Does Trade Protection Improve Firm Productivity? Evidence from Philippine Micro Data

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This paper examines the impact of trade policy changes on firm productivity in the Philippines, characterized by an incomplete liberalization process and reversal of policy in midstream. Though the Philippines implemented substantial trade reforms from the 1980s up to the mid-1990s, it adopted a selective protection policy in the early 2000s. The regression results show that among firms in the purely importable sector, trade protection is negatively associated with firm productivity. For firms in the mixed sector, a negative relationship is also present, but is not statistically significant. Among firms in the purely exportable sector, the evidence is weak due to the strong bias of the system of protection against exportable. Coinciding with policy reversal, the aggregate productivity of the purely importable and mixed sectors both declined from 1996 to 2006. In contrast, the productivity of the purely exportable and non-traded sectors increased during the same period. This paper shows that the selective protection policy not only reversed the productivity gains from the previous liberalization, but undermined the output restructuring from less productive to more productive firms that was already underway as the protection of selected sectors allowed inefficient firms to survive.

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1. Introduction

The more recent empirical literature on trade and productivity shows that in the presence of firm heterogeneity, trade liberalization allows more productive firms to expand while less efficient firms either exit or shrink. Trade liberalization may lead to improved productivity through the exit of inefficient firms and the reshuffling of resources and outputs from less to more efficient firms. As Melitz (2002) points out, trade opening may induce a market share reallocation towards more efficient firms and generate an aggregate productivity gain, without any change at the firm level. With the exit of inefficient firms, resources (labor and capital) will be freed and will move to other industries where they can be used more productively. Trade liberalization drives the process of restructuring and reshuffling of resources within and across sectors of the economy such that unprofitable activities contract while profitable ones expand.

Studies indicating that productivity improves following liberalization include Pavcnik (2000) for Chile, Fernandes (2003) for Columbia, Topalova (2003) and Chand and Sen (2000) for India, Amiti and Konings (2004) and Muendler (2002) for Indonesia along with Schor (2003) for Brazil and Ozler and Yilmaz(2001) for Turkey. In India, Krishna and Mitra (1998) and Goldar and Kumari (2003) also found evidence of a significant favorable effect of reforms on industrial productivity. In Korea, Kim (2000) found that trade liberalization had a positive impact on productivity performance. Earlier works by Haddad (1993), Harrison (1994), and Tybout and Westbrook (1995) for the Ivory Coast and Mexico also showed a positive link between liberalization and productivity growth.

There are however, studies that showed the opposite. Bernard and Jones (1996) found weak support for productivity improvements after trade liberalization.Rodrik (1988, 1992) argued that there are no reasons to believe that protection discourages productivity improvement. In fact it is import liberalization that retards productivity growth by shrinking domestic sales and reducing incentives to invest in technological efforts.Thus whether liberalization really improves efficiency in less developed countries is ambiguous and has remained an empirical question.

As with many developing countries and transition economies, the Philippines

opened up its domestic economy to international trade starting in the 1980s. Studies on trade and productivity are few and mostly based on macro level analysis (Kajiwara 1994, Urata 1994, Tan 1997, Austria 1998, and Cororaton and Abdula 1999). Medalla*et al.* 1995; Pineda 1997; and Medalla 1998 carried out industry based analysis that examined the impact of trade liberalization on resource allocation. Hallward-Driemeier, M. *et al.* (2002) conducted a cross-country study including the Philippines. Their results showed that exporters are significantly more productive than non-exporters that sell only in the domestic market and productivity gaps are larger the less developed the domestic market is.

This paper will focus on the assessment of the impact of trade policy changes on firm productivity in the Philippine manufacturing industry using micro level data.The Philippines presents an interesting case due to its adoption of selective protection amidst an on-going trade liberalization process.Though substantial reforms were carried out from the late 1980s to the mid-1990s, it reversed its trade policy in the early 2000s.

A firm-level panel dataset covering the manufacturing industry was created based on the survey and census data of the National Statistics Office for the period 1996 to 2006 (with missing years for 1999, 2001, and 2004). The paper is divided into 6 sections. After the introduction, section 2 discusses the various episodes of trade policy reforms and analysis of the performance and structure of the manufacturing industry. Section 3 provides a brief review of the trade and productivity studies in the Philippines. Section 4 presents the methodology and descriptionof the data used in the paper. Section 5 analyzes the results, and section 6 summarizes the findings and policy implications of the paper.

2. Trade Policy Reforms in the Philippines

2.1. Trade Policy Reforms: 1980s-2000s

Initiated in 1981, the first tariff reform program (TRP 1)substantially reduced the average nominal tariff and the high rate of effective protection that characterized the Philippine industrial structure. The second phase of the tariff reform program (TRP II) was launched in 1991. It introduced a new tariff code that further narrowed down the tariff range with the majority of tariff lines falling within the 3 to 30 % tariff range. The government initiated another round of tariff reforms (TRP III) in 1995 as a first major step in its plan to adopt a uniform 5% tariff by 2005. This further narrowed down the tariff range for industrial products to within 3 and 10% range and reduced the ceiling rate on manufactured goods to 30 % while the floor remained at 3%.

In 1996, Republic Act 8178 legislated the tariffication of quantitative restrictions imposed on agricultural products andthe creation of tariff quotas. Tariff quotas imposed a relatively lower duty up to a minimum access level (or in-quota rate) and a higher duty beyond this minimum level (or out-quota rate).

In January 1998, Executive Order 465 was legislated to further refine the tariff structure and gradually implement the tariff reduction on 23 industries identified as export winners.In 1999, Executive Order 63 was issued to increase the tariff rates on certain products and froze tariff rates at their 2000 levels. In January 2001, EO 334, which was to constitute TRP IV, was passed to adjust the tariff structure towards a uniform tariff rate of 5 % by 2004. This was never implemented, as a series of executive orders were passed to either postpone or increase tariff rates on selected products. In 2003, a comprehensive tariff review was carried out which culminated in the legislation of Executive Orders 241 and 264. These Executive Orders modified the whole tariff structure such that the tariff rates on goods that are not locally produced goods were made as low as possible while the tariff rates on locally produced goods were adjusted upward.

2.2. Structure of Protection: 1998-2004

Table 1 shows that the overall level of tariff rates is already low. As of 2004, the average tariff rate for all industries is 6.82 %. The average for manufacturing is almost the same as the average for all sectors at 6.8 %.Agriculture has the highest average tariff rate of 11.3 %. Unlike the rest of the sectors where ad valorem tariffs are applied, tariff quotas are used in agriculture.

Table 1. Average Tariff Rates: 1998-2004

	1998	1999	2000	2001	2002	2003	2004
All Industries	11.32	10.25	8.47	8.28	6.45	6.6	6.82
Coefficient of variation	0.96	0.91	0.99	1.04	1.17	1.06	1.07
% of tariff peaks	2.24	2.24	2.48	2.5	2.69	2.53	2.71
Agriculture	15.9	13.2	11.5	12.3	10.4	10.4	11.3
Coefficient of variation	1.07	1.14	1.3	1.23	1.31	1.22	1.17
Fishing and forestry	9.4	8.9	6.7	6.7	5.8	5.7	6
Coefficient of variation	0.63	0.7	0.66	0.62	0.45	0.48	0.57
Mining and quarrying	3.3	3.3	3.1	3.2	2.8	2.7	2.5
Coefficient of variation	0.42	0.41	0.24	0.23	0.38	0.4	0.48
Manufacturing	11.38	10.35	8.5	8.28	6.39	6.57	6.76
Coefficient of variation	0.93	0.88	0.95	1	1.13	1.03	1.03

Aldaba (2005).

