IDB WORKING PAPER SERIES # IDB-WP-150

Microeconomic Flexibility, Creative Destruction and Trade

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Vice Presidency for Sectors and Knowledge
Integration and Trade Sector

December / 2009

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2009

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Blyde, Juan.
Microeconomic flexibility, creative destruction and trade / Juan Blyde, José Pineda.
p. cm. (IDB working paper series ; 150)
Includes bibliographical references.
1. Export trading companies. 2. Costs, Industrial. 3. Industrial productivity. 4. Commerce—Costs. I. Pineda, José. II. Inter-American Development Bank. Integration and Trade Sector. III. Title. IV. Series.
HF1416 B59 2009
382.6 B661—dc22

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Abstract

We investigate whether greater microeconomic flexibility facilitates the process of creative destruction in the context of new trade models with heterogeneous firms (Bernard et al., 2003 and Melitz, 2003). In these models, freer trade increases aggregate productivity because high-efficiency firms expand through exporting and low-efficiency firms exit the market. However, factor reallocation could be negatively affected by the presence of microeconomic frictions. We use these insights of the theory to analyze whether a reduction in trade costs increases the probability of becoming an exporter relatively more in industries with greater microeconomic flexibility and whether plant exit driven by trade costs declines is more likely in industries with lower frictions. Using plant level data from Venezuela, we report results supporting these predictions.

JEL No. F13, F14, L1, O12

Key word: Trade costs, microeconomic frictions, resource reallocation.

1. Introduction

It is increasingly recognized that the process of creative destruction is one of the core components of economic development. Popularized by Schumpter, the notion that innovative entry is the force that sustain long-term economic growth even as it renders obsolete and consequentially destroys value of established processes, products or firms, has not only been formalized many times in the profession (see e.g. Segerstrom, Anant, and Dinopoulos, 1990, Aghion and Howitt, 1992) but has also found strong support in the empirical literature. Plant level studies, for example, increasingly show that an important share of aggregate productivity growth, in both developed and developing countries, arises by the reallocation of resources from low to high productivity plants (see e.g., Bernard and Jensen, 1999, Foster, Haltiwanger and Krisan, 1998 and Bartelsman, Haltiwanger and Scarpetta, 2004). This highlights the role of creative destruction on productivity growth.

New trade models with heterogeneous firms (Bernard et al., 2003 and Melitz, 2003) suggest that international trade play a significant role in this reallocative process across firms. Indeed, consistent empirical evidence supporting these trade-induced reallocation channels has been found in Bernard et al., (2006), Blyde, Iberti and Moreira (2009) and Eslava et al., (2009). However, there is relatively less investigation on how the presence of microeconomic frictions affects this trade-induced reallocative process. This paper is a contribution to fill this gap in the literature.

We use the predictions of the new trade models with heterogeneous firms to explore the workings of creative destruction in the presence of microeconomic rigidities. In these new models, trade raises the economy's average productivity by weeding out the low and boosting the high productivity firms. Therefore, we test whether a reduction in trade costs increases the probability of becoming an exporter relatively more in industries with lower microeconomic frictions, and whether falling trade costs raises the prospects of plant exit relatively more in more flexible industries.

Our analysis contributes to three literatures. First, we examine specific channels by which microeconomic distortions affect the reallocation of resources across firms of different productivity levels. This is associated with a recent surge of studies indicating that the presence of distortions account for large differences between developed and developing countries in the efficiency of resource allocation across heterogeneous firms (Hsieh and Klenow, 2009; Restuccia and Rogerson, 2008 and Alfaro et. al., 2008). By testing various mechanisms of factor reallocation and their frictions, our paper provides concrete examples to this literature regarding some of the channels by which distortions affect an efficient allocation of resources across plants.

Second, our results highlight the limited role of trade in boosting aggregate productivity in economies that are highly distorted with microeconomic frictions. A large cross-country empirical literature has examined the effects of trade on economic performance. While many studies have found that trade have positive effects on income (Dollar, 1992; Ben David, 1993; Sachs and Warner, 1995; Frankel and Romer, 1999 and Wacziarg and Welch, 2003) others have casted doubts about the robustness of these aggregate results (Rodriguez and Rodrik, 2001, and Rodrik et al. 2004). A more recent work in Freund and Bolaky (2008) contributes to clarify some of the controversy by showing that there is a positive relationship between trade and income per-capita in flexible economies, but not in economies that are highly distorted with regulations. This work is important because it highlights the potential limits of trade in boosting income in economies with various types of frictions. Our work advances this discussion even further by showing some of the specific channels by which microeconomic frictions interfere with the capacity of trade to enhance economic performance.

Finally, our research contributes to a more general literature of creative destruction and its impediments. Several factors, from constrained contracting ability in labor markets to underdeveloped financial markets, have been suggested to slow down the required reallocation and restructuring inherent of creative destruction processes (see e.g. Caballero and Hammour, 1994, Caballero and Hammour, 2000). However, empirical evidence not only on the role of these and other microeconomic frictions in hampering creative destruction but also on the channels through which these distortions operate is still relatively scarce. In the context of this paper, the notion of creative destruction is related to the prediction that the most efficient plants are likely to grow when trade costs are reduced and the less efficient plants are likely to exit the market as a result. By analyzing the extent to which this process is hampered by microeconomic frictions, the paper helps to understand why some processes of creative destruction might never take place.

