WPS5661

Policy Research Working Paper 5661

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A Firm-Level Analysis of the Trade-Productivity Linkages

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The World Bank
Development Research Group
Trade and Integration Team
May 2011

Policy Research Working Paper 5661

Abstract

Did the North American Free Trade Agreement make Mexican firms more productive? If so, through which channels? This paper addresses these questions by deploying an innovative microeconometric approach that disentangles the various channels through which integration with the global markets (via international trade) can affect firm-level productivity. The results show that the North American Free Trade Agreement stimulated the productivity of Mexican plants via: (1) an increase in import competition and (2) a positive effect on access to imported intermediate inputs. However, the impact of trade reforms was not identical for all integrated firms, with fully integrated firms (i.e. firms simultaneously exporting and importing) benefiting more than other integrated firms. Contrary to previous results, once self-selection problems are solved, the analysis finds a rather weak relationship between exports and productivity growth.

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Economic Performance under NAFTA: A Firm-Level Analysis of the Trade-Productivity Linkages*

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Keywords: Firm-level productivity, Trade Reforms, Mexico

*The authors are grateful to Alejandro Cano, Abigail Durán, Gerardo Leyva and Gabriel Romero for granting access and showing how to use the industrial data at the offices of INEGI in Aguascalientes. We also thank Alan Winters, Gustavo Crespi, Sherman Robinson, Beata Javorcik, Valeria Arza, Nick Von Tunzelmann, Jorge Mattar, and seminar participants at the University of Sussex, SPRU, IADB, INEGI, ECLAC, and Anahuac University for their valuable comments. Leonardo Iacovone gratefully acknowledges the ESRC and LENTISCO financial support.

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1 Introduction

In the past two or three decades most Latin American countries have redefined their development strategies, moving away from import-substitution regimes towards policies promoting integration with the global economy through exports and foreign direct investments (FDI). This important shift has been accompanied by an intense academic debate regarding the relationship between integration with the international markets and domestic growth. Despite the general presumption of a positive impact of trade liberalization on economic growth, there is still disagreement among economists about the nature of this relationship (Baldwin 2000). Most of the controversy is explained by the difficulty in identifying the underlying mechanisms driving this relationship (Winters 2004). Furthermore, since trade liberalization is often just one element of a more comprehensive set of market-oriented reforms it is hard to disentangle its effect from the impact of other policies.

This paper contributes to this debate by developing an innovative microeconometric approach that can disentangle the various channels through which integration with the global markets –via international trade– can affect firm-level productivity. Our empirical analysis is based on Mexican firm-level data covering 1993-2002, [1] a period of economic integration between Mexico, the US, and Canada within the North American Free Trade Agreement (NAFTA). The present study, defines NAFTA as a process of economic integration that goes beyond a simple tariff-reduction scheme and, instead, encompasses a set of institutional rules within which foreign trade and investment take place. The objective of this paper is to measure the impact of NAFTA on the productivity of Mexican plants.

The present study is related to various strands of literature. The pioneer set of studies collected in Roberts and Tybout (1996) analyzed the evolution of firm-level productivity dynamics in response to trade reforms and economic integralation for various developing countries. More recently, the interest has moved towards the identification of the different channels and mechanisms behind the impact of trade reforms on productivity (Aghion, Burgess, Redding, and Zilibotti 2004, Girma, Greenaway, and Kneller 2004, Pavcnik 2002, Tybout 2001, Amiti and Konings 2007, Fernandes 2007). Our research also draws on the lessons learned from the industrial organisation litera-

[1] In the paper we refer interchangeably to firm or plant to identify the unit of observation of our study, however this refers to the unit of observation of our data that is "the manufacturing establishment where the production takes place"

ture examining the impact of increased competition on industry dynamics (Olley and Pakes 1996). Finally, the present study explicitly builds on the recent theoretical literature on trade models with heterogeneous firms.[2] All of these studies provide important theoretical underpinnings for understanding the mechanisms through which economic integration affects productivity dynamics at the firm-level.

The present study builds a conceptual framework to analyze the relationship between economic integration and firm-level productivity distinguishing four transmission mechanisms: (1) enhanced competition, (2) access to intermediate inputs, (3) exports, and (4) FDI. Following a difference-in-difference estimation procedure, we are able to capture the productivity growth differentials between integrated and non-integrated firms during a period before and after NAFTA. Contrary to previous studies, our approach allows for a heterogeneous productivity impact between firms with different integration status. In other words, the productivity effects of trade liberalization will be different between firms whose only link with the international markets is given via the import of intermediate inputs, firms whose link is though exports of final goods, and firms that are importing inputs and exporting final produce, i.e. *fully integrated* firms.

Our results show that NAFTA stimulated the productivity of Mexican plants via: (1) an increase in import competition and (2) a positive effect on access to imported intermediate inputs. However, the impact of trade reforms was not identical for all integrated firms with fully integrated firms benefiting more than other integrated firms. Contrary to previous results, once self-selection problems are solved, we find a rather weak relationship between exports and productivity growth.