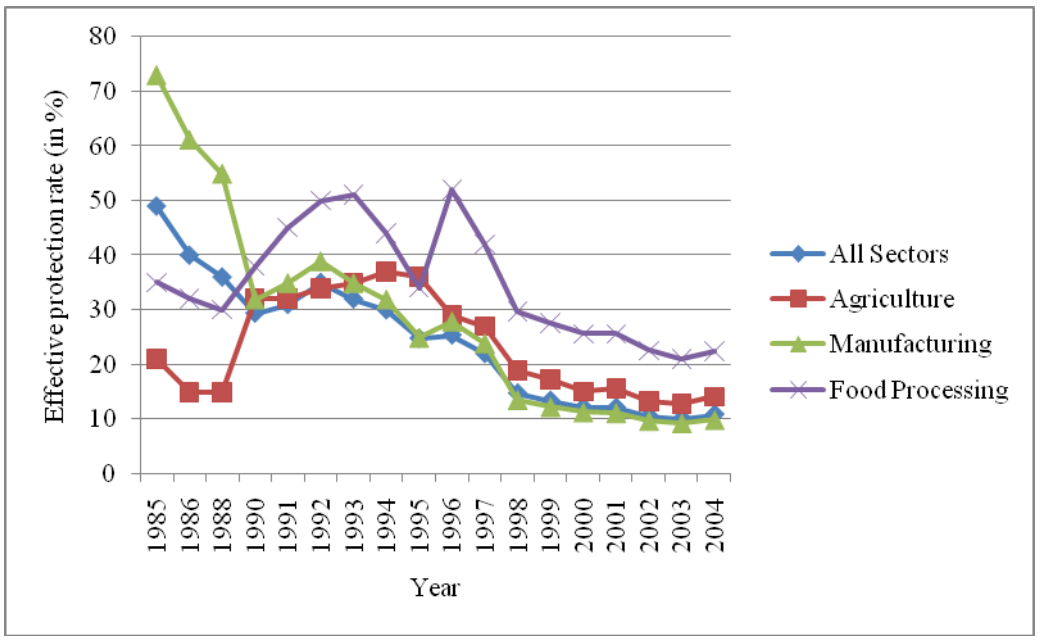
Note, however, that a lower level of tariff rates does not always imply that the tariff schedule is less distorting. The economic and trade distortions associated with the tariff structure depend not only on the size of tariffs but also on the dispersion of these tariffs across all products. Common measures of dispersion used are percentage of tariff peaks and coefficient of variation. In general, the more dispersion in a country's tariff schedule, the greater the distortions caused by tariffs on production and consumption patterns. As Table 1 shows, while the average tariff rate for all industries dropped from 11.32 % in 1998 to 6.82 % in 2004, tariff dispersion widened as the coefficient of variation went up from 0.96 to 1.07. The ad valorem tariffs for mining and quarrying as well as those for fishing and forestry show the most uniformity, while those for agriculture and manufacturing exhibit the widest dispersion.

Table 1 also indicates an increase in the percentage of tariff peaks (tariffs that are greater than three times the mean tariff) from 2.24 in 1998 to 2.71 in 2004. The sectors with tariff peaks consisted mostly of agricultural products with in- and out- quota rates along with manufacturing sectors such as slaughtering and meat packing, coffee roasting and processing, meat processing, canning and preserving fruits and vegetables, manufacture of starch and starch

products, bakery products animal feeds, miscellaneous food products, drugs and medicines, chemical products, and assembly of motor vehicles.

Compared to tariff rates, effective protection rates (EPRs)[2] provide a more meaningful indicator of the impact of the system of protection. EPRs measure the net protection received by domestic producers from the protection of their outputs and the penalty from the protection of their inputs. Figure 1 shows that average effective protection rates for all sectors declined from 49% in 1985 to 36% in 1988. In 1995, this further dropped to around 25% and to 15% in 1998 and to 10.9% in 2004.

Figure 1. Effective Protection Rates (1985-2004)



Source: Medalla, et al (1995), Manasan, R. and V. Pineda (1999), and Aldaba (2005).

The country's effective protection has continued to discriminate in favor of some industries and against others, and in favor of sales in the domestic market against sales in other markets. This implies that there is a strong incentive to misallocate resources. There are two elements of bias in the effective protection structure, one is the bias in favor of agriculture and food manufacturing, and two, anti-export bias (artificial incentive to produce for the domestic market) or penalty imposed on exports as they

[2] EPRs are rates of protection of value added, are more meaningful than actual tariff rates and implicit tariff rates (representing excess of domestic price of a product over its international price) since it is value added rather than the value of the product that is contributed by the domestic activity being protected.

continue to receive negative protection. That these industries have continued to survive suggests that they are economically efficient. This is in contrast to those sectors that have received relatively higher protection but have not exported to any significant extent. To address the problem of exporters being disadvantaged by the system of protection, the government has provided incentive mechanisms such as duty drawbacks, bonded manufacturing warehouses, and export processing zones to allow exporters duty-free importation of inputs.

Table 2 presents the average EPR for the years 1998 to 2004. Though the average EPR for all industries is already relatively low, protection continues to be uneven as indicated by the high levels of coefficients of variation, particularly in manufacturing. After falling from 3.68 in 2000 to 2.54 in 2001, it increased to 2.64 in 2004. Among the major economic sectors, agriculture continued to enjoy the highest level of protection from 1998 to 2004. Protection of importable also remained relatively higher than exportable. Manufacturing exportables continued to register negative EPRs indicating that they were penalized by the system of protection.

Table 2. Average Effective Protection Rate

	1998	1999	2000	2001	2002	2003	2004
All Sectors	**14.75**	**13.41**	**12.13**	**12.18**	**10.55**	**10.11**	**10.88**
Importable	25.64	23.45	21.21	21.11	18.82	18.05	19.09
Exportable	3.45	2.99	2.72	2.92	1.98	1.88	2.36
CV	2.82	2.91	3.21	2.19	2.13	2.23	2.27
Agriculture, Fishing, & Forestry	**18.98**	**17.29**	**15.12**	**15.63**	**13.38**	**12.86**	**14.15**
Importable	22.67	20.35	19.01	19.48	17.97	17.26	18.09
Exportable	15.36	14.29	11.31	11.85	8.89	8.55	10.3
CV	0.75	0.71	0.77	0.83	0.88	0.82	0.77
Mining	**2.52**	**2.6**	**2.65**	**2.67**	**2.41**	**2.36**	**2.28**
Importable	3.86	3.8	3.44	3.33	2.77	2.71	2.57
Exportable	2.01	2.15	2.35	2.42	2.28	2.23	2.17
CV	0.79	0.76	0.68	0.66	0.68	0.69	0.69
Manufacturing	**13.61**	**12.34**	**11.37**	**11.23**	**9.79**	**9.36**	**9.96**
Importable	27.3	25.1	22.48	22.17	19.53	18.72	19.87
Exportable	-1.57	-1.81	-0.96	-0.89	-1.02	-1.02	-1.04
CV	3.27	3.4	3.68	2.54	2.45	2.58	2.64

Source: Manasan, R. andV.Pineda (1999), Aldaba (2005).
Note: CV or coefficient of variation is the ratio of the standard deviation to the mean.

