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AY 2011-12

How did Targeted Government Trade Policies Impact the Productivity of Manufacturing Firms in Eastern Europe and Central Asia between 1995 and 2009?

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Abstract

This study investigates whether trade-related, targeted, government policies had an impact on the total factor productivity (TFP) of manufacturing firms in Eastern Europe and Central Asia (ECA region) between 1995 and 2009. It does so by looking at how different types of primarily industry-specific trade policies (or their combinations) impacted firm productivity.

The dependent variable is firm total factor productivity (TFP), calculated using the Levinsohn-Petrin approach. As an alternative measure of firm productivity, this study uses labor productivity.

This study finds that, in most instances (10 out of 14 times), targeted policies do not show a significant impact on manufacturing firms' TFP. Based on the analysis of 588 manufacturing firms in the ECA region, this study finds that, contrary to proponents of targeted policies, targeted trade-related government policies have a limited impact on the total factor productivity (TFP) in developing countries.

Keywords: targeted policies, trade policies, value chain.

INTRODUCTION

Recently, there have been several successful examples of government-initiated trade-related policies aimed to develop targeted industries, such as providing reduced tariffs for imported equipment, thereby facilitating technology adaptation, providing access to expert consultants to help firms adhere to global standards, and simplifying customs procedures. Examples of these industries include, floriculture in Kenya, salmon farming and wine production in Chile, grapes, maize farming, and software development in India, fisheries in Uganda, electronics in Taiwan and Malaysia (Chandra, 2006), and shrimp in Nigeria (Foreign Investment Advisory Service (FIAS), 2007), to name a few. Such targeted policy measures came from recognition that, apart from a small market or poor business climate, these countries' products often failed to meet the sophisticated standards required to trade within the global markets. In addition to the standards, it was found that even in labor-intensive industries, such as apparel, labor costs were not always the driving force behind sector productivity, e.g., total factor productivity (TFP) – broadly understood as a "...portion of output not explained by the amount of inputs used in production and, as such, its level is determined by how efficiently and intensely the inputs are utilized in production" (Comin, 2006: 1). Instead, variables, such as high import tariffs on key inputs like machinery and equipment (e.g., Kenya, apparel industry), delays in value added tax (VAT) redemption for exporters (e.g., textile industry in Indonesia, cashew nut industry in Brazil (FIAS, 2007; USAID, 2008)), lengthy procedures to clear customs, failures to meet global industry standards, and outdated technologies were acting as the major hurdles. In these examples, the respective governments helped firms in nascent industries to overcome such hurdles and become more productive by implementing industry-specific, trade-related targeted reforms. Targeted government trade-related policies encompass primarily industry-specific, trade-related government initiatives aimed to reduce tariff and non-tariff barriers, set up proactive bodies to assist producers to acquire and adapt new technologies, and to adhere to global standards. The final goal of such interventions is to help producers move along the value chain. Given

that the targeted reforms are mostly of a short- to -medium-term nature, they allow governments to leapfrog development by focusing their resources on developing sectors that would bring high inflows of foreign exchange.

The purpose of this paper is to contribute to the ongoing debate on government intervention and whether such intervention should be targeted or not (Lin and Chang, 2009). This study attempts to evaluate whether such government intervention is beneficial for firm performance, specifically measured by total factor productivity (TFP). We argue that trade-related, targeted, government policies have an impact on manufacturing firm TFP in developing countries.

In addition to evaluating the effect of government trade policies on firm productivity, this paper disentangles as much as is possible the mechanisms by which firms achieve higher productivity (raised by Topalova and Khandelwal, 2010) and disaggregates the effects of different types of trade policies (or their combinations) on firm productivity in developing and emerging markets (raised by Rodriguez and Rodrik, 2000).

THEORETICAL BACKGROUND

This paper disaggregates different types of industry-specific trade policies (or their combinations) and measures their impact on firm productivity. This study stresses that the trade-related policies will be particularly beneficial for a country's economic growth if they are targeted at sectors that offer the most export potential and utilize a country's resource abundances in a more effective and efficient manner. The importance of using attributes at hand (e.g. cheap labor, access to resources, and access to skilled labor) in order to exploit competitive advantage to the full extent has been supported by the resource-based view and the concept of competitive advantage (Porter, 1990).

To date, the literature has addressed the impact of trade liberalization and protection on firm performance. Exporting leads to an increase in expected profits, which induce higher entry and push up

the productivity threshold for survival. The least efficient firms tend to contract in a Schumpeterian wave of "creative destruction" while the most productive firms tend to expand. Apart from the *rationalization* and *reallocation* effects, the pro-competitive forces of trade liberalization may also induce *within-firm* productivity changes. Competition may force firms to lower their average cost curves (Helpman and Krugman, 1985), reduce managerial inefficiencies (Hicks, 1935; Rodrik, 1992), use inputs more efficiently (Holmes and Schmitz, 2001), and focus on the products that represent their core competency (Bernard, Redding, and Schott, 2006). Competition is also likely to make domestic firms invest more in new technologies and production processes in order to prevent foreign competitors from coming in (Aghion, Burgess, Redding, and Zilibotti, 2005).

In addition to competitive pressures, the trade literature also predicts that better access to superior inputs and technology can also lead to productivity improvements (Ethier 1982; Grossman and Helpman 1991; Riviera-Batiz and Romer, 1991). While lower tariffs on final goods induce higher import competition, lower tariffs on intermediate inputs induce learning, innovation and quality effects (assuming that domestic firms are able to adopt such technologies). Empirical studies by Muendler (2004), Shor (2004), Amiti and Konings (2007), among others, find that the largest productivity gains arise from reducing the tariffs on intermediate inputs.

While the trade literature has addressed the impact of trade liberalization and protection on firm performance, disentangling the exact mechanisms by which firms achieve higher productivity still remains a challenge (Topalova and Khandelwal, 2010). For that purpose, the value chain analysis represents an invaluable tool that allows identifying the relevant trade-related policies and studying them in a comprehensive manner. The value chain analysis is — "…a method for accounting and presenting the value that is created in a product or service as it is transformed from raw inputs to a final product consumed by end users" (IFC FIAS, 2007). The study uses the value chain analysis to define how the trade policies enter the basic value chain (see Figure 1.1). The trade policies that enter the different stages of the basic value chain are the policies concerning the VAT (value added tax) redemptions, import tariffs on intermediate inputs, non-tariff barriers, adherence to industry standards, and proactive bodies aimed to

assist value chain participants. The value chain analysis provides a single framework that encompasses all the relevant trade-related policies and allows for a more comprehensive analysis of how trade affects firm productivity.

Unlike most previous research that used value chain analysis to upgrade performance of firms, this research looks at it as a tool for trade development at a national level (International Trade Forum). Improving the performance of individual firms may be inadequate unless the trends in global trade flows are taken into consideration through a strategy that facilitates performance of the entire sector or at least its key players. By analyzing the way in which producers are connected to final markets, disaggregating the trade policies and distinguishing effects of different types of trade policies across different sectors and countries with different comparative advantages,[1] this research aims to address the questions raised by Rodriguez and Rodrik (2000) in their analysis of how trade benefits economic growth.

We argue that industry-specific policies do, in fact, play a dominant role in improving the performance of individual firms, facilitating greater exports and efficiently utilizing a country's abundances. The study makes a proposition that industrial policies are most effective in increasing manufacturing firm productivity when they are targeted at the industries with the largest export potential.

[1] A country's "comparative advantage" is determined by its factor endowments, such as labor, skills, capital, technology and natural resources. The traditional theory of international trade sees comparative advantage as the main determinant of trade. A country is assumed to specialize in those industries that make intensive use of factors with which the country is relatively well endowed. More recent trade theory has highlighted the importance of product differentiation which can explain the incidence of intra-industry trade (Gerber, 2011).

- ***H1: Industry Protection:*** Industry protection is negatively correlated with firm TFP.
- ***H2: Trade Agreements:*** International and regional trade agreements are positively correlated with firm TFP.
- ***H3: Import Tariffs:*** Imports tariffs on key inputs are negatively correlated with firm TFP.
- ***H4: Value-Added Tax:*** Value added tax (VAT) on imported materials is negatively correlated with firm TFP.
- ***H5: Value-Added Tax:*** Time period to reinstate the VAT is negatively correlated with firm TFP.
- ***H6: Export Processing Zone:*** Firm's location in the export processing zone is positively correlated with firm TFP.
- ***H7: Non-Tariff Barriers:*** Number of days to clear customs is negatively correlated with firm TFP.
- ***H8: Non-Tariff Barriers:*** Number of documents to clear customs is negatively correlated with firm TFP.
- ***H9: Non-Tariff Barriers:*** Cost to import/export is negatively correlated with firm TFP.
- ***H10: Industry Standards:*** Compliance with industry standards is positively correlated with firm TFP.