The paper proceeds as follows. Section 2 presents a summary of the reallocation effects predicted by the new trade models with heterogeneous firms and explains how the predictions can be used to analyze the impact of microeconomic rigidities on the process of creative destruction. Section 3 describes the various datasets used in the analysis. The empirical results are also presented in this section. Section 4 concludes.

2. Theoretical Background

A large empirical literature using microeconomic data have found a positive correlation between international trade and the productivity of the plant, although the evidence is still mixed regarding the causality of this relationship (see e.g. Aw, Chung, and Roberts, 2000; Bernard and Jensen, 1999; Bernard and Jensen, 2004; Clerides, Lach, and Tybout, 1998; Harrison, 1994; Pavcnik, 2002; Alvarez and Lopez, 2005; and Fernandes, 2007). Much less controversial, however, is the role that international trade plays in boosting aggregate productivity by reallocating resources from low to high efficiency plants. An increasing body of evidence indicates that a large share of aggregate productivity growth arises from the reallocation of resources from low to high productivity plants (see e.g., Bernard and Jensen, 1999, and Bartelsman, et. al., 2004) and new trade models with heterogeneous firms indeed suggest that international trade plays an important role in this reallocative process (Bernard et al., 2003 and Melitz, 2003). Consistent empirical evidence supporting these trade-induced reallocation channels has been found in Bernard et al., (2006), Blyde, Iberti and Moreira (2009) and Eslava et al., (2009).

These new trade models with heterogeneous firms provide an excellent framework to investigate the process of creative destruction and its obstacles because they lay out the specific mechanisms by which trade weeds out the low productivity and boost the high productivity firms. In this section we present a brief summary of one of these models, the Melit'z model, in order to highlight the theoretical predictions that guide our empirical analysis.

The trade model in Melitz (2003) is characterized by monopolistic competition in which each variety is produced by a single firm, and there is free entry into the industry. All firms use the same technology represented by a cost function with constant marginal costs and a fixed production cost, but firms are heterogeneous in terms of their intrinsic productivity. The model assumes the existence of an unbounded pool of prospective entrants into the industry. To enter the industry, firms must make an initial investment, or fixed entry cost, and only afterwards they learn about their productivity. The firm will produce if profits are positive, otherwise it will exit immediately.

Trade is costly in the sense that to export a manufacturing variety to a particular market, a firm must incur in a fixed export cost which is different (and additional) to the fixed cost of production. The firm also faces variable trade costs, which take the standard iceberg formulation. These fixed and variable trade costs mean that, depending on their productivity, some firms may choose not to export in equilibrium. Specifically, the less productive firms will produce exclusively for the domestic market and only the most productive firms will be able to export.

In this model, a reduction in trade costs induces a reallocation of resources from low to high productivity plants. The reallocative process associated to creative-destruction works as follows: falling trade costs implies greater profits for the exporters which induce more entry. Specifically, lower trade costs reduce the productivity threshold for exporting which increases the number of firms which export. The new exporters are drawn from the most productive non-exporters firms and from the new entrants. The expansion of the more productive firms through exporting raises the demand for domestic inputs. As a result, domestic producers who do not export are hit by competition from foreign exporters, on the one hand, and by higher input prices on the other, which forces the least productive of these firms to exit the market. This completes the process of creative destruction. In summary, aggregate productivity gains occur because the most productive non-exporters begin to export when trade costs decline and the low productivity establishments exit the market as a result.

The workings of this model provide an excellent framework to test the specific channels by which microeconomic frictions deter a process of creative destruction induced, in this case, by international trade. Before getting into the details on how we do this, it is worth saying a few words about what we mean by microeconomic frictions. Generically, we define microeconomic frictions as all the bureaucratic, legal and institutional hurdles that increase the costs of opening and operating a business. These frictions could arise form government policies and regulations or from government deficiencies or red tape. For example, excessive bureaucratic procedures required to start or to close a business, to register property, to acquire a business license or to obtain construction or operating permits can all increase the costs of doing business. Similarly, stringent labor market regulations can make more difficult and costly the process of hiring and firing workers which in turn increases the adjustment costs of operating a firm. Equally, weak institutional environments can increase the costs of enforcing contracts by raising the time and the number of procedures that a firm must incurred from filing a lawsuit to actual payment. All these are examples of microeconomic rigidities that can increase the costs of running a business.

In the context of the Melitz's model described above, we can think of all these costs as being part of the fixed production costs. It is instructive to know, then, that the zero-profit productivity cutoff in this model is increasing in these fixed production costs. In other words, higher fixed production costs imply that firms must draw a higher productivity in order to earn sufficient revenue to cover them. This implies that in industries with large microeconomic rigidities, and consequentially high fixed production costs, fewer firms will be able to produce profitably and even less will be able to export. On the contrary, in industries with low microeconomic frictions, the much lower zero-profit productivity cutoff means that a larger number of prospective firms will be able to produce and perhaps become exporters. This feature provides the basis for our inference strategy in the context of the main insights of Melitz's model. In particular, the predictions of the model that we want to test are: i) a decrease in variable trade costs increases the probability of becoming an exporter relatively more in industries with lower microeconomic frictions, and ii) a decrease in variable trade costs raises the probability of firm exit relatively more in industries with lower microeconomic rigidities. The next section describes an empirical model to test these predictions.