3. Empirical Framework and Data Description

3.1. Methodology

Following Pavcnik (2000), the paper will first estimate total factor productivity using the methodology of Levinsohn and Petrin(2003).Second, the estimated aggregate TFP is decomposed to understand the factors that underlie the changes in TFP growth and examine the importance of the contribution of resource reallocation within industries to productivity growth. Third, the correlation between trade liberalization and productivity is examined in a regression framework by industry trade orientation and by usingeffective protection rate as a trade proxy. Pavcnik used dummy variables as a measure of trade policy. In the case of the Philippines, applying trade orientation dummy variables might not correctly capture the changes in tariffs and protection since the trade liberalization program was carried out in various stages at an uneven pace across industries from the early 1980s to the 1990s. This is different from Chile's trade liberalization experience that occurred in one big bang from 1974 to 1979 with the adoption of a uniform 10% tariff in 1979. In other studies that measure the impact of trade liberalization on productivity, nominal tariffs are applied. Amiti and Konings (2004) used both input and output tariffs in Indonesia while Topalova(2003) employed nominal tariffs on finished goods in India.

Effective protection rates take into account both the tariff on the firm's output and the tariffs on the inputs that the firm uses. EPRs are important because tariffs vary considerably along the production stage generally exhibiting an escalating structure with inputs having lower protection while final goods receive higher protection. For instance, in 2004, the tariff rate on completely knocked down (CKD) packs was 3%, the average tariff rate on other parts and components was about 5% while the tariff rate on completely built units (CBUs) was 30%. The calculated EPR was around 76%.

In the analysis of the impact of trade liberalization on productivity, a firm-level panel dataset covering an eight-year period from 1996 to 2006 is employed (1999, 2001 and 2004 are missing). As earlier discussed, major tariff reform programs were implemented in 1980, 1991, and 1995. The first major step towards the plan to adopt a uniform 5% tariff by 2005 started in 1995. In 1996, the government legislated the

tariffication of quantitative restrictions imposed on agricultural products and the creation of tariff quotas. Note, that these are inputs to food manufacturing. Further reforms were pursued in 1998, although these were not implemented as the government adopted a policy of selective protection.

Domestic firms are differentiated depending on the trade orientation of their industry sector. Each industry sector is classified into traded or non-traded, based on the sector's import penetration ratio and export intensity ratio calculated from the 2000 Input-Output Table. A sector is classified as non-traded if export and import ratios are zero or less than 1%, such as slaughtering and meat packing, ice cream, mineral water, and custom tailoring and dressmaking. A traded sector is categorized into three: purely importable, purely exportable, or mixed.

A purely exportable sector is characterized by zero or minimal imports and substantial exports or an export ratio of at least 10 %. Examples are tobacco leaf flue-curing, articles made of native materials, wood carvings, fish drying, knitted hosiery, crude coconut oil,rattan furniture, and jewelry. A purely importable sector is characterized by minimal exports and significant imports or an import ratio of at least 10 %. This includes meat and meat products, coffee roasting and processing, butter and cheese, animal feeds, starch and starch products and the manufacture and assembly of motor vehicles.A mixed sector has substantial imports and exports such as motor vehicle parts and components, semi-conductors, parts and supplies for radios, tvs, communication appliances and house wares, garments, carpets and rugs, furniture, along with sugar, glass, chemicals, cigarettes, soap and detergents, iron and steel, and drugs and medicines. Moreover, aside from tariff protection, certain products under these sectors also received additional protection through safeguard measures that are imposed on importation of cement, glass, chemicals, and ceramic tiles.

3.1.1. TFP Estimation

Total factor productivity or TFP, defined as the residual of a Cobb-Douglas production function, is used as the performance measure. To address the simultaneous problem in the input choice when estimating the production function by ordinary least

squares (OLS)[3], a semi-parametric estimator with an instrument to control for unobserved productivity shocks is applied. For this instrument, Olley and Pakes (1996) use investment while Levinsohn and Petrin (2003) suggestthe use of intermediate inputs. Due to the large number of missing investment observations, the Levinsohn and Petrin approach is applied in the analysis.[4]Given the availability of fuel and electricity data, this variable is employed as a proxy for productivity shocks.

In order to estimate the production function, data on value added (output less cost of materials and energy) and two factors of production, labor and capital, are used. All variables are expressed in logarithmic form. The production function estimated for firm i in industry j at time t is written as:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \mu_{it} \quad \text{Equation (1)}$$

wherey_{it}: log of output (measured as value added) in year t

k_{it}: log of firm i's capital stock

l_{it}: log of labor input

μ_{it}: error term which is assumed to be additive in two unobservables, ω_{it} and η_{it}. This can be written as $\mu_{it} = \omega_{it} + \eta_{it}$ where ω_{it} is an efficiency term (or productivity level) known by the firm[5] but not by the econometrician. η_{it} is an unexpected productivity shock with zero mean unobserved by both the firm and the econometrician.

Using equation (1), a production function is estimated for 11 industry-sectors with

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[3]The problem with this approach was pointed out in Marschak and Andrews (1944).They noted that plants with large positive productivity shock may respond by using more inputs.To the extent that this occurs, OLS estimates of production functions will yield biased estimates and by implication, biased estimates of productivity. The usual solution to this econometric endogeneity is to use an instrumental variables estimator. Olley and Pakes applied semi-parametric econometric methods to solve the endogeneity problem.

[4]The Olley and Pakes methodology can only be applied to firms reporting non-zero investment. This usually leads to a sizeable number of observations that must be dropped from the estimation because they violate the strict monotonicity condition necessary for the validity of the Olley and Pakes procedure. The Levinsohn and Petrin approach avoids this problem.

[5]The fact that ω_{it} is known by the firm when it takes the decision whether to stay in the market and produce, and if deciding to produce, which input combination to use, makes the OLS estimate of the production function biased. The error term is not uncorrelated with the explanatory variables, the key assumption for OLS to produce unbiased estimates. There is not only a simultaneity bias but also a selection bias. The former is due to the fact that unobserved efficiency level is taken into account when the firm decides what input combination and quantities it will produce. The latter is attributed to the fact that the firm chooses whether to stay in the market or exit after it knows its productivity level ω_{it} that is unobservable to the econometrician. (See Schor, 2003).

the Levinsohn and Petrin methodology. The estimates of firm i's TFP is obtained by subtracting firm i's predictedy from its actual y at time t. To make the estimated TFP comparable across industry-sectors, aproductivity index is created. Following Pavcknik (2000), the index is obtained by subtracting a productivity of a reference firm in a base year from an individual firm's productivity measure:

$$prod_{it} = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_l l_{it} - (y_\tau - \hat{y}_\tau) \text{ Equation (2)}$$

Where

$$y_\tau = \bar{y}_{it} \text{ and } \hat{y}_\tau = \hat{\beta}_k \bar{k}_{it} + \hat{\beta}_l \bar{l}_{it}$$

The bar over a variable indicates a mean over all firms in a base year. Here, 1996 is used as base year. Hence, y_τ is the mean log output of firms in the base year 1996 and $\hat{y}_\tau$ is the predicted mean log output in 1996. This productivity measure represents a logarithmic deviation of a firm from the mean industry in a base year.