METHODS

We tested the hypotheses on a panel of manufacturing firms in Eastern Europe and Central Asia between 1995 and 2009. The regional emphasis is important because of the region's several unique characteristics. The World Bank study (World Bank, 2008) shows that when compared to other parts of the world, the Eastern Europe and Central Asia (henceforth, ECA) region experienced one of the largest growth in TFP between 1999 and 2005 due to reallocation of labor and capital across sectors. Moreover, the ECA region experienced the largest economic contraction in the world as a result of a global financial crisis (World Bank, 2010). Such a significant increase in productivity in the face of a severe economic contraction represented an impressively large disparity in economic performance, as compared to other world regions, in a relatively short period of time. Studying a region with such a distinct performance allows seeing results more clearly as opposed to studying another region which had an average performance over the same period of time.

Also, there is a large heterogeneity within the region itself. As a result of a socialist regime that ended in the early 1990s, the ECA region offers a somewhat similar institutional environment. Yet, there is a drastic difference in economic performance, especially between the Central and Eastern Europe countries and the former Soviet republics (Campos and Coricelli, 2002). During its transformation process from the socialist regime, the ECA region has undergone significant reforms. Most of these reforms were required as consequence of its membership in the World Trade Organization, or its membership in a regional block. The largest component of these reforms was trade-related. Given such heterogeneity in economic performance, this region makes it a perfect sample to study the productivity changes induced by the trade-related policies while controlling for the effect of institutions.

The period from 1995 to 2009 has been selected because it represents a period of major changes in trade policies in the Eastern Europe and Central Asia region. It also provides the most consistent data sets as most former Soviet countries have missing data points well up to 1993/1994 due to collapse of the socialist regimes and the ensuing confusion and political and economic transformation to market-based economies.

There are several reasons why this study focuses on the manufacturing sector, as opposed to agriculture, mining, or services. Over the last 60 years, the exports of manufactured products have surpassed the exports of agricultural, fuels and mining products, and services (WTO, 2010; UNCTAD, 2011). In 2008, for example, manufactured products accounted for 59% of developing economies' trade, while agricultural products accounted for only 8% (WTO, 2010).

In addition, studies by established economists such as Rodrik (2006) confirm that rapidly growing countries are characterized by large manufacturing sectors. As a result of technological innovations in tools and equipment, productivity in manufacturing sectors will likely continue to increase, while production of services, especially in labor-intensive sectors that rely on human interaction, such as nursing, teaching, performing arts, may have little or no productivity growth over time. Nurses, teachers, or waiters can increase the volume of provided services, however, it can be difficult to achieve without a decline in the quality of the service (Iversen and Wren, 1998).

Specifically in the ECA region, the merchandise trade is characterized by large exports of manufactures and fuels (see Figure 1.2). This study focuses on manufactures because a broad-based manufacturing sector offers more market opportunities than sectors based on few primary-based products (Rodrik, 2006). The manufacturing sector offers greater linkage and spillover effects, as opposed to agriculture or mining sectors, with technological change flowing mainly from manufacturing to other sectors (Szirmai, 2009).

Variables and Measures

The dependent variable is the firm total factor productivity (TFP). The difficulty in calculating firm total factor productivity from the production function arises because of the correlation between unobserved productivity shocks and input decisions. Therefore, ordinary least squares (OLS) estimation yields inconsistent estimators. To address these issues the research follows the Levinsohn-Petrin (2003) approach. The Levinsohn and Petrin (henceforth, LP) estimator is based on the assumptions similar to those of Olley and Pakes (1996) about the timing of a firm's input choices, their change over time, and the productivity process of a firm. However, it is less demanding in terms of required data; in this approach, intermediate inputs are used as a proxy for unobserved productivity shocks.

The main independent variables of interest are trade-related policies listed in Table 1.1. The trade-related policies are comprised of a set of variables that measure overall industry protection, membership in international and regional trade agreements, import tariffs, value-added taxes, and the presence of export processing zones, non-tariff barriers, and industry standards. Each of these variables is measured by several proxies. This table has been developed based on the Foreign Investment Advisory Service framework (IFC FIAS, 2007). The industry-specific value chain approach presented in the FIAS report is designed to facilitate formulating a targeted reforms agenda to support the private sector development. It allows analyzing the trade-related policies concerning tariff and non-tariff barriers, compliance with the industry standards and other market issues in a comprehensive manner. Apart from presenting a sound analytical framework, it also offers a practical approach for using the value chain analysis as a tool to identify impediments to industry growth and it serves as a basis for the development

of targeted policies. Such policies help achieve a better access to intermediate inputs and to understand the obstacles to greater integration of a targeted industry with the global market.[2]

To see if the trade-related policies should be targeted at industries within a country's comparative advantage, we start with identifying the industries with high/growing economic rents, or top export industries. Table 1.2 for Armenia summarizes the methodology for industry selection. The industries with high/growing economic rents are selected according to the US dollar value of a nation's goods exports across 36 clusters in 2007. They are the most prominent in the country's export portfolio. The research utilizes the data and the methodology developed by M. Porter and the Institute for Competitiveness at Harvard University to identify top export clusters. When unavailable, the data on top export commodities are taken from the UN Commodity Trade database (UN Comtrade). Based on the firm's main product highlighted in its reported ISIC code in the Enterprise Surveys (World Bank), the study categorizes the firm into the corresponding top four export clusters. When missing firms in that cluster, the study skips the cluster with a missing firm data and assigns that rank to the following cluster. The cut-off threshold is top 10 clusters (highlighted in grey). [3] In the further analysis, to distinguish the most important industries, the study uses the dummy variable for the industries that rank as top 4 in a country's export portfolio in the ECA region.

In terms of control variables, most studies find that the most productive firms tend to be large, exporting and foreign-owned. Dabla-Norris, Kersting, and Verdier (2010) identified that large, predominately exporting and privately owned (by foreign or domestic private interests) firms tend to be the most productive. Bernard, Stabilito, and Yoo (2010) have also confirmed that larger firms tend to be

[2] We also developed a table that identifies the key intermediate inputs used in each industry (see Table 1.3). It is based principally on the major capital equipment required for each firm to manufacture their products.

[3] For example, there were no firms representing the Jewelry, Precious Metals and Collectibles cluster in Armenia, or firms in the Plastics cluster in Azerbaijan, thus the study had to go down to the next cluster. When the industries are represented by firms outside of the top four clusters, these industries were assigned a rank value of 0. The reason the study had missing firms in certain clusters is because of the nature of the Enterprise Surveys data. To keep comparability with previous surveys and across countries, the two industries were selected in *all* countries: the manufacture of food products and beverages, and manufacture of apparel and fur. Other industries that were added to the survey do not necessarily represent the firms within the top 10 clusters. The study keeps the foregoing comment in mind when interpreting the final results.

more efficient, especially if they are foreign-owned; such firms are most likely to self-select into exporting. In terms of labor skills, Escribano and Guasch (2005) find external training and having a fraction of the staff engage in R&D to be particularly important for the productivity of smaller firms. Productivity in larger firms seems to benefit more from the quality certifications, as well as having the ability to upgrade to machinery which is controlled by computers (especially in old and large firms). Additionally, it was noted that the more educated the staff was, the greater the level of productivity was achieved. Based on these observations, the study uses the control variables, which include firm size, age, ownership (foreign versus domestic, private or state ownership, or publicly-traded status), as well as exporter/importer status, and labor skills. Table 1.4 describes the proxies for these variables and their units of measurement.

Method of Analysis

To model the effects of the industry and country levels, the study uses a two-level HLM technique. Specifically, a two-level HLM model is used to test the effects of j industries (level 1) nested within k=1, … K countries (level 2). The model is as follows:

$$TFP_{jk} = \beta_{0k} + \beta_{1k} Control_{jk} + \beta_{2k} Trade_{jk} + \varepsilon_{jk} \quad (1.1)$$

Level 2: the coefficients at level 1 are treated as outcomes to be predicted.

$$\beta_{0k} = \gamma_{00} + \gamma_{01} Trade_k + u_{0k} \quad (1.2)$$

$$\beta_{1k} = \gamma_{10} + \gamma_{11} Trade_k + u_{1k} \quad (1.3)$$

$$\beta_{2k} = \gamma_{20} + \gamma_{21} Trade_k + u_{2k} \quad (1.4)$$

Where:

TFP_{jk} = log-level of firm total factor productivity aggregated to the industry-level *j* in country *k*

$Control_{jk}$ = control variables (i.e., firm characteristics) of firm *i* aggregated to the industry-level *j* in country *k*

$Trade_{jk}$ = the vector of industry-level trade policies in industry *j* and country *k*, (fixed effects)

$Trade_k$ = the vector of country-level trade policies in country *k*, (fixed effects)

β, γ = regression coefficients

$\varepsilon_{ij,t}$, u_{0k}, $u_{1k,} u_{2k}$ = *iid* random terms determined independently of production inputs (random effects)

The fixed effect would refer to the overall effect of a trade-related policy on firm productivity. The random effect gives information on whether or not this effect differs between countries.

