

Table 9 summarizes the main findings of the paper. Separate regressions are run for the two measures of domestic competition as mentioned already, and they give relatively similar results everywhere. The competition effect on firm productivity is quite robust to the alternative checks. In all equations I let the production functions differ for each industry, which means that I include all the industry-input interaction terms (the overall results of estimation are reported in the Appendix, Table 7).

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VARIABLES	OLS	FE	OLS	FE
1-CR2	0.87*	0.26		
	(0.10)	(0.36)		
1-HHI	_	_	0.97*	0.18
			(0.13)	(0.26)
Import Penetration	-0.34*	-0.31*	-0.36*	-0.31*
	(0.05)	(0.14)	(0.07)	(0.14)
No. Obs.	4620	4620	4620	4620
R-squared	0.69	0.93	0.69	0.93
Adjusted R-squared	0.69	0.91	0.69	0.91

 Table 9. Basic Regressions: dependent variable is log (Output)

\*significant at 5 % significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: Fixed Effects (FE) regressions include year dummies, industry-year and industry-input interaction terms

*Note3*: OLS regressions include year and regional dummies and industry-year and industry-input interaction terms.

Note4: The total outcome of the regressions is provided in Appendix, Table7.

First and third columns in Table 9 list the simple OLS results for both regressions, which are quite different from the rest of the columns, which give the results from fixed effects estimation method, as indicated in the table. This will take care of the unobservable firm specific factors which do not change over time and influence the level of productivity like technology levels existing in the specific firm, managerial efficiency, location of the business, etc. The regressions also include year dummies to control for economic and other shocks which are common to all firms in the economy. On top of it I add industry-year

interaction terms to the regression to account for the fact that each industry is exposed to industry-specific demand or other types of shocks each year. Ignoring these shocks may lead to biased results, e.g. through the adjustment of factors of production (discussed in Chapter 5). Taking all of these into account we can see that actually the results from fixed effects estimation method are quite different from the simple OLS estimation, suggesting that there were some endogeneity problems in the regressions estimated by OLS. We can see that both of the measures of domestic competition are positive but insignificant in FE estimation, implying that competition might have a disciplinary effect on productivity, although we cannot derive any conclusions from these estimates. On the other hand, if we look at the measure of foreign competition – import penetration ratio – the effect of it on productivity is everywhere negative and significant, which implies that imports do not have disciplinary effect on firms, on the contrary if the competitive pressure of imports increases by 1%, productivity of the domestic firm falls by 31%. As already discussed in the beginning the possible explanations can be the difficulty to finance the adjustment costs most likely to be caused by the need of restructuring to adapt to the new competitive market. The cost of adjustment will most probably be covered from the retained earnings in the absence of long term bank loans or difficulty to get them, which might cause a decline in performance (Ickes, Ryretman and Tenev, 1995). Another possible explanation might be the competition's ability to have two opposite effects on productivity, through reducing prices and spurring productivity, among which price effect is usually quicker than the direct stimulation of productivity. So it is possible that the first effect dominates the second in the early years of transition and we get the negative effects of competition on productivity, though the long run effect might be positive (Anderson et al, 1999).

It is interesting to see the effect of competition on productivity of the firms under different ownership. To check this effect I add private ownership and competition interaction terms to the regressions. The results are summarized in the Table 10. Again the columns OLS and FE give relevant estimation results. Inclusion of interaction terms gives interesting results. In particular, the effect of domestic competition is not found to matter for the firms under different ownership - the estimates in all equations are insignificant, so it is very controversial to make any conclusions about this relationship. On the other hand, the disaggregated effect of import penetration is found to affect more *adversely* privately owned firms relative to the state owned ones. Namely its effect is found to be ranging between negative 38% and 39% from the both equations, meaning that if import penetration ratio increases by 1 % the productivity in privately owned firms decreases by 38% more than in state owned ones. The alternative reason could be that time passed since privatization is not sufficiently enough to actually see its benefits. Managers of the privatized firms need time to develop the strategy for the increased efficiency of the firms. So they might lag behind the state owned ones in the adjustment process. This conclusion does not imply that these effects will last in long-run. The reason that state owned enterprises seem to better handle the foreign competition pressure than private owners can also be the reflection of the fact that state has better access to the factors that might ease the processes of adjustment e.g. banks might evaluate the creditworthiness of the state more favorably than the private ones' due to the level of risk associated, which gives better access for the state owned companies to the long-term bank loans in the periods of adapting to the competitive markets. In summary, privately owned firms might come across higher barriers in the process of adjustment that can explain their relatively worse performance compared to the state owned ones.