3.1.2. TFP Decomposition

To see whether the reallocation of resources and outputs from less to more efficient firms contributes substantially to productivity gains, aggregate productivity measures are computed for each year and decomposed as follows:

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t) \text{ Equation (3)}$$

The bar over a variable denotes a mean over all firms in a given year. Ω_t is the industry-level productivity and is a weighted average of firm-level productivities, s_{it} is firm i's weight in year t and $prod_{it}$ is the estimate of firm-level productivity.

In the decomposition, the first term represents the part of industry-level productivity growth due to within plant productivity growth. The second term, a covariance term, captures the reallocation effect as output shares are reallocated from less productive to more productive firms. A positive covariance term indicates that more output is produced by the more efficient firms. If trade liberalization induces reallocation of resources within industries from less to more productive firms, the covariance term

should be positive and increasing over time.

3.1.3. Trade and Firm-level Productivity Link

To examine the impact of trade liberalization on productivity, the following regression framework is employed:

$$\text{prod}_{it} = \alpha_0 + \alpha_1 \text{trlib} + \alpha_2 z_{it} + \varepsilon_{it} \qquad \text{Equation (4)}$$

where*Prod* is the total factor productivity measure for firm i at time t relative to an average firm in firm i's industry in the base year.*Trlib* is trade policy variable proxied by nominal tariff and effective protection rates. Z_{it} is a set of firm characteristics including employment as a size measure and firm exit indicator. Time trend, industry indicators, and firm indicators will be included in the regression. To directly explore the relationship between trade liberalization and firm productivity, the firms are pooled based on their trade orientation. A negative sign on *Trlib* is expected indicating that lower protection is associated with higher productivity. This provides evidence that trade liberalization leads to productivity gains among domestic manufacturers differentiated into four groups: purely importable, purely exportable, mixed, and non-traded.

Trade liberalization affects both final and input tariffs. Reducing tariffs on final goods will increase competition forcing firms to trim their fat, reduce agency problems and adopt innovative processes leading to productivity increases. Reducing tariffs on inputs will enable firm's access to high quality intermediate goods and to adopt new production methods leading to efficiency increases. The effective protection rate tries to capture both effects.

Gains from trade liberalization could also arise from reallocation effects with more efficient firms gaining market share and increasingaverage industry productivity. The coefficient on the exit indicator is thus expected to be negative, indicating that exiting firms have lower productivity than continuing firms.

3.2. Data

The data used in the paper are from the Annual and Census of Establishments of the National Statistics Office. The Census of Manufacturing Establishments is conducted every five years and includes all manufacturing establishments. The Annual Survey is conducted annually and covers a subsample of firms in operation. The establishment or firm refers to an economic unit engaged, under single ownership or control, in one or predominantly one kind of economic activity at a fixed single location. The datasets contain consistent firm level information on revenues, employment, compensation, physical capital, and production costs. Data on exports and foreign capital participation are not consistently reported.

Firms are categorized by industry according to the 5-digit Philippine Standard IndustrialClassification (PSIC) of 1994. The panel dataset is created by linking the establishment control numbers (ECNs) or identification codes of firms. However, due to changes in firm ECNs in 1996, datasets prior to this year could not be matched with the data from 1996 onwards. The firm-level panel dataset built covers the period 1996 to 2006, with three missing years in between (1999, 2001, and 2004). The years 2000 and 2006 are both census years while the remaining six years are surveys. The panel dataset is unbalanced and covers all firms with two or more overlapping years during the period 1996-2006. Firms with missing zero or negative values for the variables used to estimate TFP as well as those with duplicates were dropped. Firms with less than 10 workers were also excluded. Firm exit is indicated by firms that are no longer included in the 2006 census as well as those whose 2-digit PSIC codes have changed. Initially, the number of observations totaled 27,818 but after removing observations with missing or negative values as well as duplicates, the total was reduced to 22,500 (see Appendix 1).

The data on economic activity are complemented with annual effective protection rates (EPRs). These used were sourced from Manasan and Pineda (1999) for EPRs covering the 1990s and Aldaba (2005) for EPRs in the more recent period. The calculated EPRs in these papers are all coded based on the Input-Output codes. In determining the trade orientation of industries (traded or non-traded), the 2000 input-output table is used on the basis of sector level exports, import, and total output.

5. Trade Protection and Productivity: What CanBe Learned from Micro Data?

5.1. TFP and TFP Decomposition

The analysis is based on an unbalanced panel dataset covering eight years during the period 1996 to 2006. Table 3 presents the variables and descriptive statistics. Value added by sector was deflated using the gross domestic product (GDP) by industrial origin implicit price index, for capital assets, GDP fixed capital formation index was used, and for fuel and electricity, the wholesale price index for fuel, lubricants and related materials was applied. Table 4 shows the estimates of the coefficients of the production function using the Levinsohn-Petrin method. These input coefficients are then applied to construct a measure of firm productivity. For each year, the aggregate industry productivity measures are calculated. These are then decomposed into two components: (i) within firm productivity and (ii) reallocation of resources and market shares from less to more efficient firms.

Table 3. Descriptive Statistics

Variable	Definition	Obs	Mean	Std. Dev.
Tot workers	Total number of workers	22500	259.4827	627.1911
Capital	Book value of assets	22500	157000000	889000000
Value added	Output less raw material, electricity and fuel costs	22500	202000000	1260000000
Fuel elect	Fuel and electricity	22500	33100000	1550000000
Epr	Effective protection rate	22500	8.450309	15.97052
Tar	Tariff rate	22500	12.42712	8.913147

Source: National Statistics Office, Annual Survey of Establishments and Census of Establishments, various years

Table 4. Estimated Production Functions

Sector	Description	Capital	Labor
1	Food, beverages, tobacco	0.1209807***	0.5496299***
	Standard error	0.0277454	0.0273871
	Number of observations	4754	
2	Textiles	0.1213055***	0.75908***

	Standard error	0.0340724	0.038312
	Number of observations	1149	
3	Garments	0.1652882***	0.6739292***
	Standard error	0.0505077	0.0267207
	Number of observations	2215	
4	Leather and leather products	0.3313098***	0.7494902***
	Standard error	0.1181212	0.0578855
	Number of observations	568	
5	Wood, paper products, and publishing	0.1295727***	0.5809723***
	Standard error	0.0394782	0.0346143
	Number of observations	2452	
6	Coke, petroleum, chemicals, rubber and plastic	0.1442959***	0.6266484***
	Standard error	0.0406107	0.0419769
	Number of observations	2794	
7	Non-metallic products	0.1944391***	0.5718431***
	Standard error	0.070396	0.0478595
	Number of observations	1031	
8	Basic metals and fabricated metal	0.1101153**	0.5723843***
	Standard error	0.0496199	0.0415097
	Number of observations	1943	
9	Machinery, equipment and transport	0.1007086***	0.6016929***
	Standard error	0.0292542	0.0220874
	Number of observations	4090	
10	Furniture	0.2238909***	0.6444838***
	Standard error	0.0815305	0.0400102
	Number of observations	844	
11	Other manufactured products	0.0327132	0.7433052***
	Standard error	0.1006939	0.0586069
	Number of observations	660	

Source: Author's estimates.
Note:* 10% level of significance, **5% level of significance, ***1% level of significance.