Data sources

The study uses a firm-level survey of a private sector collected by the World Bank through the Enterprise Surveys (ES) in various developing and emerging markets. The dataset is publicly available at the World Bank Enterprise Surveys website.[4] Businesses surveyed include manufacturing, retail, construction, transport, communication, and other services. The Enterprise Surveys contain information necessary to calculate firm-level productivity, or TFP indices. These include annual sales, employment (total hours worked per year), labor costs, and net book value of capital stock. The database provides the nominal values of the variables due to the lack of price indices (see Table 1.5). From a range of available datasets, the study uses the "panel" dataset, which covers the time period of 2005 and 2009. The study uses the manufacturing firm TFP data for the year of 2009 as the benchmark to gauge the effect of targeted trade-related policies. The study excludes all the services industries; thus, it focuses on industries with the ISIC codes 15-37. Table 1.6 provides a snapshot of a sample of manufacturing firms used in this study.[5]

[4] https://www.enterprisesurveys.org/Methodology/

[5] The Eastern Europe and Central Asia (ECA) region includes: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, FYR Macedonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan. However, the study had to drop Serbia due to the lack of reliable data (due to the nature of the survey, most of firms in Serbia dropped out of the survey and have been replaced with other firms' data). That prevented the study from being able to calculate firm total factor productivity which requires at least two years of data. The data on trade policies is mostly absent for Turkmenistan as well.

RESULTS

Table 1.7 provides the summary statistics. Tables 1.8-1.9 provide correlation matrices. The firm characteristics have been aggregated to the industry-level. It appears that the sample is somewhat uniformly distributed in terms of firm size. In terms of previous state ownership, there are more non-state firms that are in the top 4 export industries.

Testing the hypotheses requires conducting a hierarchical linear modeling analysis on the relationship between the value of firm total factor productivity and firm control variables (aggregated to the industry-level) without including industry protection in the model. The results of the empty model are displayed in Table 1.10 (see Model 1a). The sample has 26 countries. The average productivity level (based on LP) across countries, reflected in the intercept term, is 65.35676 (γ_{00}). Results indicate that the variance in the intercepts of the lines that represent the different countries (i.e. the variance across countries) is equal to 381.9. Because these estimates are larger than their standard errors, there appears to be significant variations in country means. To partition the variance across levels, the following variance components can be used. In the LP case, the intra-class correlation coefficient for the country level is equal to [381.9/(2353.4+381.9)] = 0.139, meaning that roughly 13.9% of the variance is attributable to the country-level. These results indicate that in a further analysis it would be appropriate to look at the country-level variables to account for such variance.

The effect of having skilled labor and a firm's age becomes not statistically significant and the coefficients change their sign to negative once the study introduces the dummy variable for the state ownership and size of firms in the industry. Some control variables may be correlated with each other, for example: state ownership and age, size and exporter status, size and number of skilled employees, size and age, exporter and foreign ownership, or importer and exporter status (see Table 1.8). Some industry characteristics such as firms' exporter status might be captured by the variable pertinent to this study such as the rank of the industry in the export portfolio of the country (measured in 2007). The rank value has been re-coded with a value equal to 1 if the industry is ranked from top 1 to 4, and a value equal to 0 otherwise. The coefficient on top four export industries is positive and statistically significant at 90%

confidence level, meaning that the industries ranked as the top four in the country's export portfolio, on average, tend to be more productive. For the subsequent analysis, it was decided to drop the exporter status as it seems to be measured by the dummy variable for the industry's rank in the country's export portfolio.

Hypothesis 1: industry protection

To test the first hypothesis, the study uses the industry protection variables: the applied tariffs (weighted) and non-tariff barriers (frequency ratios). Models 10-16 (see Table 1.11) show the effect of industry-level policies on a measure of firm productivity. Because the alternative hypothesis is directional, two conditions need to be met. First, the printed probability has to be divided by 2 before being compared to the alpha level 0.05 set prior to the beginning of the analysis. Second, the coefficient has to be consistent in directionality with the alternative hypothesis.

The coefficients on applied tariffs (import weighted) for 1997, 2002, 2007 and 2008 are negative and their p-values divided by two are less than 0.05. Thus, we can reject the null hypothesis and accept the alternative hypothesis that for firms in all industries, the applied import weighted tariffs are negatively associated with firm TFP once we control for industry characteristics. To see if the effect of trade-related policies varies for those top 4 industries, the study uses the interaction term between trade-related policies and the dummy variable "Rank 1-4" (Models 17 and 19). For firms in the top four export industries, the alternative hypothesis on the negative effect of applied import tariffs has been supported. A one-unit increase in the average applied tariff (import-weighted, 2008) for firms in the top four export industries is associated with an expected decrease in firm TFP of 1.96.

For firms in all industries, a coefficient on a measure of non-tariff barriers is not statistically significant so we cannot be reasonably sure that it is other than zero. However, for firms in the top four export industries, the coefficient is negative. The potential explanation for non-significance of non-tariff barriers is the lack of reliable data because that measure is available only for 1999 and for selected countries (9 countries).

These findings support the proposition made in H1 on industry protection measured by applied import tariffs (weighted) that it is negatively correlated with firm TFP. The results hold for various industry characteristics. It should be noted that industries ranked as top four in the country's export portfolio, on average, perform better. The results hold when the study controls for EU membership and introduces the interaction between EU membership and rank of the industry in the country's export portfolio (Models 18 and 20).

It should also be noted that previous state ownership and size have a significant positive effect on firm productivity in the ECA region.

Hypothesis 2: trade agreements

Since there is a statistically significant variation at the country-level, the study incorporates the country-level predictors into the model. That can be done when testing the second hypothesis H2. As expected, there is a high correlation between membership in various trade agreements and regional blocks such EU, WTO, and OECD, as well as CIS, GUUAM, EurAsEc, and oil and gas exporter status. Thus, the study focuses on EU and WTO only. From the results of the Models 21a-24a, we can see that the variance component for the random intercept at the country level became not statistically significant once the study introduced EU or WTO membership (see Table 1.12). This suggests that the study may be justified in constraining the effect to be fixed.

The variance component corresponding to the dummy variable for the four top export industries and cross-level interactions between membership in EU/WTO and the dummy variable for the industry being in the top four in the country's export portfolio are not statistically significant. Such interaction allows testing if the effect of the industry being in the top four in the country's export portfolio varies between countries. It seems that the difference is not statistically significant. The AIC and BIC statistics reported in STATA are given in smaller-is-better form. Comparing both the AIC and BIC statistics in Table 1.11, it is clear that the final Models 21-24 are more preferable to the previous models because the fit measured by AIC and BIC statistics is lower.

Overall, across all industries, these results support the hypothesis that membership in the EU or WTO is positively associated with firm productivity, measured as total factor productivity and aggregated to the industry-level. However, the effect does not differ depending on the rank that industry holds in the country's export portfolio.

Hypothesis 3: import tariffs on key intermediate inputs

The effect of applied import-weighted tariffs on intermediate inputs, such as key machinery and equipment, is negative and statistically significant in the case of total factor productivity of firms in the top four export industries (see Table 1.13, Model 25 a). The study introduces the cross-level interaction in the model between the country's characteristics, such as membership in the EU, and the dummy variable for the industry being in the top four in the nation's export portfolio.

For firms in all industries, the effect is not statistically significant. Thus, we can be reasonably sure that the coefficient for input tariffs for firms in the top four export industries is negative and statistically significant (see Models 25a-26a).

Hypotheses 4-5: VAT and VAT refund period

Since the data on value added tax is measured at the country level, the study introduces an interaction between the measure of value added tax (VAT) and industry control variables such as a dummy for the industry being the top four in the country's export portfolio (Rank 1-4). The results of such model are displayed in Table 1.14 . For firms in the top four export industries, the effect of the VAT is positive. For firms in all industries, we cannot be reasonably sure that the effect of a value added tax rate (VAT in 2009) is other than zero.

The results testing for the effect of the refund period required to obtain the VAT refund on firm productivity are provided in Model 27 a-b (see Table 1.14). Since this variable is measured at the country level, the study introduces the cross-level interaction between the time period to obtain the tax refund and the dummy variable for the industry being in the top four. For firms in the top four export industries, the effect of the time period to obtain the VAT refund is not statistically significant. For firms in all

industries, the effect is negative and statistically significant effect in case of firm performance measured by the TFP. It appears that this hypothesis is supported only for firms across all industries; a longer time period to reinstate the VAT is associated with a decrease in the average firm productivity measured by the TFP. The results under the alternative hypotheses H4 and H5 also hold after the study controls for EU membership (see Models 29 and 30).

Hypothesis 6: export processing zone

For firms in the top four export industries, the coefficient for the export processing zone is not statistically significant, so we cannot be sure that the effect is other than zero. For firms in all industries, the coefficient is negative; however, it becomes non-significant once we control for EU membership (see Table 1.15, Model 33a). There are some country–level random effects, as expected. Membership in the EU accounts for most of the variation at the country-level. The cross-level interactions between EU membership and the dummy variable for the industry rank are not statistically significant.