VARIABLES	OLS	FE	OLS	FE
1-CR2	0.50*	0.09		
	(0.24)	(0.29)		
1-ННІ	_	_	0.69*	0.07
			(0.19)	(0.13)
IMPORT PENETRATION	-0.54*	0.05	-0.59*	0.04
	(0.04)	(0.29)	(0.05)	(0.29)
PRIVATE OWNERSHIP	0.67*	0.14	0.61*	0.13
	(0.08)	(0.15)	(0.10)	(0.17)
PRIVATE OWNERSHIP*(1-CR2)	0.38	0.18	_	_
	(0.21)	(0.28)		
PRIVATE OWNERSHIP*(1-HHI)	_	_	0.29	0.11
			(0.19)	(0.21)
PRIVATE OWNERSHIP*IMPORT_PEN	0.22*	-0.39**	0.26*	-0.38**
	(0.05)	(0.20)	(0.07)	(0.20)
No. Obs.	4620	4620	4620	4620
R-squared	0.69	0.93	0.69	0.93
Adjusted R-squared	0.69	0.91	0.69	0.91

Table 10. Basic Regressions 2: dependent variable is log (Output)

\*significant at 5 % significance level

\*\*significant at 10% significance level

Note1: all standard errors in parentheses are heteroskedasticity robust White standard errors.

*Note2*: Fixed Effects (FE) regressions include year dummies, industry-year and industry-input interaction terms

*Note3*: OLS regressions include year and regional dummies and industry-year and industry-input interaction terms.

It will be interesting to also check whether the marginal effect of competition on productivity varies with the level of competition. As Brown and Earle (2000) suggest the reason for possible non-monotonicity of competition can be the costs associated with decreasing the scale of operations for the firms, such as layoffs of workers, shedding of assets etc. "If the liberalization shock was very large for some firms...in the sense that they need to restructure and downsize, then such firms may exhibit lower productivity. This suggests that the effects of increased competition may be non-monotonic, positive at low levels but negative at higher ones" explain Brown and Earle (2000). To test this hypothesis on my data I add quadratic terms of competition variables to the basic regressions from Table 9. As can be seen FE columns in Table 11 show that the effect of import competition is indeed nonmonotonic on firm productivity in Georgia. The effect is positive and significant for lower levels of competition but turns negative at higher levels of competition for both regressions. Non-monotonic effect of domestic competition was not found on firm performance. For both regressions the estimates are insignificant.

VARIABLES	OLS	FE	OLS	FE
1-CR2	1.16*	0.26		
	(0.38)	(0.36)		
1-HHI	_	_	-1.13*	-0.22
			(0.46)	(0.16)
IMPORT_PENETRATION	0.47*	0.56**	0.64*	0.58**
	(0.24)	(0.33)	(0.25)	(0.34)
(1-CR2)^2	-0.38	0.03	_	_
	(0.46)	(0.45)		
(1-HHI)^2	_	_	1.67*	0.43
			(0.32)	(0.33)
IMPORT_PENETRATION^2	-0.94*	-0.99*	-1.06*	-1.02*
	(0.24)	(0.27)	(0.26)	(0.28)
<i>No. Obs.</i>	4620	4620	4620	4620
R-squared	0.69	0.93	0.70	0.93
Adjusted R-squared	0.69	0.91	0.69	0.91

Table 11. Non-monotonic effect of Competition. Dependent variable is log (Output)

\*significant at 5 % significance level \*\*significant at 10% significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: Fixed Effects (FE) regressions include year dummies, industry-year and industry-input interaction terms

*Note3*: OLS regressions include year and regional dummies and industry-year and industry-input interaction terms.