The paper is organized as follows: Section 2 briefly develops the conceptual framework describing the different trade-productivity transmission channels. The data used for the empirical analysis, Mexico's macroeconomic background, and trends in firm-level productivity are shown in Section 3. Section 4 describes our econometric approach and shows the results of various specifications. This Section also discusses potential endogeneity and selection problems, as well as the difficulties in isolating the impact of NAFTA from the peso devaluation of 1994. Finally, Section 5concludes.

[2]Among the most influential studies in this field include the following contributions: Melitz (2003), Bernard, Eaton, Jenson, and Kortum (2003), Bernard, Redding, and Schott (2007), Yeaple (2005), Verhoogen (2008), Bustos (2007).

2 Trade-Productivity Linkages

Economic theory predicts that trade reforms can affect firm-level productivity through several channels. This Section describes the theoretical linkages behind these channels, representing the basis for the empirical analysis. As it is depicted by Figure 1, there is not a unique and well-defined model capturing the trade and productivity linkages, but rather a number of different approaches aimed at capturing different mechanisms through which economic integration can impact firms' performance. In Figure 1 we identify four main channels through which trade reforms can influence productivity: competition, intermediate inputs, exports, FDI. Each one of this channels can affect both internal restructuring, i.e. productivity changes within the firm, and external restructuring, i.e. productivity changes due to market shares reallocation between firms, exit and entry. In the next sub-Sections we discuss in detail each one of these channels, except the FDI one because, due to data limitations, we are unable to study this channel in our empirical analysis.

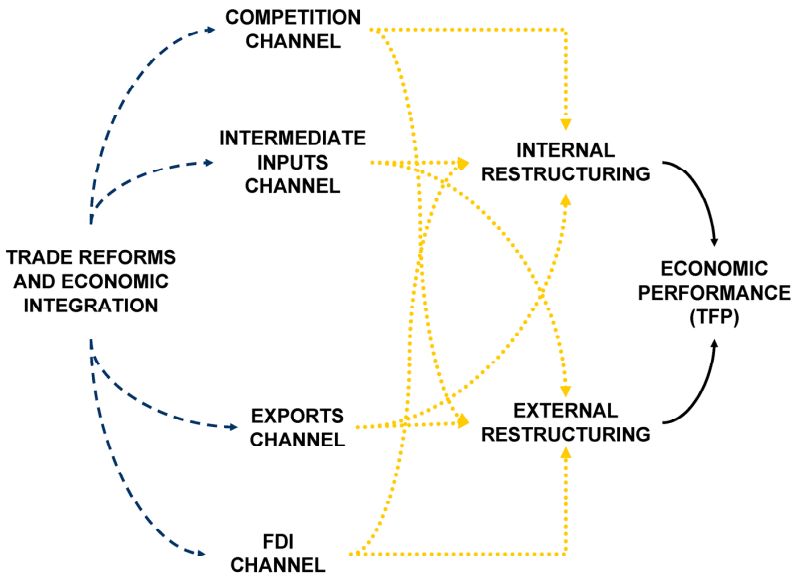


Figure 1: Trade-Productivity Linkages: Conceptual Framework

2.1 Competition Channel

Trade liberalization and tariff reductions are expected to increase the competitive pressures to which domestic firms are exposed. This effect is expected to be stronger for import-competing firms and import-competing sectors than for export-oriented ones. The first studies to formally explore this argument and relate the increase of the competitive pressures to an improvement of intra-firm efficiency were Martin (1978) and Martin and Page (1983). These authors argued that an increase in competitive pressures would reduce the "X-inefficiency", defined as the gap between actual productivity and the maximum productivity achievable (Leibenstein 1966, Leibenstein 1978). The intuition behind their argument is that the efficiency of a firm is, *ceteris paribus*, a positive function of the managers' efforts ("internal restructuring" in Figure 1) and this, in turn, is triggered by the exposure to foreign competitors.

A second productivity effect of increase competition is given by its impact on firm size and size distribution; in fact, traditional trade models with homogeneous goods and identical firms assume that scale effects are the principal drivers of productivity changes following trade liberalization. In a world where firms are heterogenous, the import-competing channel can explain changes in aggregate economic through "external restructuring", as less efficient firms are forced to contract or exit (Disney, Haskel, and Heden 2003). This is shown clearly in Melitz and Ottaviano's (2008) and Bernard, Redding, and Schott's (2007) models, where the increased competition leads to the exit and contraction of less productive firms, while more productive ones expand.

2.2 Intermediate Inputs Channel

Economic theory suggests that liberalization of intermediate inputs will increase productivity levels of domestic firms due to an expansion in the menu of available intermediate inputs. This allows individual producers to match more appropriately their technology or product characteristics with the intermediate input used (Feenstra and al. 1999).[3]

Another line of thought, linked to the endogenous growth models, suggests that the

[3]Formally, economic theory provides us with models where specialised inputs are characterised by increasing returns (i.e. high initial capital and learning costs) and consequently the degree of differentiation is limited by the size of the market. In this model, the liberalization of intermediate inputs will increase the varieties of available inputs, some of them more specialised and closer in terms of complementarity to the domestic ones.

import of "tangible commodities facilitate the exchange of intangible ideas" (Grossman and Helpman 1991a, Grossman and Helpman 1991b). This model emphasises the learning effects of imports of intermediate inputs as a mechanism through which trade will impact productivity growth.