Hypotheses 7-9: non-tariff barriers to trade

Since the number of days to clear customs is measured at the country level, we can allow the cross-level interaction between this variable and the dummy for the industry being in the top four in the country's export portfolio. The interaction is not statistically significant; thus, for firms in the top four export industries, we cannot be reasonable sure that the effect of non-tariff barriers, measured as the number of days to clear exports/imports, is something other than zero (see Table 1.16, Models 34 and 35).

The alternative hypothesis on the negative effect of non-tariff barriers, measured as the number of documents to export/import, has not been supported for firms in the top four export industries. For firms in all industries, the hypothesis has been supported in the case of the number of documents to import (see Table 1.16, Models 36 and 37).

The alternative hypothesis on the negative effect of non-tariff barriers, measured as a cost per container to export/import, has not been supported for firms in the top four export industries. For firms in all industries, the hypothesis has been supported for firm TFP (see Table 1.16, Models 38 and 39).

Hypothesis 10: compliance with industry standards

The positive effect of compliance with industry standards, measured as a dummy variable=1 if firms have an internationally recognized quality certificate, has been supported for firms in the top four export industries. It is suggesting that better compliance with industry standards may have a more positive impact on firm productivity (see Table 1.17, Models 40-42). The results hold after the study controls for EU membership.

Robustness

We run several additional analyses not presented here for the sake of brevity, to verify that the findings are not explained by other reasons and to confirm the robustness of the results. The alternative explanations were not supported. First, we used alternative measures and found that they yield similar results. We used the labor productivity (sales over a number of employees) as an alternative measure of firm productivity. We controlled for firm size using measures of sales in place of labor. We also analyzed whether the timing and pace of targeted reforms affected the findings. We used the measures of import tariffs for different years. The results of these analyses support the same conclusions reported above. The results have been checked for robustness by carrying a similar analysis using the benchmark countries. The benchmark countries include high-income OECD countries such as Germany, Spain, Ireland, Portugal, South Korea, and Greece.

Similar to Topalova and Khandelwal (2010), we carry a test for political protection by regressing the change in output import tariffs between 2002 and 2008 on industrial characteristics such as sales and the number of employees, since these are the only variables available for the initial year 2002. It is also possible to add some industry characteristics measured in 2005; however, one has to be cautious when interpreting the results. The results are presented in Table 1.18. The table indicates no statistical correlation between changes in output import tariffs and of any industry characteristics except the share of unskilled workers in 2005 (columns 1-3). In case of regressing changes in import tariffs on key intermediate inputs, most variables turn out to be statistically significant (columns 4-6).

Also, to investigate whether policymakers adjusted tariffs in response to industry's productivity levels, the study regresses the future measures of trade protection (2008) on industry productivity levels in 2005 (see Table 1.19).

DISCUSSION

This study finds that, in most instances, targeted policies do not show a significant impact on manufacturing firms' TFP. That is an unexpected finding; it somewhat contradicts the seminal work by Lin (2009), which has been used as a basis for this study. Lin (2009, 2012) argues that a country should target industries that follow a country's comparative advantage. Lin also predicts that by targeting industries with specific policies, a country is able to incentivize the industries within its sphere of comparative advantage to invest in value added activities, which increase TFP.

One of the potential reasons as to why targeted trade policies tend not to work in the ECA region is a lack of comprehensive industry-level data. In the few instances when the hypotheses were supported, the data was available for the industry-level. Thus, it is possible to conclude that the actual data is critical (industry- versus country-level) and can dramatically change the results. Once additional industry-level data becomes available, it is entirely plausible that this study may find more evidence in favor of targeted policies impacting the manufacturing firm TFP. However, at this juncture, the limited availability of industry-level data prevents the author from conducting further analysis.

Another potential explanation is related to the older literature that precedes Lin (2009). Until very recently, the majority of the literature on economic development opposed using targeted trade policies to favor certain industries with the goal of increasing a country's overall productivity. It advocates using reforms that affect *all* industries, rather than reforms that target only certain industries. The reasoning was that targeting particular industries is accompanied by three major challenges such as: identifying such industries, tackling a severe information asymmetry between government and firms, and preventing higher rent-seeking by firms, i.e., corruption (World Bank Development Report, 2005). Hence, according to that literature, targeting certain industries would promote/breed corruptive practices, and most benefits expected from implementing targeted policies would be undermined. The earlier literature clearly

identifies that targeted trade-related policies would not work in improving firm productivity due to issues of corruption. Inter alia, while Lin's New Structural Economic Theory acknowledges corruption and suggests that by adopting policies to target specific industries within their comparative advantages, corruption would be mitigated in the long-run when governments remove their target policies aimed at specific industries. Lin argues that firms entering those industries that have already been identified as being in the sphere of a country's comparative advantage become more viable as opposed to firms entering in industries not classified within the country's sphere of comparative advantage. Hence, if we are to fully prove that targeted government trade policies for certain industries do, in fact, yield higher TFP, in the future studies, we should account for the effect for corruption.

This article has some limitations because we do not distinguish between the strategic policies initiated by respective governments and the policies imposed by the WTO, or the members of a corresponding regional block such as EU or CIS. Future research could potentially focus on distinguishing the effects of the initiated and imposed policies. Also, ideally, to fully exploit the value chain analysis, the study requires connecting producers to supporting services. Unfortunately, the lack of data precludes the study from incorporating this type of information in its value chain analysis. Therefore, the study is limited to simply tracing manufactured products to final destination and identifying the industry standards existing in those markets.

Since we use deflated revenues rather than physical product to describe output and calculate firm productivity, most likely such study would suffer from a blurred distinction between the actual factor productivity and price-cost mark-ups. It creates a bias in case of production differentiation or market power differences between firms (Arnold, 2005). One of the drawbacks of using the Enterprise Surveys is missing data. That issue is being handled by interpolating the missing data. Also, the way the Enterprise Surveys selected firms is considered to be somewhat skewed for the purpose of this dissertation. To keep comparability with previous surveys and across countries, the two industries were selected in all countries: the manufacture of food products and beverages, and manufacture of apparel and fur. Another major limitation is a lack of consistent firm-level data for that region that would go back in time. Thus, to

test the hypotheses, the study uses the manufacturing firm TFP data for the year of 2009 as the benchmark to gauge the effect of targeted trade-related policies. For the benchmark countries, firm-level data is only available for 2005, thus, the study used the data for that particular year.

For future research, the study could be extended to apply to services and/or multiproduct firms. As more data becomes available, the study would aim to connect producers in industries with comparative advantage to supporting services, in order to fully utilize the value chain analysis. As more waves of Enterprise Surveys become available, it may be worthwhile to split the data into pre- and post-crisis periods and extend the study to other regions and benchmark countries. Given that the global financial crisis is still unfolding, the effects of changes in trade policies can be better ascertained in the future. Another important area for future research is to evaluate how the relationship between the targeted trade-related policies and firm productivity changes depending on the level of corruption. Such analysis has not been done before; hence, this would contribute greatly to the existing literature, as well as to our understanding of the point at which targeted policies would result in greater TFP.