3. Empirical Analysis

3.1 Model Specification

The previous section suggests that the market selection effects of trade reductions are larger in industries with lower microeconomic frictions. Based on this implication, our empirical approach is to test for a differential effect of changes in trade costs in industries that are more flexible. We estimate two models to analyze the two predictions stated above: one model for the probability of becoming an exporter and another model for the probability that a plant exit the market.

We use the following probit model to analyze the impact of falling trade costs on the probability that a non-exporting plant becomes an exporter:

$$\Pr(s_{ijt+1}) = \phi(\beta \Delta Tar_{jt-1} + \gamma X_{ijt} + \varphi \Delta Tar_{jt-1} F_j + \alpha_j + \alpha_t + \alpha_r) \qquad (1)$$

where s_{ijt+1} takes the value of 1 if plant *i* in industry *j* is a non-exporter in period *t* and becomes an exporter in period *t+1*; ΔTar_{jt-1} is the change in the tariff rate in industry *j* between *t-1* and *t*; X_{ijt} is a vector of plant characteristics, F_j is a measure of microeconomic frictions in industry *j* and α_j, α_t and α_r are industry, time and region effects respectively. Finally, the interaction term between the tariff rate and the measure of microeconomic frictions allows us to assess whether the effect of changes in trade costs on the probability of exporting is less significant in more rigid industries.

Equivalently, we use the following probit model to analyze the impact of falling trade costs on the probability of plant exit:

$$\Pr(e_{ijt+1}) = \phi(\beta\Delta Tar_{jt-1} + \gamma X_{jit} + \varphi\Delta Tar_{jt-1}F_j + \alpha_j + \alpha_t + \alpha_r) \qquad (2)$$

where e_{jit+1} takes the value of 1 if plant *i* in industry *j* exits between periods *t* and *t+1*, and the rest of the variables are described as before. We estimate these models using plant level data from Venezuela.

3.2 Data

We use a panel of manufacturing plants drawn from the Venezuelan Industrial Survey (Encuesta Industrial de Venezuela). This is an annual survey of manufacturing conducted by the Venezuelan Statistics Agency, the *Instituto Nacional de Estadística* (INE). The survey covers manufacturing plants that employ at least five individuals and collects detailed information on plant characteristics, such as geographic location, manufacturing industry, production, value added, exports, employment, intermediate inputs, and investment. Capital stocks are constructed using the perpetual inventory method for each plant. A measure of total factor productivity is constructed using the Levinsohn and Petrin (2003) methodology.

Given the dynamic nature of the creative destruction process we are interested in covering the longest time period possible. The available data spans from 1995 to 2004. The survey is conducted using a stratified random sample procedure with 828 strata corresponding to 4 occupational categories, 23 estates and 9 economic activities (ISIC revision 2 at 2 digits). Only the largest occupation category -that is plants with more than 100 employees- is treated like a census during this entire period of analysis. This implies that only the plant exits that are recorded in this occupational category represent “true” exits of the market and not the result of the random sampling process. Accordingly, we use only the plants in this occupational category which provides us with a panel of 6,431 observations. Table 1 shows a summary statistics of the main variables used from this survey.

Measuring microeconomic flexibility is a challenging exercise. One way is to look directly at regulations. For example, we could examine whether there are differences in labor regulations across industries and construct an index of labor regulation at the industry level similar to those that have been constructed at the country level (see e.g. Botero, Djankov, La Porta, Lopez-de-Silanes and Shleifer, 2004 and Heckman and Pagés, 2004). The problem with this approach, however, is that microeconomic flexibility depends not only on labor regulations but also on an array of many other factors, as mentioned before. Constructing various indices to provide a “big picture” of all these factors would be a formidable task, to say the least. Instead, we take a different route and construct a general measure of microeconomic flexibility following the methodology developed by Caballero, Engel and Micco (2004) (CEM henceforth).

The main idea behind this methodology is that a general degree of microeconomic flexibility can be captured by the speed at which establishments reduce the gap between their labor productivity and the marginal costs of such labor. According to the authors, an economy or industry is inflexible at the microeconomic level if these gaps persist over time. Conversely, a very flexible economy or industry, is one in which gaps disappear quickly because adjustments can be done promptly.

According to the authors, the theoretical underpinning of such estimation is based on an adjustment hazard model, where the change in the number of jobs in plant *i* in industry *j* between *t-1* and *t* is a probabilistic function of the gap between desired and actual employment:

$$\Delta e_{ijt} = \psi_{ijt}(e^*_{ijt} - e_{ijt-1})$$

where e_{ijt-1} is the logarithm of employment of plant *i* in industry *j* at time *t-1*, e^*_{ijt} is desired employment in period *t*, ψ_{ijt} is assume to be i.i.d. both across establishments and over time, takes values between 0 and 1 and has mean λ and variance $\alpha\lambda(1-\lambda)$, with $0 \le \alpha \le 1$. The degree of microeconomic flexibility is captured by λ which increases when λ approaches one and falls when λ declines. A key part of the calculation is to obtain good proxies for the desired level of employment. This is done employing observables like labor productivity and the average market wage (see CEM for details). The authors use firm-level data to estimate country-wide measures of microeconomic flexibility for Brazil, Chile, Colombia, Mexico and Venezuela. They found, for example, that Chile exhibits the highest degree of microeconomic flexibility while Venezuela the lowest.