Table 5 presents the results of the decomposition in terms of the contribution of unweighted productivity and covariance growth (between output and productivity) to aggregate productivity growth. The unweighted productivity component is a measure of within firm productivity growth while the covariance component measures the reshuffling of resources in favor of more productive firms. The growth figures are normalized and interpreted as growth relative to 1996. From 1996 to 2006, aggregate productivity gains are evident in leather, textile, furniture, other manufacturing, and basic metals and fabricated metal sectors. Leather grew by 9.5%, textile by 2.4%, other

manufacturing by 2.9%, furniture by1.9% and basic metals by 1.3%. In these sectors, growth was driven mainly by growth in the covariance component indicating a reallocation of market shares and resources from the less productive to the more productive firms. In the leather sector, the covariance grew by 17%, 6.3% in other manufacturing areas, 4.6% in textile, 2% in basic and fabricated metal, and 1.7% in furniture. Except for furniture, all the sectors posted negative unweighted mean productivity growth.

Table 5. Aggregate Productivity Growth Decomposition

Code	Description	Year	Aggregate productivity	Unweighted productivity	Covariance
1	Food, beverages, and tobacco	1996	0	0	0
		1997	0.4456	0.54735	-0.10168
		1998	3.0068	2.59885	0.40802
		2000	-0.8192	0.70045	-1.51967
		2002	-1.8349	0.80495	-2.63986
		2003	-2.2529	1.40055	-3.65345
		2005	-1.3558	-0.11777	-1.23805
		2006	-1.4387	-1.93472	0.49602
2	Textiles	1996	0	0	0
		1997	1.7962	0.71022	1.08594
		1998	1.011	0.84162	0.16932
		2000	0.9479	0.29292	0.65497
		2002	-0.4619	-0.21031	-0.25165
		2003	1.1993	0.49042	0.7088
		2005	6.0031	-0.71472	6.71781
		2006	2.3518	-2.26561	4.61733

(Table 12. *Continued*)

Code	Description	Year	Aggregate productivity	Unweighted productivity	Covariance
3	Garments	1996	0	0	0
		1997	1.1206	0.647	0.47361
		1998	2.4573	1.1334	1.32394
		2000	0.5061	0.9195	-0.4134
		2002	0.4899	-1.69075	2.18071
		2003	0.6202	-0.34748	0.96772
		2005	-0.746	-1.9897	1.24373
		2006	-0.9928	-2.5954	1.60258
4	Leather	1996	0	0	0

		1997	-1.34725	0.1061	-1.45333
		1998	0.8141	-0.9926	1.80669
		2000	0.634	-2.0482	2.68219
		2002	7.197	-3.1659	10.36288
		2003	12.1027	-4.82032	16.92295
		2005	8.0915	-5.75065	13.8421
		2006	9.5435	-7.69629	17.23975
5	Wood, paper, and publishing	1996	0	0	0
		1997	0.6098	-0.18835	0.79821
		1998	0.286	0.6708	-0.3848
		2000	-2.4618	-1.72184	-0.73992
		2002	-1.0602	-1.1114	0.05119
		2003	-3.8456	-0.20203	-3.64358
		2005	-3.6436	-1.32284	-2.32074
		2006	-5.3884	-1.40469	-3.98371
6	Coke, petroleum, chemicals and rubber	1996	0	0	0
		1997	-0.611	0.3368	-0.94784
		1998	-2.6792	-0.86638	-1.81286
		2000	2.9396	-0.04676	2.98633
		2002	-6.6506	-0.67928	-5.97139
		2003	4.1851	-1.66832	5.85343
		2005	-1.1094	-2.58193	1.47251
		2006	-4.7642	-2.13054	-2.63366
7	Non-metallic products	1996	0	0	0
		1997	0.1131	-0.05724	0.17031
		1998	1.4701	0.5215	0.94862
		2000	-1.1175	0.3424	-1.46001
		2002	-7.3836	-2.00975	-5.37392
		2003	-2.196	1.2883	-3.48432
		2005	0.3894	-0.66352	1.05283
		2006	-0.6473	-2.37125	1.72388

(Table 12. *Continued*)

Code	Description	Year	Aggregate productivity	Unweighted productivity	Covariance
8	Basic metal and fabricated metal products	1996	0	0	0
		1997	-0.2004	1.32661	-1.52696
		1998	-4.3883	0.24961	-4.63793
		2000	-1.7683	0.17731	-1.94565
		2002	-3.1787	-1.16508	-2.01367
		2003	-2.7001	0.72681	-3.42692
		2005	-4.4682	-0.05965	-4.40855
		2006	1.3205	-0.70002	2.02053
9	Machinery and equipment, motor vehicles and	1996	0	0	0

	other transport	1997	0.3735	1.05154	-0.67812
		1998	-4.9195	1.36814	-6.28774
		2000	0.9015	0.50724	0.39427
		2002	-2.004	1.88764	-3.89168
		2003	-2.7507	2.97624	-5.72693
		2005	-1.6976	2.07454	-3.77218
		2006	-0.858	0.82884	-1.68693
10	Furniture	1996	0	0	0
		1997	1.1589	0.43804	0.7209
		1998	1.6444	0.50134	1.14312
		2000	3.1225	-0.83565	3.95822
		2002	3.4577	0.18164	3.2761
		2003	2.0269	0.81994	1.20695
		2005	2.5903	-0.14386	2.73416
		2006	1.864	0.20054	1.66347
11	Other manufacturing	1996	0	0	0
		1997	-0.1807	-0.34956	0.16884
		1998	3.0145	0.53862	2.47583
		2000	0.2715	-1.56496	1.83647
		2002	1.4867	-1.05729	2.54396
		2003	0.6263	-2.15807	2.78441
		2005	1.1844	-3.02796	4.21237
		2006	2.8653	-3.44865	6.31391
	All manufacturing	1996	0	0	0
		1997	-0.2289	0.52691	-0.75581
		1998	-1.5939	0.94821	-2.54213
		2000	-0.4444	0.04361	-0.48812
		2002	-4.8621	-0.20471	-4.65744
		2003	-1.0019	0.61681	-1.61874
		2005	-2.5331	-0.62714	-1.90597
		2006	-3.3701	-1.47782	-1.89236

(Table 12. *Continued*)

Code	Description	Year	Aggregate productivity	Unweighted productivity	Covariance
	Non-traded (NT)	1996	0	0	0
		1997	1.0615	1.0713	-0.0099
		1998	-2.0268	0.6031	-2.63
		2000	1.7744	1.9616	-0.1872
		2002	1.2714	1.8996	-0.6282
		2003	3.7791	3.1779	0.6012
		2005	12.8997	3.8971	9.0026
		2006	3.9191	0.7626	3.1564
	Purely importable (PM)	1996	0	0	0

		1997	0.9131	0.6038	0.3093
		1998	2.1644	2.3049	-0.1404
		2000	-2.8248	0.0552	-2.8799
		2002	-4.4221	0.65	-5.072
		2003	-1.7409	2.3334	-4.0742
		2005	-1.5688	0.0233	-1.592
		2006	-0.9943	-0.9624	-0.0318
	Purely exportable (PX)	1996	0	0	0
		1997	4.7958	1.0313	3.7645
		1998	12.0972	2.7059	9.3914
		2000	4.2568	0.1134	4.1434
		2002	9.1702	0.0232	9.147
		2003	4.2675	0.0232	4.2443
		2005	3.479	-0.5855	4.0645
		2006	3.7554	-1.2888	5.0442
	Mixed sector (MX)	1996	0	0	0
		1997	-0.4724	0.437	-0.9094
		1998	-2.524	0.7156	-3.2397
		2000	0.0477	-0.0164	0.0641
		2002	-5.3206	-0.3946	-4.9259
		2003	-1.099	0.3881	-1.4871
		2005	-3.0772	-0.8372	-2.24
		2006	-3.9225	-1.5295	-2.3931

Source: Author's estimates

Out of the 11 manufacturing sectors, six sectors covering food, beverages, tobacco, garments, wood, paper, and publishing; coke, petroleum, chemicals and rubber; non-metallic products; basic metal and fabricated metal products as well as machinery and equipment, motor vehicles and other transport registered negative productivity growth rates from 1996 to 2006. On the whole, the manufacturing sector's aggregate productivity declined by 3.4% from 1996 to 2006.