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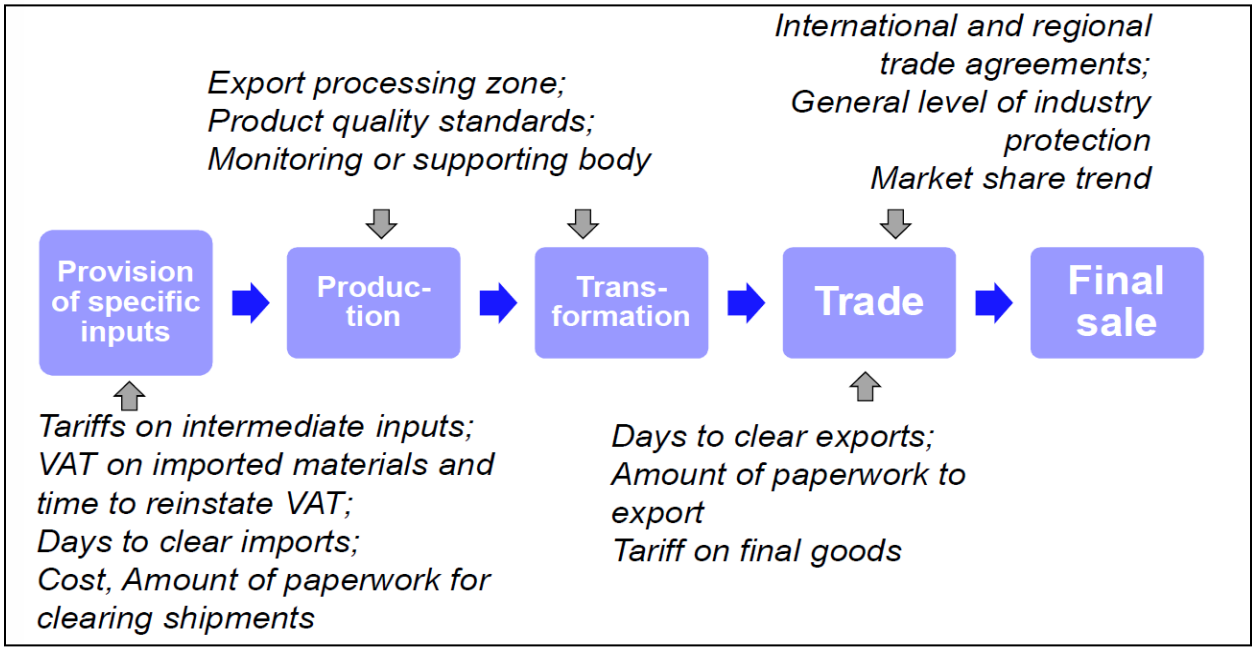
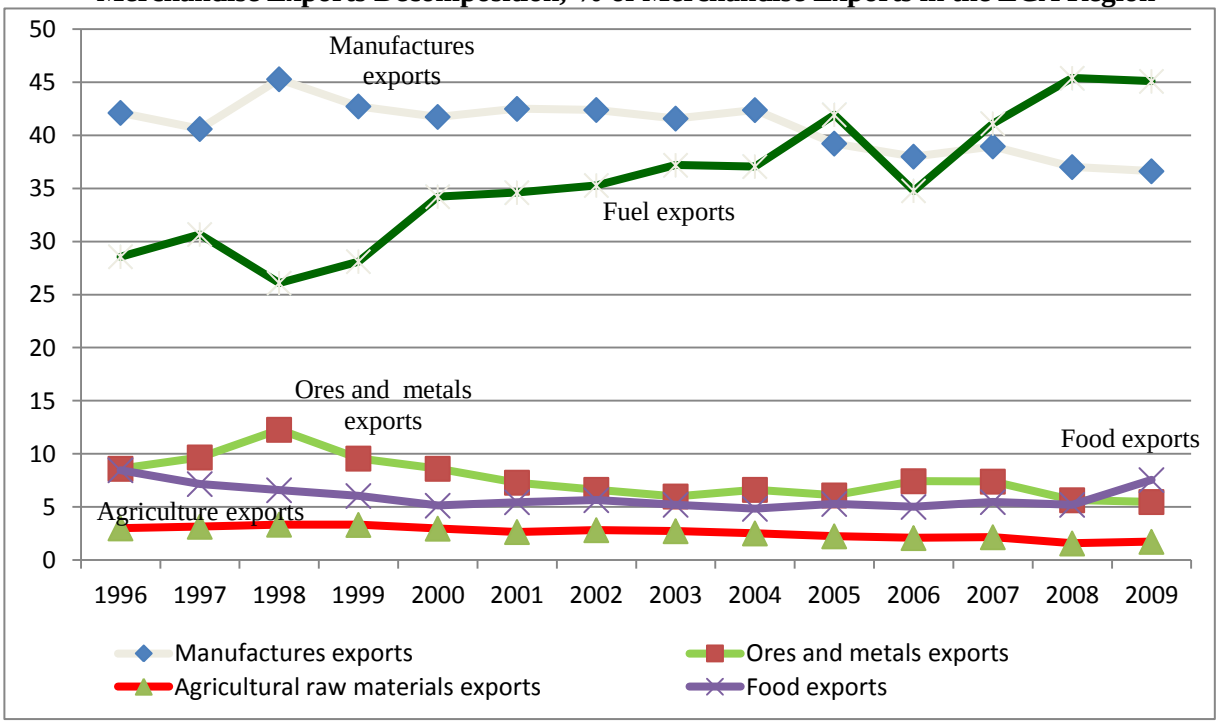
APPENDIX

Figure 1.1
Basic Value Chain



Source: Adapted from Value Links Manual, GTZ Eschborn, 2007.

Figure 1.2
Merchandise Exports Decomposition, % of Merchandise Exports in the ECA Region



Source: WDI 2011, World Bank.
Note: ECA – Europe and Central Asia.

Table 1.1
Trade-Related Policies

	Trade Policy	Variable	Response	Firm	Industry	Country	Year	Source
1	**Overall Protection**							
1.1	Weighted Applied Tariff	w_ave[year]	%		x		1997, 2002, 2007, 2008	World Integrated Trade Solution Database WB
2	**Regional/International Trade Agreements**							
2.1	Membership in a regional trade agreement	WTO, EU, CIS, CEFTA, ECOTA, BAFTA, GUAM, EurAsEc	Yes/No			x		International Trade Statistics 2010; EIA, Global Preferential Trade Agreements Database (GPTAD), and various sources for EU, OECD membership (as of August 2011)
3	**Import Tariffs on Key Intermediate Inputs**							
3.1	Weighted Applied Tariff	w_ave[year]input	%		x		1997, 2002, 2008	World Integrated Trade Solution Database WB; Key Intermediate Inputs defined by author (see Table 3.4)
4	**Value Added Tax (VAT)**							
4.1	VAT rate	VAT2009	%			x	2009	Taxes at a Glance 2009 PwC; Cedidlová,M.; Redinová, H. (2010) VAT in the EU (2000 – 2010)

4.2	Time to Reinstate VAT	refund09	Number of months			x	2009	Taxes at a Glance 2009 PricewaterhouseCoopers
5	**Export Processing Zone**							
5.1	Dummy for industry being in the zone	zone	Yes/No		x			IFC FIAS 2008, ILO 2007, US & Foreign Commercial Service and US Department of State
6	**Non-Tariff Barriers: Days to Clear Customs**							
6.1	Days to Clear Exports	d4, q8a	Number			x		Enterprise Surveys
6.2	Days to Clear Imports	d14, q16a	Number			x		
7	**Non-Tariff Barriers: Amount of Paperwork**							
7.1	Documents to Export	docexport07	Number			x	2007-2009	Doing Business
7.2	Documents to Import	docimport07	Number			x		
8	**Non-Tariff Barriers: Cost to export/import**							
8.1	Cost to Export	costexport07	Number			x	2007-2009	Doing Business
8.2	Cost to Import	costimport07	Number			x		
9	**Industry Standards**							
9.1	Internationally-Recognized Quality Certificate	b8	Yes/No	x	x			Enterprise Surveys

Source: Adapted from IFC FIAS (2007).

Note: DB – Doing Business, World Bank, ES – Enterprise Surveys, World Bank, GPTAD – Global Preferential Trade Agreement Database, World Bank, World Trade Organization (WTO), UNCTAD – United Nations Committee on Trade and Development.

Table 1.2
Armenia's Exports by Cluster, 2007

Armenia							
Services Clusters Excluded							
Exports by Cluster, 2007							
Cluster	**Export Value (in $ thous.)**	**Begin Year**	**End Year**	**Value Rank**	**Rank**	**ISIC Rev.2**	**ISIC Rev.3.1**
Metal Mining and Manufacturing	$433.78	1997	2007	78	1	371,381	
Jewelry, Precious Metals and Collectibles	$164.12	1997	2007	60	n.a.	372	
Agricultural Products	$47.18	1997	2007	123	2	311,312,313	
Prefabricated Enclosures and Structures	$37.12	1997	2007	64	3		2811, 2915
Construction Materials	$33.05	1997	2007	76	4	369	
Plastics	$27.15	1997	2007	93	0	356	
Processed Food	$15.60	1997	2007	106	0	362	1554, 1553, 1520
Power and Power Generation Equipment	$10.03	1997	2007	67	0		3110
Chemical Products	$7.11	1997	2007	110	0	351, 352	

Communications Equipment	$6.71	1997	2007	89	0		3200
Production Technology	$4.87	1997	2007	95	0	382	
Fishing and Fishing Products	$4.67	1997	2007	108	0		1512
Tobacco	$3.47	1997	2007	84	0		1600
Lighting and Electrical Equipment	$3.36	1997	2007	89	0		3100

Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.

Note: n.a. – not available. Value Rank indicates the nation's rank among all reporting nations for goods exports in the cluster. It reflects the magnitude of the size of the nation's cluster when compared to the rest of the world. The Rank indicates the cluster's rank among the nation's clusters; it shows the importance of that cluster to the nation's exports.

Table 1.3
Defining Key Intermediate Inputs

ISIC Rev 2	Product name	Intermediate Inputs	ISIC Rev 3.1
311	Food manufacturing	Manufacture of machinery for food, beverage and tobacco processing	2925
313	Beverage industries	Manufacture of machinery for food, beverage and tobacco processing	2925
314	Tobacco manufacturers	Manufacture of machinery for food, beverage and tobacco processing	2925
321	Manufacture of textiles	Manufacture of machinery for textile, apparel and leather production	2926
322	Manufacture of wearing apparel, except footwear	Manufacture of machinery for textile, apparel and leather production	2926
323	Manufacture of leather and products of leather	Manufacture of machinery for textile, apparel and leather production	2926
324	Manufacture of footwear	Manufacture of machinery for textile, apparel and leather production	2926
331	Manufacture of wood and products of wood	Manufacture of machine tools	2922
332	Manufacture of furniture and fixtures	Manufacture of machine tools	2922
341	Manufacture of paper and paper products	Manufacture of other special purpose machinery	2929
342	Printing, publishing and allied industries	Manufacture of other special purpose machinery	2929
351	Manufacture of industrial chemicals	Manufacture of other special purpose machinery	2929
352	Manufacture of other chemical products	Manufacture of other special purpose machinery	2929
355	Manufacture of rubber products	Manufacture of other special purpose machinery	2929
356	Manufacture of plastic products	Manufacture of other special purpose machinery	2929
361	Manufacture of pottery, china and earthenware	Manufacture of other special purpose machinery	2929
362	Manufacture of glass and glass products	Manufacture of other special purpose machinery	2929
369	Manufacture of other non-metallic mineral products	Manufacture of machine tools	2922
371	Iron and steel basic industries	Manufacture of machinery for metallurgy	2923
372	Non-ferrous metal basic industries	Manufacture of machinery for metallurgy	2923
381	Manufacture of fabricated metal products, except machinery	Manufacture of machine tools	2922
382	Manufacture of machinery, except electrical	Manufacture of other special purpose machinery	2929
383	Manufacture of electrical machinery	Manufacture of other special purpose machinery	2929
384	Manufacture of transport	Manufacture of bearings, gears, gearing and driving elements	2913
385	Manufacture of professional and scientific equipment	Manufacture of other special purpose machinery	2929
390	Other manufacturing industries	Manufacture of other special purpose machinery	2929

Source: author, based on input-output tables for select countries.