While it is certainly useful to estimate an average country-wide measure of microeconomic flexibility, particularly to make comparisons across countries, the degree of microeconomic flexibility might not be necessarily the same across industries within the same country. For instance, the Venezuelan labor law establishes the right of workers and employers to negotiate collective bargaining agreements. These are agreements that are made between unions and employers and they normally establish several conditions for labor relations and the rights and obligations of the two sides. The collective bargaining agreements may cover everything from wages and fringe benefits to work rules, grievance procedures and the prerogative of union officials. While collective agreements can certainly be negotiated at the plant level, in Venezuela there is a general trend towards industry-wide bargaining to set minimum conditions for all the plants in the industry. As union affiliation and its capacity to negotiate can vary markedly across industries, the outcome of these collective bargaining agreements can also be very different across industries.

Similarly, obtaining a business license involves a completely different set of bureaucratic hurdles in different industries of the economy. For example, in Venezuela, besides the standard registering requirements, firms seeking to operate in sectors like mining, processing of metals, production of construction of materials, energy industries, petroleum industries and chemical industries must submit an environmental-impact study with specific obligations that vary by sectors. Another example of industry-specific frictions is that the government confers strategic importance to certain industries. Projects in those industries must get an approval by Congress and sometimes by the executive branch (EIU, 2008). We exploit all this variation in the level of microeconomic frictions across industries in our empirical analysis. In essence, we use the methodology presented in CEM but estimate a measure of microeconomic frictions that varies across industries.[1]

Results are shown in Table 2. Microeconomic rigidity in Venezuela seems to vary greatly across industries from “footwear” (ISIC 324) exhibiting the lowest degree of frictions to “other chemicals” (ISIC 352) -with twice the degree of rigidity in footwear- showing the highest. Although there is not a clear uniform pattern, a general trend is evident: the industries in the textile, wearing apparel and leather sector and in the non-metallic mineral sector seem to be the most flexible while the industries in the chemical and basic metal sectors seem to be the most rigid.[2]

The ad valorem tariff rates used in the probit models come from Nicita and Olarreaga (2006). The information refers to applied tariff rates which take into consideration preference schemes. The data is provided at the 3 digit ISIC revision 2 industry level, where the rate in industry *j* is the import weighted average across all products in *j*. Table 2 reports the information for three alternative years. The average tariff rate in Venezuela and its dispersion increased from 1995 to 2000, but declined since then. Between 2000 and 2005, the external protection rate fell in 21 out of 27 industries.[3]

3.3 Empirical Results

Before testing the predictions of the model stated above, we would like investigate whether firms that exit are in general less productive than firms that do not exit, and whether exporters are more productive than the non-exporters. This is shown in Table 3. Each row in the table reports results from a separate regression of the following form:

$$\ln(TFP_{it}) = \alpha + \beta L_{it} + \gamma X_i + \alpha_j + \alpha_t + \alpha_r + \varepsilon_{it} \qquad (3)$$

[1] To emphasize the existence of microeconomic distortions, we present the index as a measure of microeconomic frictions rather than an index of microeconomic flexibility as presented by CEM. Therefore, our measure is equal to one over the index constructed as in CEM.

[2] We have excluded the petroleum refineries (ISIC 353) and the miscellaneous petroleum and coal products (ISIC 354) from the analysis because they are organized in a manner that is inconsistent with the underlying behavioral trade model; that is, they are organized as monopolies, are mostly state-owned and produce with very few plants.

[3] The theoretical models described above contemplate symmetric reductions in trade costs, i.e., both outbound and inbound trade costs change in the same way. The correlation of the changes in the inbound and the outbound trade costs of Venezuela’s main trading partners across ISIC 3-digit industries is positive and significant at the 1% level. Therefore, in our econometric model we only use the change in the inbound trade costs as our proxy for trade costs as this variable is already highly correlated with the change in the outbound trade costs. This also gives us a more parsimonious empirical specification.

where the dependent variable is the TFP of plant; L_{it} is the plant's labor force (a proxy for size); X_i is a dummy equal to 1 if the plant exit during the sample period (regression in row 1), if the plant is a non-exporter and eventually becomes an exporter (regression in row 2); and α_j, α_t and α_r are industry, year and region fixed effects. The coefficients in the table report the estimated $\hat{\gamma}$ for the two different regressions.

The results in the first row indicate that after controlling for differences in size and industry characteristics, plants that exit are indeed less productive than plants that do not exit. Plants that exit are on average 18% less productive than plants that do not exit. The second row shows that non-exporters that eventually become exporters are on average 38% more productive than the plants that never export. This is consistent with evidence in other countries.[4]

While not directly testing the effects of trade on resource allocation, these results provide some preliminary elements that are important for the creative destruction process to take place, namely that the plants that normally exit are on average less productive than the plants that do not exit and that the plants that eventually become exporters are usually more productive than the plants that do not export.