It would be also interesting to see the yearly effect of competition on firm productivity. Table 12 provides the evolution of the effect of competition variables on firm productivity. The Fixed Effects section comes from including year-competition dummies in the regressions from Table 9, estimated with fixed effects; the second section comes from OLS estimation. We can notice that the adverse effect of import penetration on firm performance started to decrease in magnitude starting from year 2002, although the estimates on last two years are insignificant. Domestic competition evolution seems more challenging to interpret because the effects do not show any specific trends.

		<b>,</b>				
	VARIABLES	2001	2002	2003	2004	2005
	1-CR2	0.17	0.44	0.34	0.43	0.04
S	I	(0.29)	(0.28)	(0.29)	(0.28)	(0.28)
ect	Import Penetration	-0.29*	-0.37*	-0.36*	-0.16	-0.02
Efi		(0.16)	(0.16)	(0.14)	(0.13)	(0.19)
[ p	1-HHI	0.15	0.42*	0.38*	0.41*	0.00
ixe	 L	(0.18)	(0.19)	(0.19)	(0.22)	(0.22)
H	Import Penetration	-0.30*	-0.41*	-0.37*	-0.17	-0.04
	İ	(0.15)	(0.16)	(0.14)	(0.13)	(0.18)
	1-CR2	0.83*	1.02*	0.96*	1.04*	0.33*
	ı L	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
	Import Penetration	-0.38*	-0.43*	-0.33*	-0.19*	-0.27*
S	I L	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Ю	1-HHI	0.94*	1.14*	1.13*	1.15*	0.31*
	1 1	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
	Import Penetration	-0.47*	-0.52*	-0.36*	-0.17*	-0.25*
	 	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)

Table 12. Effect of competition over years. Dependent variable is log (Output)

\*significant at 5 % significance level

\*\*significant at 10% significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: The regressions are from Table 8, but instead of competition variables competition-year interaction terms were added.

As already discussed above, redefinition of the market at the regional level might appear to be more close to the true market, taking into account Georgia's mountains and difficult to access geographical location. It seems logical that these factors constrain competition in some regions or affect it in some other way relative to the others. Not taking it into account might bias the measure of competition effects.

Table 13 provides the results of competition variables which are calculated at two-digit regional level, the number of which is 11 in the data. The regressions are run only for food manufacturing industry for the reasons discussed in chapter 4. The results look convincing and significant. All the competition variables are significant in both of the regressions. The estimates are robust to the two types of domestic market concentration measures. In particular the positive effect of domestic competition on firm performance in food manufacturing

industry is found to be around 50%. Import penetration has still negative effect on firm productivity and the magnitude is also around 30% as in previous cases.

VARIABLES	OLS	FE	OLS	FE
1-CR2	1.07*	0.88*	_	_
	(0.17)	(0.19)		
1-HHI	_	_	0.83*	0.46*
			(0.15)	(0.14)
IMPORT_PENETRATION	-0.07	-0.11	-0.10	-0.03
	(0.09)	(0.35)	(0.09)	(0.33)
No. Obs.	2145	2145	2145	2145
R-Squared	0.70	0.94	0.70	0.94
Adjusted R-Squared	0.70	0.92	0.70	0.92

 Table 13. Competition at the Regional Level. Dependent variable is log (Output)

\*significant at 5 % significance level

\*\*significant at 10% significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: all regressions include year dummies

Note3: OLS regressions include regional dummies

We can also see the effect of competition across ownership types for the newly defined market. In Table 14 We do not observe any special effect of domestic competition on privately owned firms; none of the estimates are significant for any measure of competition. Though we can detect a significantly strong *negative* effect of import penetration on privately owned firms relative the state owned ones. The magnitude is around 36% in both regressions and is almost always significant. So here as well as in the previous case we can conclude that high import penetration rates can be more damaging for the privately owned firms in terms of decreasing productivity compared to those under state management.