The manufacturing sector was divided into four groups: non-traded, purely importable, purely exportable, and mixed. Both the non-traded and purely exportable sectors posted positive growth rates from 1996 to 2006, most of which was contributed by growth in the covariance component. The non traded sector grew by 3.9% during this period, of which 3.2% was due to the reallocation of market share from less efficient to more efficient firms. The purely exportable sector grew by 3.8%, of which 5% was contributed by the reshuffling of market shares towards more efficient firms.

The purely importable and mixed sectors declined by 1% and 3.9%, respectively from 1996 to 2006. In both groups, unweighted productivity growth and covariance growth rates were negative.

5.2. Impact of Trade Liberalization on the Different Groups: 1996-2006

To examine the direct effects of trade liberalization on productivity growth in the presence of firm heterogeneity, equation 4 is applied to the non-traded, purely importable, purely exportable and mixed sectors. Evidence points out that the reshuffling of output share and resources among firms with different productivity levels is an important source of trade-induced productivity gains (Melitz 2002). In particular, the productivity of firms exposed to international trade (exporters and import-competing firms) grew much more than that of firms in the non-traded sectors (Epifani 2003). As Chile's experience shows (Pavcnik 2000), the reallocation of resources and market share towards more productive firms is a critical determinant of productivity growth and this can be largely due to trade liberalization.

Melitz (2002) shows that trade can contribute to the Darwinian evolution of industries by forcing the least efficient firms to contract or exit while promoting the growth of the more efficient ones. Exposure to trade will induce only the more productive firms to enter the export market and will simultaneously force the least productive firms to exit, while the less productive firms continue to produce only for the domestic market. The entry of firms in response to the higher relative profits earned by exporters leads to the exit of the least productive domestic firms.Through trade liberalization, additional inter-firm reallocations towards more productive firms occur which can generate industry productivity growth, without necessarily affecting intra-firm efficiency.

Tables 6, 7, and 8 present the results of the regression using pooled OLS, random effects, and fixed effects techniques respectively. Two trade policy proxies are applied, effective protection rate and nominal protection measured by tariff rate on finished goods. Using effective protection rate as trade proxy, Table 6 shows that based on pooled OLS technique, the coefficient on l*nepr* is negative and highly significant for the purely importable, mixed and non-traded sectors. For the purely exportable sector, a significant (at the 5% level) positive sign is obtained. This tends to imply that since

exportable are penalized by the protection system, increasing their protection would improve the sector's productivity.

Table 6. Regression Results (Equation 4): OLS Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.122***	-0.076***	0.065***	-0.057***	-0.036***	-0.024***	0.002	-0.034***
	(0.036)	(0.015)	(0.028)	(0.009)	(0.010)	(0.003)	(0.013)	(0.002)
exit indicator	0.004	0.003	-0.001	-0.010***	0.003	0.005	-0.001	-0.010***
	(0.008)	(0.007)	(0.006)	(0.002)	(0.008)	(0.007)	(0.006)	(0.002)
lnworkers	0.051***	0.064***	0.041***	0.044***	0.051***	0.064***	0.041***	0.043***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.4117	0.3787	0.267	0.2887	0.4111	0.3854	0.2648	0.3033
N	1024	2296	1738	17442	1024	2296	1738	17442

Source: Author's estimates

Note:Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

With respect to the *exit indicator*, the coefficient is negative and highly significant only for the mixed sector. For the purely importable and non-traded sectors, the coefficient on *exit* is positive but insignificant. For the purely exportable sector, the coefficient is negative but not statistically significant. The coefficient on *lnworkers* is positive and highly significant for all groups.

Next, equation 4 is tested using the random effects method. In general, the same results areobtained as shown in Table 7. The coefficient on the trade variable, *lnepr*, is negative and highly significant for both purely importable and mixed sectors.It is also negative for the non-traded sector but insignificant. For the purely exportable sector, a positive sign is also obtained but is not statistically significant. The coefficient on the exit variable is negative and highly significant for firms in the mixed sector while the coefficient on *lnworkers* is positive and highly significant for all groups. A test for random effects was performed based on the Breusch and Pagan Lagrangianmultiplier test. The result rejected the null hypothesis that random effects are not needed.

Table 7. Regression Results (Equation 4): Random Effects Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.049	-0.073***	0.037	-0.031***	-0.013	-0.024***	-0.004	-0.022***
	(0.043)	(0.017)	(0.027)	(0.009)	(0.011)	(0.005)	(0.012)	(0.002)
exit indicator	0.001	0.006	-0.0005	-0.006***	0.001	0.007	-0.0003	-0.007***
	(0.006)	(0.006)	(0.005)	(0.002)	(0.006)	(0.006)	(0.005)	(0.002)
lnworkers	0.046***	0.047***	0.033***	0.036***	0.046***	0.047***	0.033***	0.035***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)	(0.003)	(0.001)
sector indicators	yes		yes		yes	yes	yes	yes
year indicators	yes		yes		yes	yes	yes	yes
within	0.0721	0.0009	0.0004	0.0026	0.0711	0.0012	0.0002	0.002
between	0.3971	0.4028	0.2956	0.3451	0.3981	0.4007	0.2966	0.362
overall	0.407	0.3728	0.2652	0.2809	0.4064	0.379	0.2631	0.296
N	1024	2296	1738	17442	1024	2296	1738	17442
Breusch-Pagan Test	$chi^2(1) = 10314.56$ Prob> $chi^2 = 0.0000$				$chi^2(1) = 9850.85$ Prob> $chi^2 = 0.0000$			

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Equation 4 is then estimated using the fixed effects method. The results in table 8 show that the coefficient on *lnepr* is negative and significant at the 5% level only for the purely importable sector. For the purely exportable, mixed and non-traded sectors, the coefficients are positive but not statistically significant. The coefficient on the *exit* variable is negative and statistically significant only for the mixed sector. The coefficient on *lnworkers* is positive and highly significant for the mixed and non-traded sectors. For the purely importable sector, the coefficient on *lnworkers* is negative and highly significant indicating that relatively smaller firms are more productive. It also indicates that firms in the purely importable sector are downsizing to improve their efficiency. The Hausman test was applied and the result rejected the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator.This justifies the use of the results obtained through the fixed effects method.