3.4 New Exporters

We now investigate the role of microeconomic frictions in the potential reallocative effects of trade. We start with the estimation of equation 1 for the probability of becoming an exporter. Results are reported in Table 4. The first column focuses only on the tariff rate. The second column includes the plant's productivity. According to the theory, the productivity of the plant should be positively associated with the probability of becoming an exporter. In column 3 we include additional plant controls that are assumed to be positively correlated with the probability of exporting: the plant's size (using labor force as a proxy) and its capital intensity. Finally, in column 4 we include the interaction term between the index of microeconomic frictions and the change in trade costs. The interaction explores whether the probability of becoming an exporter when trade costs fall is lower in industries with greater microeconomic frictions.

Except for the labor force, the estimated coefficients for all the plant controls are positive and significant, as expected. The coefficient for the labor force is negative but is not statistically significant. Regarding the effect of trade costs, the first three regressions show a lack of

[4] See Alvarez and Lopez (2005) for the case of exporters in Chile.

relationship between the change in the tariff rate and the probability of becoming an exporter. However, this result changes in column 4 after explicitly controlling for the role of microeconomic frictions. In this last regression the coefficient for the change in the tariff rate becomes negative and statistically significant and the coefficient for the interaction term between the change in the tariff rate and the friction index is positive and is also statistically significant. These two results imply that a reduction in trade costs increases the probability of becoming an exporter, but that the effect diminishes with the level of microeconomic frictions. In other words, the larger the microeconomic friction in an industry, the less likely that a firm in that industry will become an exporter when facing a reduction in trade costs.

Figure 1 presents an illustration of this finding. Using the results from the regression in column 4, the figure is constructed as follows: first, we add the marginal effect of the change in the tariff rate with the marginal effect of the interaction term. This is done for each plant. This gives us the overall marginal effect of the change in the tariff rate on the probability of exporting for each plant. Then, we obtain the average marginal effect for each industry by taking the average of the marginal effects of all the plants in that industry.

The industries are sorted according to their friction index in a way that moving from left to right, the level of friction increases. What the figure shows is that, in general, the positive effect of the reduction in the tariff rate on the likelihood of exporting diminishes with the level of frictions. In other words, plants in industries with low microeconomic frictions tend to have a large probability of becoming an exporter when trade costs fall, but this likelihood decreases as frictions increase. In fact, as the frictions become very large, the probability of becoming an exporter turns negative, meaning that in industries with very large frictions, a smaller number of plants become exporters in the face of falling trade costs than the number of plants that are already servicing foreign markets and stop exporting.

Going back to the regression results presented in column 4, another way to interpret the findings is to think about two forces that are pulling in opposite directions. On the one hand, a reduction in the tariff rate increases the probability of servicing the export market. This force is captured in the regression by the negative (and statistically significant) coefficient of tariff rate change. On the other hand, the level of friction diminishes the effect of the tariff reduction on the probability of becoming an exporter which is captured by the positive (and statistically significant) coefficient of the interaction term. The overall effect depends on the relative size of these two opposite effects. Note that the regression in column 3 does not control for the level of friction explicitly. Therefore, in this regression these two forces are captured by the coefficient of the tariff rate alone. As shown, the estimated coefficient is not statistically significant. But it would be misleading to conclude from this regression that the reduction in trade costs does not have any effect on the probability of exporting. What regression 4 (and figure 1) is telling us is that a reduction in trade costs indeed has an effect on the probability of exporting but when the level of microeconomic frictions is small. As the level of frictions increase this effect disappears.

The result highlights the notion that the removal of trade costs by itself would not necessarily generate some of the expected effects from trade liberalization if other microeconomic distortions are not tackled as well.

3.5 Plant Exit

As mentioned in the theoretical background, the other side of this trade-induced creative destruction process is the exit of the inefficient plants when trade barriers are lowered. Table 5 shows the result of estimating equation 2 with an increasing number of plant controls in each column. Consistent with the theory, we find a negative and statistically significant relationship between the changes in the tariff rate and the probability of exit. Also, the results show that the overall probability of exit decreases with the productivity of the plant.[5] Finally, as shown in column 4, the coefficient for the interaction term between the index of microeconomic frictions and the change in trade costs is positive and statistically significant, meaning that the probability of exit the market with a decline in the tariff rate is smaller in industries with large frictions, as expected.

Figure 2 is equivalent to Figure 1 for the case of the probability of exit. Once again, the general trend is that the increase in the likelihood of exit from a cut in trade costs diminishes with the level of distortions. That is, the larger the microeconomic friction in the industry, the less likely that a firm in that industry will exit the market when hit by the reduction in trade costs.

The results on new exporters and on plant exit indicate that the trade-induced reallocation of resources across heterogeneous plants is contingent to the level of microeconomic rigidities. In highly distorted industries these trade-induced reallocation effects might only be marginal.

[5] Plant exit is also negatively associated with the level of capital intensity but not with its size.