Table 1.4
Control Variables from the World Bank Enterprise Surveys

Definition	Question	Unit of measurement	Response type	Variables
Control variables	Staff-skilled workers	Percentage of skilled production workers in firm's staff	Percent	l4a/l1
	Size of the firm	Categorical variable taking value: 1 = small (<20 employees), 2 = medium (20-99 employees, 3 = large (>99)	Category: 1-3	size
	Age of the firm	Difference between the year that the plant started operations and year of survey	Year	b5
	Dummy for ownership	Dummy variable taking value 1 if the firm previously belonged to the government	Yes/No	ECAq5
	Dummy for foreign direct investment	Variable taking value 1 if any part of the capital of the firm is foreign	Yes/No	b2b
	Dummy for exporter	Variable taking value 1 if firm exports directly	Yes/No	d3c
	Dummy for importer	Variable taking value 1 if firm imports	Yes/No	d13

Source: Enterprise Surveys, BEEPS IV (2008/2009).

Table 1.5
Production Function Variables and General Information at Plant Level

1. Sales: Used as the measure of output for the production function estimation. Sales are defined as total annual sales. The series are deflated by using the country-level Wholesale Price Index (WPI), base 2005.
2. Employment: Total number of permanent and temporary workers.
3. Total labor costs: Total expenditures on personnel, including wages, salaries, bonuses, etc. The series are deflated by using the country-level Wholesale Price Index (WPI), base 2005.
4. Materials: Total costs of intermediate and raw materials used in production (excluding fuel). The series are deflated by using the country-level Wholesale Price Indexes (WPI), base 2005.
5. Capital stock: Current replacement value of fixed assets (machinery and equipment). The series are deflated by using the country-level Gross Fixed Capital Formation growth rate.
6. Industrial classification: i) food and beverages; ii) textiles; iii) wearing apparel; iv) leather; v) wood products; vi) furniture; vii) paper products; viii) printing; ix) chemical products; x) rubber; xi) plastics; xii) glass; xiii) basic metals; xiv) fabricated metal products, excluding machinery and equipment; xv) machinery and equipment, excluding electrical; xvi) electrical machinery apparatus, appliances and supplies; xvii) transport equipment; xviii) professional and scientific equipment; xix) other.
9. Regional classification: i) Central; ii) North-West; iii) Siberia; iv) South; v) Ural

Source: adapted from Pena, 2009.

Table 1.6
Sample Countries in the ECA Region

a.1 Country Code	Freq.	Percent	Cum.
Albania	6	1.02	1.02
Belarus	19	3.23	4.25
Georgia	19	3.23	7.48
Tajikistan	29	4.93	12.41
Ukraine	26	4.42	16.84
Uzbekistan	31	5.27	22.11
Russia	13	2.21	24.32
Poland	29	4.93	29.25
Romania	55	9.35	38.61
Kazakhstan	31	5.27	43.88
Moldova	61	10.37	54.25
Bosnia	26	4.42	58.67
Azerbaijan	38	6.46	65.14
FYROM	31	5.27	70.41
Armenia	44	7.48	77.89
Kyrgyz	19	3.23	81.12
Estonia	11	1.87	82.99
Czech Republic	5	0.85	83.84
Hungary	17	2.89	86.73
Latvia	13	2.21	88.95
Lithuania	10	1.70	90.65
Slovakia	10	1.70	92.35
Slovenia	15	2.55	94.90
Bulgaria	17	2.89	97.79
Croatia	11	1.87	99.66
Montenegro	2	0.34	100.00
Total	588	100.00	

Source: Enterprise Surveys, World Bank.
Note: Frequency (FREQ) indicates a number of firms.

Table 1.7
Summary Statistics in the ECA Region

Variable	Obs	Mean	Std. Dev.	Min	Max
size	588	1.95068	.8020095	1	3
type	588	.3265306	.4693432	0	1
FDI	588	.170068	.3760124	0	1
exporter	588	.3282313	.4699693	0	1
skilled	588	70.43537	181.5752	0	2650
importer	588	.5646259	.4962281	0	1
age	572	19.16958	19.2497	2	184
w_ave1997	241	9.886017	8.347899	0	31.43
w_ave2002	588	9.497449	7.407033	0	63.69
w_ave2007	588	4.904541	4.866838	0	25.88
w_ave2008	588	4.44619	4.138981	0	28.96
ntb_core_w	183	.0442595	.1115426	0	.8909985
EU	588	.3095238	.4626909	0	1
WTO	588	.6785714	.4674225	0	1
w_ave1997i~t	254	1.985945	3.056621	0	14
w_ave2002i~t	586	2.668003	2.799455	0	12.02
w_ave2008i~t	588	1.611905	2.186681	0	9.97
VAT2009	588	18.71939	2.372722	12	22
refund09	521	7.569616	16.4882	.67	60
zone	588	.335034	.4724042	0	1
avgexport	588	4.559566	4.553438	1.4	20.38
avgimport	588	10.25492	12.43174	1.8	52.5
docexport07	588	6.894558	2.130121	3	13
docimport07	588	8.192177	2.707578	4	14
costexport07	588	1593.474	726.6524	645	3200
costimport07	588	1810.959	1032.707	675	4500
certificate	588	.3809524	.4860344	0	1
ave_corr1	588	2.155536	.9909352	1	6
ave_corr2	588	1.913783	.9295878	1	6
ave_corr3	588	1.722434	.8820882	1	6
ave_corr4_~d	588	2.856414	.9383095	1	5
ave_corr5_~e	588	2.487581	.9865118	1	5

Table 1.8
Correlation of Variables on Firm Characteristics

	size	age	type	FDI	exporter	importer	skilled
size	1.0000						
age	0.2727	1.0000					
type	0.3912	0.4710	1.0000				
FDI	0.2597	-0.0635	-0.0822	1.0000			
exporter	0.3711	0.1630	0.1699	0.1862	1.0000		
importer	0.3314	0.0923	0.1195	0.2132	0.3475	1.0000	
skilled	0.3933	0.1654	0.2140	0.2293	0.2369	0.1080	1.0000

Table 1.9
Correlation of Variables on Trade-Related Policies

	w_a~2008	ntb_co~w	EU	WTO	w~8input	VAT2009	refund09	zone	avgexp~t	avgimp~t	docex~07	docim~07	coste~07	costi~07	certif~e
w_ave2008	1.0000														
ntb_core_w	-0.1848	1.0000													
EU	-0.4976	0.2020	1.0000												
WTO	-0.4860	0.1090	0.5314	1.0000											
w_ave2008i~t	0.2249	-0.1301	-0.6542	-0.0627	1.0000										
VAT2009	-0.2014	-0.1234	0.2372	0.4430	-0.0331	1.0000									
refund09	0.4546	-0.1404	-0.5260	-0.9753	0.0720	-0.3723	1.0000								
zone	0.0293	-0.1264	-0.1698	0.0602	0.2265	-0.0066	-0.0180	1.0000							
avgexport	0.1643	-0.1668	-0.1493	-0.2230	0.0088	0.5322	0.1646	-0.1332	1.0000						
avgimport	0.3907	-0.2022	-0.3995	-0.6206	0.0662	0.1657	0.6112	0.0385	0.7084	1.0000					
docexport07	0.4474	-0.1394	-0.6768	-0.7919	0.2789	-0.3804	0.7649	0.0815	0.1113	0.4664	1.0000				
docimport07	0.4782	-0.1303	-0.7340	-0.8493	0.3008	-0.5550	0.7971	0.0578	0.0907	0.4194	0.8993	1.0000			
costexport07	0.5164	-0.0677	-0.8459	-0.7039	0.4601	-0.5744	0.6241	0.0150	-0.0016	0.2404	0.7430	0.8574	1.0000		
costimport07	0.5110	-0.1186	-0.9263	-0.6695	0.5440	-0.5448	0.6413	0.1163	-0.0850	0.2612	0.7599	0.8504	0.9599	1.0000	
certificate	-0.2926	-0.0046	0.3133	0.2519	-0.1151	-0.0157	-0.2697	0.0543	-0.2110	-0.3906	-0.1449	-0.1662	-0.1959	-0.2413	1.0000