VARIABLES	OLS	FE	OLS	FE
1-CR2	3.23*	1.27*		_
	(0.70)	(0.53)		
1-HHI	_	_	1.65*	0.44
			(0.74)	(0.56)
IMPORT_PENETRATION	-0.34	0.75**	-0.79*	0.99**
	(0.48)	(0.42)	(0.39)	(0.58)
PRIVATE_OWNERSHIP*(1-CR2)	-2.18*	-0.40	_	-
	(0.72)	(0.37)		
PRIVATE_OWNERSHIP*(1-HHI)	_	_	-0.82	0.01
			(0.78)	(0.42)
PRIVATE_OWNERSHIP*IMPORT_PEN	0.29	-0.87**	0.71**	-1.04*
	(0.48)	(0.45)	(0.42)	(0.52)
No. Obs	2145	2145	2145	2145
R-squared	0.71	0.94	0.70	0.94
Adjusted R-squared	0.70	0.92	0.70	0.92

Table 14. Competition at the Regional Level . Dependent variable is log (Output)

\*significant at 5 % significance level

\*\*significant at 10% significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: all regressions include year dummies

*Note3*: OLS regressions include regional dummies

The test for non-monotonicity of competition on firm performance is conducted successfully also for this case. Again, the effect of foreign competition is found to have positive effect at lower levels of competition and huge negative effect on higher levels of competition. The results are provided in Table 15, columns FE.

VARIABLES	OLS	FE	OLS	FE
<u>1-CR2</u>	1.93*	0.50		
	(0.52)	(0.90)		
1-HHI	_	_	-0.50	0.18
			(0.41)	(0.37)
IMPORT_PENETRATION	1.08*	0.42	0.85*	0.65
	(0.38)	(0.70)	(0.38)	(0.70)
(1-CR2)^2	-1.28*	0.39	_	_
	(0.58)	(1.04)		
(1-HHI)^2	_	_	1.30*	0.29
			(0.33)	(0.50)
IMPORT_PENETRATION^2	-1.32*	-0.72	-1.14*	-0.93*
	(0.39)	(0.51)	(0.39)	(0.56)
No. Obs	2145	2145	2145	2145
R-squared	0.71	0.94	0.71	0.94
Adjusted R-squared	0.70	0.92	0.70	0.92

Table 15. Non-monotonicity of competition. Dependent variable is log (Output)

\*significant at 5 % significance level

\*\*significant at 10% significance level

*Note1*: all standard errors in parentheses are heteroskedasticity robust White standard errors. *Note2*: all regressions include year dummies

Note3: OLS regressions include regional dummies

A short summary of the findings of the paper is as follows: I did not find any significant effect of domestic competition on firm performance in Georgia, but I observed a significant and negative effect of import penetration on productivity, the magnitude is 31%. I also found that the *negative* effect of foreign competition is 38-39% *more* for privately owned firms than for those under state ownership. And finally I revealed that for lower levels of competition the effect of import competition is positive 56-58% and for higher levels it turns to negative 43-44% (the sum of the estimates on import penetration and a square of it).

The findings of this paper are closer to the findings of Brown and Earle (2000) and Anderson et al (1999), who also researched the effect of competition on firm performance in transition economies. In particular, Brown and Earle (2000) find the effect of domestic and foreign competition on firm productivity to equal to about 30% for both of the measures, which is similar to my findings. The non-monotonic effect of foreign competition found by Brown and Earle equals to negative 38% (as compared to my negative 99%), but overall effect of import competition is positive in their research.

Angelucci et al (2002) while doing research on Bulgarian, Romanian and Polish firms find the following results: foreign competition has *negative* 32% and 68% on firm performance in Bulgaria and Romania, respectively and positive 62% in Poland. The estimate on interaction terms of import and private ownership are negative but insignificant.

Anderson et al (1999) show very strong but higher effect of competition on productivity of Mongolian firms, in particular, they found 60-90 % effect of domestic competition on Mongolian firm productivity.

Nickell (1996) finds very minor but significant effect of competition on firm performance, namely he shows that 25% increase in market share causes 1% fall in TFP in the long run. The reason of such a big difference between the findings of Nickell and the rest of the researchers might lie in the fact that the researched markets were totally different from each other – developed country versus the transition economies.

# **Chapter 7. Conclusion**

The question of how should domestic market and foreign trade be regulated, if at all, has been a hot topic in Georgia recently. To my best knowledge there are not many empirical studies done to address this issue. This paper tried to identify the effect of domestic and foreign competition on firm productivity, which can be helpful for policy makers of trade liberalization and architects of domestic market competition in Georgia. The findings of the paper suggest that lower levels of foreign competition and local market concentration affect positively firm productivity in Georgia, whereas higher level of import penetration might not be favorable for manufacturing business. Thus big care should be applied in taking actions towards complete liberalization of foreign trade, the consequence of which will be increased volumes of imports and increased competition.