Table 8. Regression Results (Equation 4): Fixed Effects Method

	(1)EPR as trade proxy (*lnepr*)				(2)Tariff rate as trade proxy (*lntar*)			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.059	-0.052**	0.036	0.007	0.024	-0.016	0.008	0.003***
	(0.067)	(0.030)	(0.042)	(0.014)	(0.019)	(0.010)	(0.015)	(0.004)
exit indicator	0.001	0.007	-0.003	-0.004**	0.001	0.008	-0.002	-0.004**
	(0.007)	(0.006)	(0.007)	(0.002)	(0.007)	(0.006)	(0.007)	(0.002)
lnworkers	0.034***	-0.002	-0.015***	0.005***	0.034***	-0.001	-0.015***	0.005***
	(0.009)	(0.007)	(0.008)	(0.002)	(0.008)	(0.007)	(0.008)	(0.002)
sector indicators	yes	yes	yes		yes	yes	yes	yes
year indicators	yes	yes	yes		yes	yes	yes	yes
within	0.0768	0.0186	0.0319	0.0107	0.0786	0.0185	0.0311	0.0108
between	0.3399	0.0034	0.1396	0.0342	0.2956	0.0014	0.1667	0.0317
overall	0.3564	0.0038	0.1555	0.0229	0.3154	0.0016	0.1729	0.021
N	1024	2296	1738	17442	1024	2296	1738	17442
Hausman Test	chi^2=788.23 Prob> chi^2 = 0.0000				chi^2=788.96 Prob> chi^2 = 0.0000			

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Using tariff rate as a trade proxy, the results are on the whole the same as those obtained using effective protection rate. In terms of magnitude, the coefficients on *lnepr* are higher than the coefficients on *lntar*. Note that the tariff rates applied above are only for the firm's final output while effective protection rates take into account the tariff rates on both inputs and outputs of the firm.

5.3. Policy Reversal

Amidst an incomplete trade liberalization process, the government adopted a policy of selective protection in 2003. Two pieces of legislation were passed which increased the tariffs on goods that were domestically produced, and reduced those on goods that were not locally manufactured. To examine the impact of the reversal, Equation 4 is estimated by dividing the years into two periods to roughly cover the years before and after the policy reversal. Tables 9 and 10 show the fixed effects results (Appendix 2 contains the results using OLS and random effects methods).

Table 9. Period 1996-2002 Fixed Effects Results

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.083	-0.044*	0.04	-0.007	0.011	-0.005	-0.016	0.007
	(0.066)	(0.031)	(0.050)	(0.014)	(0.020)	(0.011)	(0.022)	(0.004)
exit indicator	-0.009	0.015*	0.006	-0.002	-0.009	0.015**	0.006	-0.002
	(0.008)	(0.007)	(0.008)	(0.002)	(0.008)	(0.007)	(0.008)	(0.002)
lnworkers	0.016*	-0.003	-0.012	0.008**	0.016*	-0.002	-0.013	0.008**
	(0.012)	(0.010)	(0.012)	(0.004)	(0.012)	(0.010)	(0.012)	(0.004)
sector indicators	no	yes	no	yes	no	yes	no	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.046	0.037	0.04	0.011	0.041	0.034	0.039	0.012
between	0.261	0.007	0.195	0.047	0.27	0.006	0.22	0.033
overall	0.26	0.008	0.145	0.046	0.281	0.006	0.17	0.034
N	519	1364	912	9660	519	1364	912	9660
Hausman Test	chi^2=271.91 Prob> chi^2 = 0.0000				chi^2=334.18 Prob> chi^2 = 0.0000			

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Table 10. Period 2003-2006 Fixed Effects Results

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	0.025	0.152	0.092	-0.007	0.021	0.01	-0.004	0.008
	(0.866)	(0.145)	(0.262)	(0.053)	(0.056)	(0.017)	(0.035)	(0.007)
exit indicator	0.003	-0.028	-0.004	-0.0001	0.003	-0.028	-0.004	0.00001
	(0.020)	(0.021)	(0.016)	(0.004)	(0.021)	(0.022)	(0.016)	(0.004)
lnworkers	0.029	-0.020*	-0.024***	-0.010***	0.029	-0.020**	-0.025***	-0.010***
	(0.016)	(0.013)	(0.009)	(0.004)	(0.015)	(0.013)	(0.009)	(0.004)
sector indicators	yes	no	no		yes	no	no	yes
year indicators	yes	yes	yes		yes	yes	yes	yes
within	0.047	0.02	0.025	0.01	0.047	0.018	0.025	0.01
between	0.357	0.209	0.274	0.074	0.313	0.261	0.269	0.088
overall	0.344	0.188	0.234	0.083	0.301	0.25	0.237	0.095
N	505	932	826	7782	505	932	826	7782
Hausman Test	chi^2=401.13 Prob> chi^2 = 0.0000				chi^2=422.08 Prob> chi^2 = 0.0000			

Source: Author's estimates
Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.
NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Prior to the policy reversal, the coefficient on *lnepr* is negative and significant at 10% level for the purely importable sector. For the mixed sector, the coefficient on *lnepr* is also negative but not statistically significant. Its coefficient on *lnworkers* is positive and highly significant. After the announcement of the selective protection policy, the coefficient on *lnepr* for the purely importable sector turned positive, but insignificant. For the mixed sector, the coefficient on *lnepr* is still negative and insignificant. The purely importable sector registered positive aggregate productivity growth rates in 1997 and 1998. The sector grew by 2.2% from 1996 to 1998, most of which was due to within productivity growth. For the whole period, the sector's productivity declined by about 1% from 1996 to 2006. For the mixed sector, aggregate productivity declined by around 4% between 1996 and 2006.

It is possible that with the selective protection policy, the early productivity improvements arising from the mid-1990's liberalization were not sustained due to the increase in protection in the early 2000s. As Table 5 shows, the aggregate productivity was positive immediately after 1996 till the late 1990s for food, beverages and tobacco, which grew by 3% from 1996 to 1998.[6]Garments also grew by 2.5% during the same span of years along with wood and metallic products. Petroleum, chemicals and rubber grew by 2.9% from 1996 to 2000, while machinery equipment and transport also grew by 0.9% during the same period. Thereafter, aggregate productivity growth in these sectors turned negative.

With respect to the coefficient on *lnworkers*, this turned negative and highly significant, which might indicate that firms were downsizing to improve their efficiency. For the purely exportable and purely importable sectors, the coefficient on *lnworkers* is also negative and significant at the 1% level for the former and at 10% level for the latter. Meanwhile, the coefficient on *exit* remained insignificant before and after the policy reversal. Note however, that for the purely importable sector, the

[6]The Asian Financial Crisis in 1997-1998 might have led to negative aggregate productivity growth in the early 2000s.

coefficient on exit was positive and significant at the 10% level during the period 1996-2002 indicating that exiting firms have higher productivity than continuing firms. This might signal an economic distortion in production and misallocation of resources due to the wide differences in protection. In the next period, however, this was no longer significant.

6. Conclusions and Policy Implications

The results of the paper provide some evidence in support of the hypothesis that trade liberalization leads to productivity gains and conversely, protection leads to productivity losses. This is confirmed by the negative and significant coefficient on *lnepr* for the purely importable sector. For the mixed sector, the coefficient on *lnepr* is also negative but statistically insignificant. With respect to the coefficient on the *exit* indicator, it has the correct negative sign that is significant at the 5% level.

The fourth tariff reform program was designed to further modify tariffs towards a more uniform structure. However, it was never implemented and instead, the government adopted a selective protection policy. Simultaneously, the government resorted to alternative instruments of protection as seen in the growing application of contingent protection measures[7] such as safeguard measures and anti-dumping duties. Tariff Commission reports show that between 2000 and 2006, safeguard measures were granted in cement, ceramic tiles, chemicals, float glass, figured glass, and glass mirrors. As such, the gains in terms of productivity improvement arising from initial trade reforms may have dissipated. It may also have weakened the whole process of restructuring and reshuffling of resources from less productive to more productive firms, as the protection of selected industries allowed and prolonged the survival of inefficient firms.