3.6 Robustness Checks

We re-estimate equations 1 and 2 with a number of modifications to check for the robustness of the results. Essentially, we eliminate extreme values in the covariates to make sure that the results have not been influenced by outliers. Table 6 shows the case for the probit model of exporting. The estimation presented in column 1, for example, excludes all the plants in the industries with the highest and lowest values of the microeconomic friction index. The estimation in column 2 excludes all the plants in the industries with the highest and lowest changes in the tariff rate. The estimation in column 3 excludes all the plants below the bottom 10 percentile and above the top 90 percentile of productivity. While there are some minor changes in some of the coefficients, the estimations in all the three regressions indicate that the results do not change in any significant way.

Similar robustness checks for the probit model on plant exit are presented in Table 7. Once again, while the values of some of the estimated coefficients do change slightly, the general qualitative results hold after all of these modifications. The evidence presented in Tables 6 and 7 corroborates the results shown in Tables 4 and 5 that the market selection effects of trade are attenuated by the presence of microeconomic frictions.

4. Concluding Remarks

High trade costs tend to distort an efficient allocation of resources by protecting inefficient producers and by limiting the expansion of the efficient ones. A decline in trade costs, then, promotes a more efficient factor reallocation by increasing the likelihood that the inefficient producers exit the market and by allowing the efficient producers to grow through exporting. Microeconomic frictions, however, might prevent this trade-induced reallocative process to take place. This paper presents empirical evidence supporting this argument. Lowering trade costs increases the chances of becoming an exporter if the plant faces a flexible microeconomic environment, but the effect diminishes as the level of frictions increase. Likewise, it is more likely that cuts in trade costs drive inefficient producers out of the market in flexible industries than in industries plagued with distortions.

The results highlight the notion that the removal of trade costs by itself would not necessarily generate many of the expected effects of trade liberalization regarding an improved and select market of plants if other microeconomic frictions are not addressed as well.

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Table 1: Summary Statistics

Variable	Mean	Std Dev
Labor	5.37	0.82
Capital / Labor	6.81	1.40
Total Factor Productivity	6.26	1.19
Exit Rate	0.05	0.02
Entry to Export Rate	0.07	0.02
No of observations	6431	

Notes: The table reports means and standard deviations of the log of labor, the log of the capital-labor ratio, the log of TFP, the exit rate and the entry into the export market rate. The exit rate is the number of plants that reported positive production in period t but not in period t+1 divided by the total number of plants in period t. The entry into the export market rate is the number of plants that reported positive exports in period t but not in period t-1 divided by the number of plants that do not export in period t.

Table 2: Microeconomic frictions index and ad valorem tariffs by three-digit ISIC industry

Industry		Microeconomic frictions index	Tariffs (%)		
			1995	2000	2004
311	Food manufacturing	2.242	14.3	18.8	13.9
312	Prepared animal feeds & food products nec	1.919	14.1	18.6	13.7
313	Beverages	1.388	17.0	18.7	18.6
314	Tobacco	1.384	19.9	20.0	18.0
321	Textiles	1.327	11.5	17.8	16.2
322	Wearing, apparel	1.243	13.5	19.8	19.5
323	Leather products	1.412	9.1	17.4	16.0
324	Footwear	1.163	14.7	20.0	19.5
331	Wood products	1.640	8.7	13.9	13.6
332	Furniture	1.608	15.3	19.2	16.8
341	Paper and products	1.635	7.8	9.9	7.9
342	Printing and publishing	1.731	12.6	6.9	7.1
351	Industrial chemicals	1.669	8.8	7.8	7.1
352	Other chemicals	2.332	9.0	11.1	8.8
355	Rubber products	1.557	11.5	13.5	13.1
356	Plastic products	1.395	15.1	18.4	16.7
361	Pottery, china, earthenware	1.498	10.7	17.6	13.7
362	Glass and products	1.364	12.4	14.3	12.4
369	Other non-metallic mineral products	1.468	12.7	13.9	12.5
371	Iron and steel	1.667	10.9	11.9	9.5
372	Non-ferrous metals	1.806	5.1	9.8	6.0
381	Fabricated metal products	1.629	13.7	15.4	13.8
382	Machinery, except electrical	1.435	10.9	9.2	8.7
383	Machinery, electric	1.676	13.8	10.6	9.1
384	Transport equipment	1.642	16.1	24.6	21.0
385	Professional and scientific equipment	1.744	11.9	7.9	7.4
390	Other manufactured products	1.615	17.0	17.9	14.7
Average		1.60	12.5	15.0	13.2
Standard deviation		3.3	3.3	4.8	4.5

Table 3: Average plant TFP relative to comparator group

Plants that exit / plants do not exit	-0.180***
	(0.0373)
New exporters / Non-exporters	0.376***
	(0.0346)

Notes: Plant-level regression results. Dependent variable is the plant's TFP. Regressors include the plant's size (Labor), year, industry and location fixed effects, and a dummy equal to 1 if the plant exit during the sample period (regression in row 1) or if the plant is a non-exporter and eventually becomes an exporter (regression in row 2). Coefficients in the table report results for this dummy variable on the two different regressions

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Table 4: Probability of Entering the Export Market