The specific characteristics of each industry should be taken into account while shaping competitive environment for them. For example the sectors which are mostly under private ownership might be more susceptible to excessive liberalization of free trade, since the paper discovered the effect of import penetration to be more adverse for private owners relative to the state.

Investigating the effect of competition on each industry individually i.e. including industry-competition interaction terms in the regression could be an interesting topic for future studies. So that exclusive competition policy could be designed for each industry in terms of restricting imports and/or domestic market concentration.

The paper does not argue for autarchy in the country but rather suggests elaborating thorough and comprehensive policies regarding free trade and market competition. Lastly, it could be more appropriate if slower liberalization of trade is implemented for industries which are more sensitive to import competition.

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# **APPENDIX**

### Table 2. a) Distribution of firms across industries

			% of
Industry	No. Cross Section	No. Obs	<u> </u>
Food (15)	646	3052	53%
Tobacco (16)	5	24	0%
Wearing (18)	23	102	2%
Leather (19)	23	110	2%
Wood (20)	99	426	7%
Pulp & Paper (21)	9	39	1%
Publishing (22)	145	702	12%
Coke & Petroleum (23)	4	14	0%
Chemicals (24)	54	257	4%
Rubber & Plastic (25)	32	133	2%
Mineral Products (26)	90	411	7%
Basic Metals (27)	8	38	1%
Metal Products (28)	34	127	2%
Machinery& Equipments (29)	15	49	1%
Electrical Machinery (31)	10	31	1%
Radio & TV Apparatus (32)	2	6	0%
Medical & Optical Instruments			
(33)	8	36	1%
Motor Vehicles (34)	5	24	0%
Other Transport Equipment			
(35)	10	48	1%
<i>Furniture (36)</i>	38	158	3%
Total	1260	5787	100%

#### b) Distribution of observations across ownership

Ownership	No. Cross Section	No. Obs	% of Total
State Ownership	86	319	6%
Municipal Ownership	4	17	0%
Ownership of Public Organizations	20	71	1%
Private Ownership	1143	5337	92%
Foreign Ownership	10	43	1%
Total	1260	5787	100%

### c) Distribution of observations across regions

Industry	<u>No. Cross Section</u>	No. Obs	% of Total
Tbilisi (Capital)	438	2033	35%
Imereti	264	1274	22%
Sida QarTli	75	335	6%
Achara	70	295	5%
Samegrelo Zemo Svaneti	78	364	6%
Guria	37	171	3%
Racha Lechkhumi & Qvemo Svaneti	40	184	3%
Kakheti	76	343	6%
Mckheta Mtianeti	46	203	4%
Samckhe Javakheti	65	265	5%
Qvemo Qartli	71	320	5%
Total	1260	5787	100%

VARIABLES	DESCRIPTION	MEAN	ST. DEV	MAX	MIN
Oristment	Real Output deflated by 2-digit industry		[		
Ouipui	PPI	577,477.80	4,265,953.00	209,000,000.00	97.67
Employment					
Employment	Employment	26.06	117.10	2,997.00	1.00
	Capital costs deflated by the average of				
Capital	PPI for the industries DK, DL & DM		l	l	
	(NACE)	374,395.30	3,316,734.00	148,000,000.00	3,316,734.00
	Intermediate costs deflated by two digit				
Costs	PPI				
		554,211.70	4,124,649.00	204,000,000.00	31.26
	National two firm concentration ratio				
CR2 National	calculated as a ratio of the output of the				
CH2 Ivalona	two largest firms (according to output)				
	to 4-digit industry output.	0.50	0.29	1.00	0.00
	Regional two firm concentration ratio				
	calculated as a ratio of the output of the				
CR2 Regional	two largest firms (according to output)				
	to 4-digit industry level output at the	0.75	0.05	1.00	0.00
	regional level.	0.75	0.25	1.00	0.00
	National Herfindahl-Hirschman index				
HHI National	calculated as sum of squared output				
	shares of each firm in 4-digit industry	0.02	0.00	1.00	0.00
	output.	0.23	0.23	1.00	0.00
	Regional Herfindani-Hirschman index				
HHI Decient	calculated as sum of squared output				
Kegionai	snares of each firm in 4-digit level	0.50	0.22	1.00	0.00
True out	Potio of the value of imports to the	0.30	0.55	1.00	0.00
Import Ponstration	value of output plus imports at 4 digit		-		
Patio	industry level	0.38	0.33	1.00	0.00
Kuto	industry iever.	0.38	0.55	1.00	0.00
Ownershin.	Dummy variable for two types of				
Ownersnip.	ownership: private and state				
Drivoto	o mership. private and suite.	0.01	0.01	1.00	0.00
riivate		0.94	0.24	1.00	0.00
State		0.06	0.24	1.00	0.00