Reversing the policy towards selective protection in midstream was costly in terms of the productivity losses in both the purely importable and mixed sectors. The productivity estimates show that right after the substantial trade reforms carried out till

[7]These are not included in the calculation of effective protection rates.

the mid-1990s, there were aggregate productivity gains observed in the purely importable sector as its growth increased by 2.2% from 1996 to 1998. Overall, its aggregate productivity growth declined by 1% from 1996 to 2006.For the mixed sector, aggregate productivity dropped by 3.9% during the same period. Note that this coincided with the 1997 Asian Financial Crisis which also aggravated the productivity decline.

In contrast, the purely exportable sector which was penalized by the protection structure and the non-traded sector were the ones that grew as their aggregate productivity increased by 3.8% and 3.9%, respectively from 1996 to 2006. For the purely exportable sector, 5% of its aggregate productivity growth was due to the reallocation of market shares towards more efficient firms. In the case of the non-traded sector, 3.2% was due to the reallocation effect and 0.8% due to within productivity growth.

Rodrik (1989) points out that the primary need for a government engaged in trade liberalization is to establish and bolster its credibility. Allowing the possibility of providing protection amidst the transition process sends a signal to firms that the government will not commit itself to a given policy reform. This can negatively affect the performance of firms and can lead to so-called time-inconsistency problems. The firms do not adjust because they expect to obtain further protection in the future. When the future comes, it may not be politically optimal for the government not to grant such protection.

The preceding analysis suggests a thorough review of the protection structure. The diverse tariff protection and bias against exports must be corrected to complete the liberalization process. Engaging in tariff reforms that do not reduce the level of dispersion of the tariff structure will convey relatively small benefits. Hence, the government needs to reduce the highest tariffs as there are costs involved in terms of inefficiencies in resource allocation. There is also a need to simplify the tariff structure by limiting the number of tariffs and reducing both tariff levels and their dispersion by adopting a more uniform tariff structure. A uniform tariff policy will address the current distortion in the protection system where intermediate inputs such as sugar, petrochemicals, glass, iron and steel have higher tariffs than their final user products.

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Appendix Tables

Appendix 1. Number of Firms inthe Panel

Year	Number of firms per year	Number of firms that exited by 2006
1996	2603	5
1997	2642	826
1998	2627	204
2000	2135	471
2002	2448	857
2003	2207	610
2005	3508	593
2006	4330	--
Total	22500	3566

Source: Author's tabulations based on NSO Annual Survey of Establishments and Census of Establishments.

Appendix 2. Regression Results

Table 2.1. OLS Results: Period 1996-2002

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.129***	-0.060***	0.119***	-0.050***	-0.027***	-0.019***	0.056***	-0.033***
	(0.033)	(0.016)	(0.032)	(0.010)	(0.012)	(0.004)	(0.021)	(0.003)
exit indicator	-0.001	0.006	-0.001	-0.010***	-0.001	0.007	-0.002	-0.010***
	(0.009)	(0.008)	(0.008)	(0.003)	(0.010)	(0.008)	(0.009)	(0.003)
lnworkers	0.048***	0.064***	0.039***	0.043***	0.048***	0.064***	0.040***	0.043***
	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.448	0.424	0.28	0.279	0.442	0.426	0.276	0.292
N	519	1364	912	9660	519	1364	912	9660

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Table 2.2. Random Effects Results: Period 1996-2002

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.028	-0.065***	0.065**	-0.032***	-0.009	-0.019***	-0.005	-0.020***
	(0.038)	(0.018)	(0.032)	(0.009)	(0.012)	(0.006)	(0.018)	(0.003)
exit indicator	-0.005	0.011*	0.004	-0.005***	-0.005	0.012**	0.004	-0.005***
	(0.007)	(0.006)	(0.007)	(0.002)	(0.007)	(0.006)	(0.007)	(0.002)
lnworkers	0.041***	0.054***	0.035***	0.038***	0.042***	0.054***	0.034***	0.038***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.029	0.004	0.007	0.005	0.029	0.004	0.006	0.004
between	0.439	0.444	0.295	0.31	0.438	0.442	0.289	0.325
overall	0.436	0.42	0.278	0.274	0.434	0.422	0.268	0.286
N	519	1364	912	9660	519	1364	912	9660
Breusch-Pagan Test	$chi^2(1) = 4551.05$ Prob> $chi^2 = 0.0000$				$chi^2(1) = 4373.08$ Prob> $chi^2 = 0.0000$			

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Table 2.3. OLS Results: Period 2003-2006

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.11	-0.127***	-0.024	-0.072***	-0.059***	-0.031***	-0.040*	-0.036***
	(0.084)	(0.031)	(0.113)	(0.017)	(0.026)	(0.005)	(0.022)	(0.003)
exit indicator	0.011	-0.004	0.0005	-0.011***	0.01	-0.002	0.002	-0.010***
	(0.013)	(0.015)	(0.009)	(0.003)	(0.013)	(0.015)	(0.009)	(0.003)
lnworkers	0.055***	0.064***	0.044***	0.044***	0.055***	0.065***	0.044***	0.043***
	(0.004)	(0.003)	(0.003)	(0.001)	(0.004)	(0.003)	(0.003)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
firm indicators	no	no	no		no	no	no	no
R-squared	0.3826	0.3235	0.254	0.3016	0.3871	0.3359	0.2572	0.3162
N	505	932	826	7782	505	932	826	7782

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.

Table 2.4. Random Effects Results: Period 2003-2006

	(1)EPR as trade proxy				(2)Tariff rate as trade proxy			
Explanatory Variable	NT	PM	PX	MX	NT	PM	PX	MX
trade proxy	-0.064	-0.118***	-0.043	-0.060***	-0.039	-0.029***	-0.023	-0.031***
	(0.092)	(0.036)	(0.129)	(0.019)	(0.028)	(0.006)	(0.021)	(0.003)
exit indicator	0.007	0.001	-0.001	-0.006*	0.006	0.001	-0.0001	-0.006*
	(0.012)	(0.013)	(0.009)	(0.003)	(0.012)	(0.013)	(0.009)	(0.003)
lnworkers	0.052***	0.053***	0.039***	0.040***	0.052***	0.053***	0.039***	0.040***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)	(0.001)
sector indicators	yes	yes	yes	yes	yes	yes	yes	yes
year indicators	yes	yes	yes	yes	yes	yes	yes	yes
within	0.043	0.006	0.016	0.003	0.042	0.006	0.015	0.003
between	0.408	0.349	0.294	0.347	0.411	0.36	0.298	0.364
overall	0.381	0.32	0.253	0.3	0.385	0.333	0.256	0.315
N	505	932	826	7782	505	932	826	7782
Breusch-Pagan Test	$chi^2(1) = 1782.12$ Prob> $chi^2 = 0.0000$				$chi^2(1) = 1728.07$ Prob>$chi^2 = 0.0000$			

Source: Author's estimates

Note: Robust standard errors in parentheses. * 10% level, **5% level of significance, ***1% level of significance.

NT: Non-traded, PM: Purely importable, PX: Purely exportable, MX: Mixed sector.