Table 1.10
HLM Results: Firm Control Variables
Dependent Variable is Log of TFP (2009)

Fixed Effects	Control Variables	Model 1a	Model 2a	Model 3a	Model 4a	Model 5a	Model 6a	Model 7a	Model 8a	Model 9a
Intercept γ_{00}	Intercept γ_{00}	65.36***	57.87***	56.57***	52.64***	50.84***	54.32***	48.91***	30.66***	33.15***
Trade (industry-level) γ_{20}										
Control (industry-level) γ_{10}	Firm Age		0.32***	0.26***	0.017	0.006	0.006	-0.030	-0.062	-0.034
	Skilled Labor			0.036***	0.021	0.017	0.017	0.006	-0.0001	-0.001
	State ownership				0.294***	0.308***	0.321***	0.310***	0.229***	0.270***
	Foreign ownership					0.098	0.115	0.029	-0.008	0.001
	Importer						-0.069	-0.09	-0.109**	-0.116*
	Exporter							0.281***	0.218***	0.251***
	Size								12.59***	7.894***
	Rank 1-4									9.825***
Trade (country-level) γ_{01} Trade (country)*Trade(industry) γ_{21} Trade(country)*Control(industry) γ_{11}	Trade (country-level) γ_{01} Trade (country)*Trade(industry) γ_{21} Trade(country)*Control(industry) γ_{11}									
Random Effects										
Intercept (country) u_{0k}		381.9***	364.7***	340.9***	375.9***	377.3***	404.5***	277.9***	262.6***	276.1***
Control (industry) u_{1k}										
Trade (industry) u_{2k}										
Residual ε_{jk}		2353.4***	2280.1***	2261.9***	2198.2***	2196.4***	2190.7***	2152.8***	2125.4***	2107.3***
Model Fit Statistics	**Model Fit Statistics**									
Deviance	Deviance	6264.67	6236.3	6236.3	6224.3	6226.0	6228.5	6214.7	6200.8	6192.1
AIC	AIC	6270.67	6244.3	6246.3	6236.3	6240.1	6244.5	6232.7	6220.8	6142.1
BIC	BIC	6283.80	6261.8	6268.2	6262.5	6270.6	6279.5	6272.1	6264.6	6262.2

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.11

HLM Results: Applied Import Weighted Tariffs and NTB Frequency Ratio

Dependent Variable is Log of TFP (2009)

Fixed Effects	Industry Protection	Model 10a	Model 11a	Model 12a	Model 13a	Model 14a	Model 15a	Model 16a	Model 17a	Model 18a	Model 19a	Model 20a
Intercept γ_{00}	Intercept γ_{00}	24.77***	56.36***	26.27***	32.49***	31.15***	23.58	27.30	27.18***	18.59**	22.51	14.24
Trade (industry-level) γ_{20}	Weight. Tariff (1997)		-0.773*									
	Weight. Tariff (2002)			-0.202								
	Weight. Tariff (2007)				-1.44***							
	Weight. Tariff (2008)					-1.671*		-1.34	-0.752	-0.317		
	NTB Freq. Ratio (1999)						-24.63	-27.73			10.85	14.04
	Tariff (2008)*Rank 1-4								-1.96*	-2.286**		
	NTB * Rank 1-4										-189.1***	-212.5***
Control (industry-level) γ_{10}	Firm Age	-0.022	-0.516	-0.019	-0.019	-0.023	0.228	0.229	-0.039	0.004	0.274	0.426**
	Skilled Labor	0.002	-0.014	0.004	0.005	0.004	-0.017	-0.016	0.001	-0.003	-0.016	-0.018
	State ownership	0.216***	0.326***	0.207***	0.176**	0.196**	0.351*	0.317**	0.204***	0.221***	0.294***	0.226*
	Foreign ownership	0.036	-0.058	0.032	0.015	0.025	0.119	0.113	0.025	0.002	0.117	-0.022
	Importer	-0.09	-0.341***	-0.097	-0.098	-0.096	0.065	0.07	-0.086	-0.097	0.020	-0.092
	Size	16.32***	15.67**	16.61***	16.96***	16.49***	8.48	9.39	16.79***	16.71***	9.766***	14.86**
	Rank 1-4	8.62**	18.86***	8.45**	7.29**	7.46***	20.16***	18.66***	16.03***	18.14***	28.67***	34.65**
Trade (country-level) γ_{01}	EU									17.34**		4.22
Trade (country) *Trade(industry) γ_{21}	Trade (country) *Trade(industry) γ_{21}											
Trade(country)*Control (industry) γ_{11}	EU* Rank 1-4									0.92		2.06
Random Effects												
Intercept (country) u_{0k}		353.7***	497.0***	335.9***	293.9***	296.7***	558.1	526.1	286.6***	162.3	626.5	125.4
Control (industry) u_{1k}	Rank 1-4									457.1		1699.4
Trade (industry) u_{2k}												
Residual ε_{jk}		2124.9***	2181.2***	2130.4***	2108.9***	2118.2***	1891.6***	1897.9***	2110.1***	2012.5***	1828.8***	1464.9***
Model Fit Statistics	**Model Fit Statistics**											
Deviance	Deviance	6197.7	2531.5	6197.9	6188.9	6191.3	1885.6	1882.1	6185.6	6139.7	1869.1	1826.5
AIC	AIC	6217.7	2553.5	6219.9	6210.8	6213.5	1907.6	1906.1	6209.6	6171.7	1893.1	1858.5
BIC	BIC	6261.5	2591.7	6267.9	6258.9	6261.4	1942.8	1944.6	6262.1	6241.6	1931.6	1909.8

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.12
HLM Results: Membership in EU and WTO
Dependent Variable is Log of TFP

Fixed Effects	Trade Agreements	Model 21a	Model 22a	Model 23a	Model 24a
Intercept γ_{00}	Intercept γ_{00}	17.36*	19.08**	12.14	9.15
Trade (industry-level) γ_{20}					
Control (industry-level) γ_{10}	Firm Age	-0.025	0.026	-0.019	0.037
	Skilled Labor	0.001	-0.001	0.002	-0.001
	State ownership	0.230***	0.230**	0.213**	0.205***
	Foreign ownership	0.038	0.014	0.035	-0.003
	Importer	-0.106*	-0.106*	-0.104*	-0.009
	Size	15.84***	15.77***	16.61***	16.67***
	Rank 1-4	8.44**	9.54	8.044**	10.93
Trade (country-level) γ_{01}	EU	23.24***	19.85**		
	WTO			18.42**	21.46***
Trade (country)*Trade (industry) γ_{21}					
Trade(country)*Control (industry) γ_{11}	EU * Rank 1-4		1.07		
	WTO * Rank 1-4				-1.34
Random Effects					
Intercept (country) u_{0k}	Rank 1-4	252.4***	160.1	298.4***	112.2
Control (industry) u_{1k}			435.8		538.7
Trade (industry) u_{2k}					
Residual ε_{jk}		2121.6***	2031.2	2124.1***	2021.6***
Model Fit Statistics	**Model Fit Statistics**				
Deviance	Deviance	6184.1	6149.6	6187.4	6164.9
AIC	AIC	6206.1	6177.6	6209.4	6192.9
BIC	BIC	6254.2	6238.8	6257.5	6254.1

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.13
HLM Results: Import Tariffs on Key Inputs: Machinery and Equipment

Fixed Effects	**Input Tariff**	**Model 25a**	**Model 26a**	
Intercept γ_{00}	Intercept γ_{00}	28.94***	20.13***	
Trade (industry-level) γ_{20}	Input Weighted Tariff (2008)	-2.38	-0.59	
	Input Tariff (2008)*Rank 1-4		-5.13**	
Control (industry-level) γ_{10}	Firm Age	-0.018	0.049	
	Skilled Labor	0.002	-0.003	
	State ownership	0.208***	0.212***	
	Foreign ownership	0.039	0.012	
	Importer	-0.104*	-0.115*	
	Size	16.28***	15.81***	
	Rank 1-4	8.73**	17.74**	
Trade (country-level) γ_{01}	EU		18.39**	
Trade (country)*Trade (industry) γ_{21}	EU* Rank 1-4		0.83	
Trade(country)*Control (industry) γ_{11}				
Random Effects				
Intercept (country) u_{0k}		349.8***	189.5	
Control (industry) u_{1k}	Rank 1-4		739.7**	
Trade (industry) u_{2k}				
Residual ε_{jk}		2120.9***	1989.6***	
Model Fit Statistics	**Model Fit Statistics**			
Deviance	Deviance	6192.7	6137.7	
AIC	AIC	6214.7	6169.7	
BIC	BIC	6262.8	6239.7	

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.14
HLM Results: Value Added Tax (VAT) and VAT Refund Period
Dependent Variable is Log of TFP (2009)