#### Table 6. Summary statistics of the variables.

VARIABLES	OLS	FE	OLS	FE
1-CR2	0.87*	0.26		_
	(0.09)	(0.36)		
1-HHI	_	_	0.97*	0.18
			(0.13)	(0.26)
IMPORT_PENETRATION	-0.33*	-0.31*	-0.36*	-0.31*
	(0.05)	(0.14)	(0.07)	(0.14)
PRIVATE_OWNERSHIP	0.93*	0.07	0.93*	0.07
	(0.05)	(0.08)	(0.05)	(0.08)
LOG(CAPITAL)*IND_18	0.33*	0.46*	0.33*	0.46*
	(0.11)	(0.18)	(0.11)	(0.18)
LOG(CAPITAL)*IND_19	0.08	0.26*	0.09	0.26*
	(0.06)	(0.04)	(0.06)	(0.04)
LOG(CAPITAL)*IND_20	0.35*	-0.01	0.34*	-0.01
	(0.03)	(0.12)	(0.03)	0.13
LOG(CAPITAL)*IND_23	0.13	1.36*	0.11	1.36*
	(0.48)	(0.39)	(0.49)	(0.39)
LOG(CAPITAL)*IND_24	0.19*	0.18*	0.19*	0.18*
	(0.04)	(0.05)	(0.04)	(0.05)
LOG(CAPITAL)*IND_25	(0.07)	$-0.10^{*}$	(0.00)	$-0.10^{\circ}$
	(0.08)	(0.05)	(0.09)	(0.05)
LOG(CAPITAL)*IND_20	$(0.09^{*})$	(0.04)	(0.04)	(0.04)
	0.20*	0.56*	0.21*	0.56*
LOG(CAPITAL) · IIVD_29	(0.07)	(0.20)	(0.07)	(0.29)
LOG(CAPITAL)*IND 36	0.14*	-0.17*	0.12*	-0.17*
LOO(CAITIAL) IND_50	(0.02)	(0.03)	(0.02)	(0.03)
LOG(CAPITAL)*IND_DA	0.09*	0.13*	0.09*	0.13*
	(0.01)	(0.03)	(0.01)	(0.03)
LOG(CAPITAL)*IND DE	0.37*	0.17*	0.38*	0.17*
	(0.02)	(0.04)	(0.02)	(0.04)
LOG(CAPITAL)*IND DJ	-0.15*	0.04	-0.15*	0.04
· · · –	(0.03)	(0.10)	(0.03)	(0.10)
LOG(CAPITAL)*IND_DL	-0.01	0.28**	-0.02	0.28**
	(0.05)	(0.15)	(0.05)	(0.15)
LOG(CAPITAL)*IND_DM	-0.02	0.17	-0.00	0.17
	(0.06)	(0.17)	(0.05)	(0.18)
LOG(EMPLOYMENT)*IND_18	1.00*	0.79*	1.00*	0.79
	(0.16)	(0.26)	(0.16)	(0.26)
LOG(EMPLOYMENT)*IND_19	1.19*	0.28	1.19*	0.28
	(0.26)	(0.20)	(0.27)	(0.20)
LOG(EMPLOYMENT)*IND_20	1.00*	0.57*	1.01*	0.57*
	(0.06)	(0.06)	(0.07)	(0.06)
LUG(EMPLOYMENT)*IND_23	-1.08*	-4.36*	-1.08*	-4.36*
	(0.51)	(0.56)	(0.51)	(0.36)
LUG(EMPLUYMENT)*IND_24	0.93*	$0.3/^{*}$	0.94*	0.58*
LOC/EMBLOVMENT\*IND 25	(0.10)	(0.11)	(0.10)	(0.10)
$LOG(EMITLOIMENT)^{*IND}_{25}$	(0.10)	0.00°° (0.08)	(0.11)	0.00 <sup>**</sup> (0.08)
IOG(FMPIOVMENT\*IND 24	1 25*	0.76*	1 2/1*	0.75*
	(0.08)	(0.14)	(0.07)	(0.15)