Regressor	Probit (1)	Probit (2)	Probit (3)	Probit (4)
Change in tariff	0.0146	0.0071	0.0042	-0.1874**
	(0.0269)	(0.0268)	(0.0262)	(0.0916)
Productivity		0.0071***	0.0056**	0.0055**
		(0.0025)	(0.0025)	(0.0026)
Labor			-0.0013	-0.0011
			(0.0041)	(0.0042)
Capital / Labor			0.0094***	0.0094***
			(0.0019)	(0.0019)
Change in tariff x friction index				0.1111**
				(0.0502)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Observations	5403	5306	5306	5306
Pseudo R2	0.04	0.04	0.05	0.05

Notes: Plant-level probit regression results. Numbers are average marginal effects. Robust standard errors adjusted for clustering at the three-digit ISIC level in parentheses. Industry fixed effects are also at the three-digit ISIC level. Dependent variable indicates whether a non-exporting plant in year t becomes an exporter in year t+1. First regressor is the change in the tariff rate between t-1 and t. Next three regressors are plant controls for year t where productivity, labor and capital/labor are the plant's TFP, its total labor force and the capital labor ratio respectively. All plant controls are in logs. Last regressor is the interaction between the change in the tariff rate and the microeconomic frictions index.

****; **; * significant at the 1%, 5% and 10% level respectively*

Table 5: Probability of Exit

Regressor	Probit (1)	Probit (2)	Probit (3)	Probit (4)
Change in tariff	-0.1104***	-0.1044***	-0.1034***	-0.4255**
	(0.0399)	(0.0381)	(0.0384)	(0.1855)
Productivity		-0.0132***	-0.0127***	-0.0127***
		(0.0033)	(0.0033)	(0.0033)
Labor			-0.0012	-0.0011
			(0.0038)	(0.0038)
Capital / Labor			-0.0056**	-0.0057**
			(0.0022)	(0.0022)
Change in tariff x friction index				0.1874*
				(0.1111)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Observations	4826	4750	4750	4750
Pseudo R2	0.08	0.09	0.09	0.09

Notes: Plant-level probit regression results. Numbers are average marginal effects. Robust standard errors adjusted for clustering at the three-digit ISIC level in parentheses. Industry fixed effects are also at the three-digit ISIC level. Dependent variable indicates plant exit between years t and t+1. First regressor is the change in the tariff rate between t-1 and t. Next three regressors are plant controls for year t where productivity, labor and capital/labor are the plant's TFP, its total labor force and the capital labor ratio respectively. All plant controls are in logs. Last regressor is the interaction between the change in the tariff rate and the microeconomic frictions index.

****; **; * significant at the 1%, 5% and 10% level respectively*

Table 6: Robustness Checks, Probability of Entering the Export Market

Regressor	**Plants in industries with highest and lowest friction indices excluded**	**Plants in industries with highest and lowest changes in tariffs excluded**	**Plants below bottom 10 percentile and above top 90 percentile in TFP excluded**
	(1)	**(2)**	**(3)**
Change in tariff	-0.2151**	-0.2109**	-0.2302**
	(0.0943)	(0.1015)	(0.1026)
Productivity	0.0038	0.0046*	0.0021
	(0.0024)	(0.0026)	(0.0040)
Labor	-0.0014	-0.0017	-0.0039
	(0.0046)	(0.0044)	(0.0048)
Capital / Labor	0.0094***	0.0101***	0.0096***
	(0.0021)	(0.0019)	(0.0023)
Change in tariff x friction index	0.1277**	0.1209**	0.1459***
	(0.0506)	(0.0554)	(0.0546)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
Observations	4700	5032	4181
Pseudo R2	0.06	0.05	0.06

Notes: Regression in column 1 excludes all the plants in the industries with the highest and lowest values in the microeconomic frictions index. Regression in column 2 excludes all the plants in the industries with the highest and lowest changes in the tariff rate. Regression in column 3 excludes the plants below the bottom 10 percentile and above the top 90 percentile of productivity. Numbers are marginal effects. Robust standard errors adjusted for clustering at the three-digit ISIC level in parentheses

****; **; * significant at the 1%, 5% and 10% level respectively*

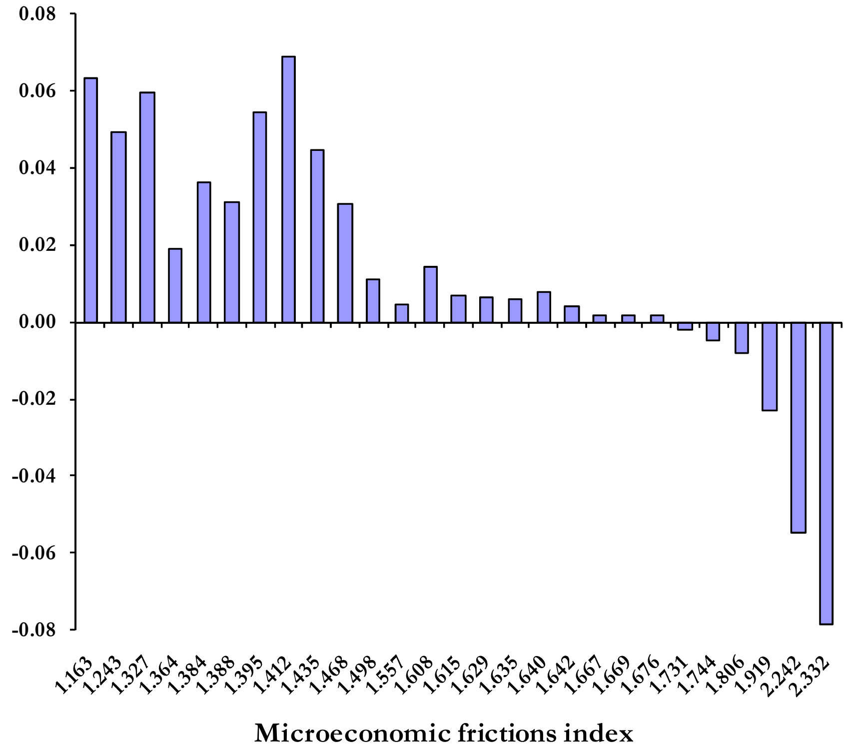
Table 7: Robustness Checks, Probability of Exit