Fixed Effects	VAT Rate, Refund	Model 27a	Model 28a	Model 29a	Model 30a
Intercept γ_{00}	Intercept γ_{00}	56.03	27.47***	78.72**	63.00***
Trade (industry-level) γ_{20}					
Control (industry-level) γ_{10}	Firm Age	0.017	-0.006	0.032	0.002
	Skilled Labor	-0.001	-0.005	-0.001	-0.006
	State ownership	0.227***	0.222**	0.239***	0.234***
	Foreign ownership	0.014	0.014	0.019	0.009
	Importer	-0.105*	-0.08	-0.111*	-0.079
	Size	15.84***	16.62***	15.87***	16.22***
	Rank 1-4	-73.98	14.73**	-72.44	13.49**
Trade (country-level) γ_{01}	VAT (2009)	-1.643		-3.27*	
	VAT Refund (2009)		-0.555***		-0.452**
	EU			23.47***	14.27**
Trade (country)*Trade (industry) γ_{21}					
Trade(country)*Control (industry) γ_{11}	VAT * Rank 1-4	4.49*		4.37*	
	VAT Refund (2009)* Rank 1-4		-0.027		-0.008
	EU * Rank 1-4			0.99	0.605
Random Effects					
Intercept (country) u_{0k}		266.3***	66.84	172.8	106.61
Control (industry) u_{1k}	Rank 1-4	479.8***	389.84***	454.6	401.66
Trade (industry) u_{2k}					
Residual e_{ijk}		2008.7***	2103.5***	2015.5***	2298.7***
Model Fit Statistics	**Model Fit Statistics**				
Deviance	Deviance	6175.3	5485.9	6138.3	5544.1
AIC	AIC	6203.2	5513.9	6170.3	5556.1
BIC	BIC	6264.5	5573.5	6240.2	5581.7

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.15
HLM Results: Export Processing Zone
Dependent Variable is Log of TFP (2009)

Fixed Effects	Export Zone	Model 31a	Model 32a	Model 33a
Intercept γ_{00}	Intercept γ_{00}	24.02***	24.41***	15.43*
Trade (industry-level) γ_{20}	Export zone	-11.75**	-13.11*	-9.41
	Zone* Rank 1-4		2.349	-1.203
Control (industry-level) γ_{10}	Firm Age	-0.019	-0.021	0.031
	Skilled Labor	-0.001	-0.001	-0.003
	St. ownership	0.191**	0.192**	0.209***
	For.ownership	0.034	0.036	0.013
	Importer	-0.069	-0.071	-0.082
	Size	18.04***	17.99***	17.65***
	Rank 1-4	9.115**	8.266*	9.563
Trade (country-level) γ_{01}	EU			22.74***
Trade (country)*Trade (industry) γ_{21}	EU*Rank 1-4			1.24
Trade(country)*Control (industry) γ_{11}				
Random Effects				
Intercept (country) u_{0k}		377.2***	379.4***	212.8
Control (industry) u_{1k}	Rank 1-4			444.9
Trade (industry) u_{2k}				
Residual ε_{ik}		2163.3***	2166.3***	2071.5***
Model Fit Statistics	**Model Fit Statistics**			
Deviance	Deviance	6213.3	6207.3	6159.7
AIC	AIC	6235.3	6231.3	6191.7
BIC	BIC	6283.5	6283.9	6261.7

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.16

HLM Results: Non-Tariff Barriers

Dependent Variable is Log of TFP (2009)

Fixed Effects	Non-Tariff Barriers	Model 34a	Model 35a	Model 36a	Model 37a	Model 38a	Model 39a
Intercept γ_{00}	Intercept γ_{00}	26.56***	27.77***	43.14***	49.43***	43.63***	38.84***
Trade (industry-level) γ_{20}							
Control (industry-level) γ_{10}	Firm Age	0.019	0.020	0.004	0.014	0.001	0.011
	Skilled Labor	-0.002	-0.001	-0.002	-0.002	-0.001	-0.001
	State ownership	0.213***	0.220***	0.233***	0.227***	0.221***	0.223***
	Foreign ownership	0.012	0.013	0.016	0.008	0.008	0.010
	Importer	-0.101	-0.098	-0.105*	-0.108*	-0.107*	-0.093
	Size	15.94***	16.34***	16.27***	16.40***	16.84***	17.38***
	Rank 1-4	17.25**	8.71	23.22	16.76	13.41	11.19*
Trade (country-level) γ_{01}	Days to clear exports	-0.396					
	Days to clear imports		-0.397				
	Documents to export			-2.76			
	Documents to import				-3.14**		
	Cost to export					-0.013***	
	Cost to import						-0.009***
Trade (country)*Trade (industry) γ_{21}							
	Days to clear export/import * Rank 1-4	-1.526	0.164				
Trade(country)*	Documents to export/import * Rank 1-4			-1.83	-0.68		
Control (industry) γ_{11}	Cost to export/import * Rank 1-4					-0.002	-0.001
Random Effects							
Intercept (country) u_{0k}		255.6	240.2	195.2	127.9	77.2	45.1
Control (industry) u_{1k}	Rank 1-4	497.9	569.7***	472.3	439.7	452.9	421.9***
Trade (industry) u_{2k}							
Residual ε_{ijk}		2016.3***	2014.3***	2024.5***	2034.2***	2039.2***	2055.1***
Model Fit Statistics	**Model Fit Statistics**						
Deviance	Deviance	6179.4	6183.7	6175.2	6174.4	6194.6	6180.8
AIC	AIC	6207.4	6211.7	6203.1	6202.4	6222.6	6208.8
BIC	BIC	6268.7	6272.9	6264.4	6263.7	6283.9	6269.9

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

The variable "Days to Clear Customs (exports/imports)" is measured at the firm level through the Enterprise Surveys; however, due to the high number of missing values the study had to use the country averages to fill out the missing data.

Table 1.17
HLM Results: Industry Standards
Dependent Variable is Log of TFP (2009)

Fixed Effects	International Quality Certificate	Model 40a	Model 41a	Model 42a
Intercept γ_{00}	Intercept γ_{00}	25.77***	27.76***	20.58***
Trade (industry-level) γ_{20}	International Quality Certificate	8.11	-0.326	-1.321
	Certificate * Rank 1-4		24.02**	21.63*
Control (industry-level) γ_{10}	Firm Age	-0.041	-0.035	
	Skilled Labor	0.003	0.001	
	State ownership	0.208***	0.209***	
	Foreign ownership	0.024	0.020	
	Importer	-0.094	-0.092	
	Size	14.69***	15.14***	
	Rank 1-4	8.25**	-0.904	
Trade (country-level) γ_{01}	EU			19.46**
Trade (country)*Trade (industry) γ_{21}	EU * Rank 1-4			0.981
Trade(country)* Control (industry) γ_{11}				
Random Effects				
Intercept (country) u_{0k}		330.4***	329.7***	144.3
Control (industry) u_{1k}	Rank 1-4			338.8
Trade (industry) u_{2k}				
Residual ε_{jk}		2128.4***	2116.7***	2039.0***
Model Fit Statistics	**Model Fit Statistics**			
Deviance	Deviance	6190.7	6179.8	6133.6
AIC	AIC	6212.7	6203.8	6165.6
BIC	BIC	6260.8	6256.3	6235.5

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level.

Table 1.18
Endogeneity Test 1: Trade Policies
Dependent Variables are Changes in Output Import Tariffs and
Import Tariffs on Key Inputs between 2002 and 2008 . Industry-level data.

	Dep.Variable – Change in Output Import Tariffs (2002-2008)			**Dep.Variable – Change in Import Tariffs on Key Inputs (2002-2008)**		
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log of Sales (2002)	-0.173	-0.173	-0.044	-0.489***	-0.465***	-0.432***
Log of Employment (2002)	0.266	0.263	0.384	0.607***	0.553***	0.582***
Percentage owned by government (2005)		0.001	-0.003		0.021*	0.021
Share of unskilled workers (2005)			-8.27***			-2.09**
F-stat	0.39	0.26	5.54	9.57	7.38	6.87
p-value	0.678	0.855	0.0001	0.0001	0.0001	0.0001
R^2	0.001	0.001	0.041	0.036	0.041	0.052
Observations:	250	250	250	250	250	250

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level. Industry- level data.

Table 1.19
Endogeneity Test 2: Trade Policies
Dependent Variables are Output Import Tariffs and
Import Tariffs on Key Inputs in 2008. Industry-level data.

	Dep.Variable –Import Tariffs (2008)		**Dep.Variable – Import Tariffs on Key Inputs (2008)**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Log of TFP (2005)	-0.003		0.003*	
Log of Labor Productivity (2005)		0.123		0.119*
Year, Industry and Country dummies included	yes	yes	yes	yes
F-stat	22.21	21.34	74.22	82.69
p-value	0.000	0.000	0.000	0.000
R^2	0.678	0.690	0.876	0.896
Observations	250	250	250	250

Note: significant at: *** - 99%, ** - 95%, * - 90% confidence level. Industry-level data.