Table 7. The total outcome of the basic regression in Table 8 (see in paper)

LOG(EMPLOYMENT)*IND_29	1.59*	1.31*	1.61*	1.31*
	(0.16)	(0.34)	(0.15)	(0.34)
LOG(EMPLOYMENT)*IND_36	0.86*	0.43*	0.91*	0.43*
	(0.03)	(0.15)	(0.04)	(0.15)
LOG(EMPLOYMENT)*IND_DA	1.18*	0.63*	1.18*	0.63*
	(0.03)	(0.08)	(0.03)	(0.08)
LOG(EMPLOYMENT)*IND_DE	0.80*	0.48*	0.79*	0.48*
	(0.05)	(0.06)	(0.05)	(0.06)
LOG(EMPLOYMENT)*IND_DJ	1.43*	1.15*	1.48*	1.15*
	(0.04)	(0.14)	(0.05)	(0.15)
LOG(EMPLOYMENT)*IND_DL	1.15	1.04	1.16	1.03*
	0.20	0.30	0.20	(0.30)
LOG(EMPLOYMENT)*IND_DM	1.20*	1.22*	1.17*	1.22*
	(0.09)	(0.40)	(0.08)	(0.40)
ACHARA	-0.22*	_	-0.23*	-
	(0.07)		(0.06)	
GURIA	0.19*	_	0.15*	-
	(0.08)		(0.08)	
IMERETI	-0.63*	_	-0.66*	-
	(0.05)		(0.04)	
KAKHETI	-0.31*	_	-0.36*	_
	(0.06)		(0.06)	
MTSKHETA MTIANETI	0.08	_	0.06*	_
	(0.08)		(0.08)	
QVEMO QARTLI	-0.18*	_	-0.24*	_
	(0.04)		(0.04)	
SAMEGRELO	-0.25*	_	-0.27*	_
	(0.07)		(0.07)	
SHIDA QARTLI	-0.19*	_	-0.22*	_
	(0.08)		(0.09)	
SVANETI	-0.57*	_	-0.61*	_
	(0.02)		(0.02)	
TBILISI (CAPITAL)	0.20*	_	0.19*	_
	(0.02)		(0.02)	
C	6.20*	6.14*	6.07*	6.44*
	(0.20)	(1.24)	(0.18)	(2.06)
No. of Obs	4620	4620	4620	4620
R Squared	0.69	0.93	0.69	0.93
Adjusted R Squared	0.69	0.91	0.69	0.91
Durbin Watson Statistics	0.49	1.86	0.49	1.86

\*significant at 5 % significance level

\*\*significant at 10% significance level

Note1: all standard errors in parentheses are heteroskedasticity robust White standard errors.

Note2: All regressions include year dummies and industry-year interaction terms

*Note3*: The numbers on industry-input interaction terms indicate 2-digit level industry according to NACE coding. Some industries are aggregated, for example DA stands for *Manufacture of food products, beverages and tobacco,* DE for *Manufacture of basic metals and fabricated metal products.* (For more details see NACE codes description)

*Note4:* The table shows the elasticities of factors of productions for all industries separately. Almost everywhere the FE estimates are positive and significant, except for capital elasticities for a few industries, which can be explained by the poor measurement of the capital in transition economies discussed in Chapter 4.

*Note5*: The last terms are regional dummies. For example we can see that operating business in the Capital (Tbilisi) is associated with 20%more productivity, *ceteris paribus*, though OLS estimates may suffer from various endogeneity.