Regressor	Plants in industries with highest and lowest friction indices excluded (1)	Plants in industries with highest and lowest changes in tariffs excluded (2)	Plants below bottom 10 percentile and above top 90 percentile in TFP excluded (3)
Change in tariff	-0.3028**	-0.3925**	-0.5324***
	(0.1485)	(0.1918)	(0.1652)
Productivity	-0.0131***	-0.0132***	-0.0167**
	(0.0038)	(0.0034)	(0.0066)
Labor	-0.0031	-0.0010	0.0003
	(0.0038)	(0.0039)	(0.0043)
Capital / Labor	-0.0040*	-0.0065**	-0.0010
	(0.0022)	(0.0022)	(0.0032)
Change in tariff x friction index	0.1146	0.2039*	0.2519**
	(0.0892)	(0.1235)	(0.1005)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
Observations	4209	4508	3692
Pseudo R2	0.1026	0.09	0.09

Notes: Regression in column 1 excludes all the plants in the industries with the highest and lowest values in the microeconomic frictions index. Regression in column 2 excludes all the plants in the industries with the highest and lowest changes in the tariff rate. Regression in column 3 excludes the plants below the bottom 10 percentile and above the top 90 percentile of productivity. Numbers are marginal effects. Robust standard errors adjusted for clustering at the three-digit ISIC level in parentheses

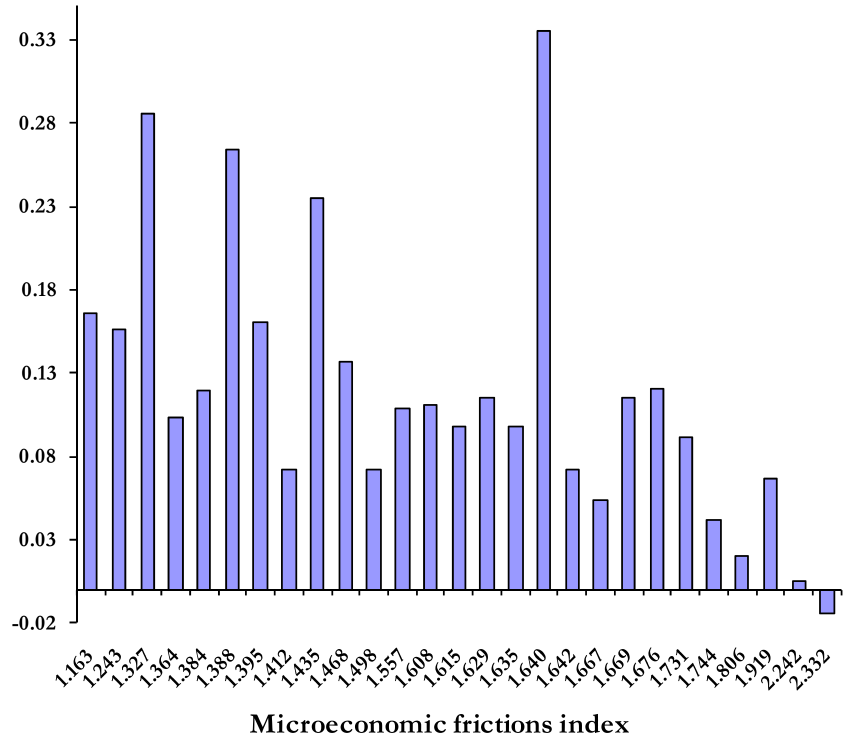
****; **; * significant at the 1%, 5% and 10% level respectively*

Figure 1: Average marginal effect of a reduction in the tariff rate on the probability of exporting at different levels of microeconomic frictions



Note: the figure shows the average marinal effect per industry calculated as the average of the marginal effects of all the plants in that industry. The marginal effects are obtained from the estimated probit model in Table 5, column 4. See text for details regarding the microeconomic frictions index.

Figure 2: Average marginal effect of a reduction in the tariff rate on the probability of exit at different levels of microeconomic frictions



Note: the figure shows the average marinal effect per industry calculated as the average of the marginal effects of all the plants in that industry. The marginal effects are obtained from the estimated probit model in Table 6, column 4. See text for details regarding the microeconomic frictions index.