NACE	Harmonized System (HS)
15.11	0201:0202:0203:0204:0206:0207:0208:0209:0210:1601:1602.
15.13	0201:0202:0203:0204:0206:0207:0208:0209:0210:1601:1602
15.32	2009
15.32	0702.0703.0704.0705.0706.0707.0708.0709.0710.0711.0712.0713.0714.0803.0804
15.55	0805.0806.0807.0808.0809.0810.0811.0812.0813.0814.2001.2002.2003.2004.200
	5.2006.2007.2008
15 /1	0405·1501·1502·1503·1504·1505·1506·1507·1508·1500·1510·1511·1512·1513·1514
15.71	151515151615171518
15 51	0401.0402.0403.0404.0406
15.52	2105
15.52	1101.1102.1102.1104
15.01	100,1102,1103,1104
15.01	1903
15.84	1/04;1801;1803;1804;1805;1806;
15.85	1902
15.86	0901;0902;2101
15.87	0904;0905;0906;0907;0908;0909;0910
15.88	This is diet food production. No close import category was found to match.
1589	This is from category n.e.c (other). No close import category was found to match.
15.91	2206;2207;2208
15.93	2204; 2205.
15.96	2203
15.98	2201; 2202.
16.00	2401;2402;2403
1754	This is from category n.e.c (other). No close import category was found to match.
18.21	This is special clothing, No close import category was found to match
18.22	6105;6106;6109;6110;6205;6206;6207;6208
19.10	4104; 4105; 4106; 4107.
19.30	6401;6402;6403;6404;6405;6406
20.10	4401;4402;4403;4404;4405;4406;4407;4408;4409;4410;4411;4412;4413
20.30	4414; 4417; 4418; 4419; 4420.
20.40	4425;4416
20.51	4421;
21.21	4808;4819
21.25	4823
22.11	4901
22.12	4902
22.13	4902
22.21	4902
22.21	4911
22.22	This is bookbinding and finishing. No close import category was found to match
23.20	2709·2710·2711·2712·2713
23.20	2801 2851: 2001 2042
24.11	2001-2001, 2001-2042.
24.30	2002.2004.2005.2005
24.42	4007;4009;4000;4010;4014;4015;4016;4017
25.15	2017,2010,2010,2020,2021
25.21	3717,3710,3717,3720,3721 2002
25.22	3723 20 <b>25</b>
25.25	3923
25.24	<u>3920</u>
26.25	0914
26.40	6901;6902;6903;6904;6905;6906;6907;6908
26.51	2523,6810,3816
2652	2522
26.53	2520
26.61	6810;3816

### Table 3. Matching between NACE and HS

26.63	3816;6810
26.70	6801;6802;6803;6804;
26.82	6815
27.10	7201;7202;7206
27.51	7201;
28.11	8201;8202;8203;8204;8205;8206;8207;8208;8209;8210;
28.12	8301;8302;8307
28.73	8311
28.74	No close import category was found to match
28.75	8303;8304;8305;8306;8308;8309;8310.(8211;8212;8213;8214;8215)
29.11	8406;8407;8408;8409;8410;8411;8412
29.22	8425;8426;8427;8428;8429;8430;8431
29.40	8456;8457;8458;8459;8460;8461;8462;8463;8464;8465
29.53	8438
29.56	8479
29.71	No close import category was found to match
29.72	No close import category was found to match
31.10	8501;8502;8503;8504
31.20	8501;8502;8503;8504;8505;8506;8507
31.62	This is from category n.e.c (other). No close import category was found to match.
32.30	8518;8519;8520;8521;8522;8523;8524;8525;8526;8527;8528;8529;8530;8531;
33.10	9018;9019;9020;9021;9022
33.20	9031;
34.30	8708
35.11	8901;8902;8903;8904;8905;8906;8907;8908
35.20	8607
36.11	9401
36.12	9403
36.14	9403
36.22	7113
36.63	This is from category n.e.c (other). No close import category was found to match.

Note: In total for 103 observations import match were not found, thus they were marked as N/A. Source: Websites <u>http://www.fifoost.org/database/nace/nace-en\_2002c.php</u> (NACE) and <u>http://www.oecd.org/dataoecd/34/57/35685884.htm</u> (HS)