In Bernard, Eaton, Jenson, and Kortum's (2003) model with heterogenous firms the impact of trade reforms on productivity is given via a reduction in the price of intermediates inputs (i.e. cheaper and higher quality imported inputs replace domestic ones). All firms benefit from the intermediate inputs price reduction, and this effect goes in hand with market reallocation from less productive firms to more productive ones.

2.3 Exports Channel

The literature suggests that the expansion of exports could work as another channel explaining the positive influence of economic integration on firm-level performance. Grossman and Helpman (1991a) and Grossman and Helpman (1991b) assume that domestic entrepreneurs enlarge the stock of domestic knowledge by increasing their contacts with foreign buyers. Similarly, Fernandes and Isgut (2005), based on Arrow's (1962) learning-by-exporting model, show that exporting activities have learning externalities that decrease over time and increase with the level of exports. Finally, at least three other hypotheses have been explored to explain productivity improvements as a consequence of export expansion. First, by having access to foreign markets, a firm can exploit economies of scale and increase its productivity. Second, relying on foreign markets can help firms to better absorb the negative shocks deriving from a contraction in domestic demand. Third, if the foreign markets are characterized by a higher degree of competition than domestic markets, then exporters will be under higher competitive pressures in those foreign markets increasing their incentives to innovate and become more efficient in order to access foreign markets. If the outlined mechanisms are valid, exporting firms will exhibit higher long-term productivity growth than non-integrated firms (Wagner 2002). The export channel will be particularly relevant when a country is granted additional market access as a result of a Regional Trade Agreement (RTA), such as NAFTA.

As we have seen in this Section, economic theory identifies different channels of transmission between trade reforms and firm-level productivity. If these transmission mechanisms are at work, post-reform firm-level productivity performance will be a function

of the firm's integration status. In other words, the productivity path followed by integrated firms will differ, *ceteris paribus*, from their non-integrated counterparts. Furthermore, given the nature of the trade-productivity linkages, we would expect a heterogeneous post-reform productivity growth pattern even among integrated firms. For example, firms that are only exporting will bear directly the effects of the exports channel without experiencing, at least not directly, the positive effects of other trade-productivity linkages. In order to capture the different channels of transmission, in the following Sections we will analyze the data categorizing firms into one of four groups based on their integration status: fully integrated, exporters, importers and non-integrated firms.

Many of mechanisms behind the channels illustrated in Figure 1 and explained above will affect all firms regardless of their integration status. For example, the enhanced market access abroad that stimulates the expansion of export-oriented firms an indirect impact also on domestic firms through general equilibrium effects. Nevertheless, based on theoretical considerations, firm's integration status will determine the magnitude of its own trade-mandated productivity shock. In other words, *a-priori* a process of trade integration would have an asymmetric productivity impact on integrated versus non-integrated firms, and perhaps this impact could differ between firms in different integration status.

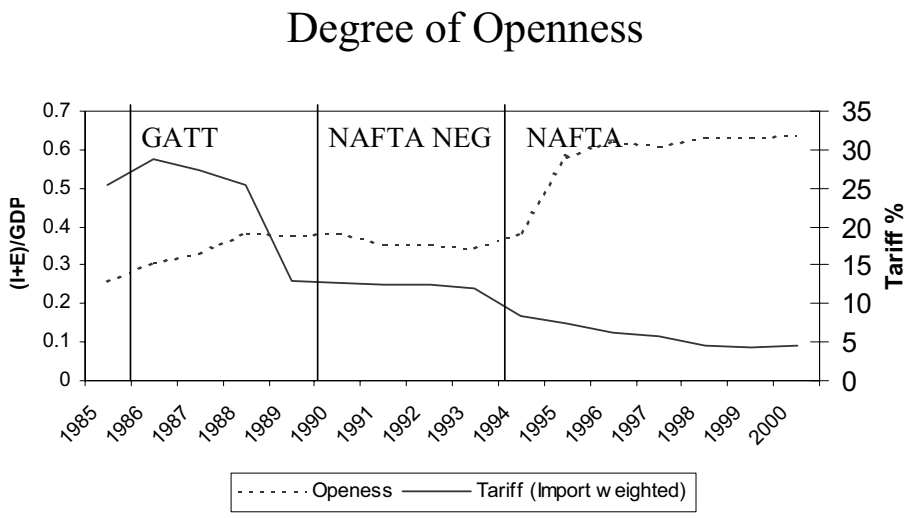
3 Descriptive Analysis

3.1 Macroeconomic Overview: NAFTA and the Devaluation

The present study covers the period from 1993 to 2002, a time characterized by major changes in the Mexican economy. In January 1994, NAFTA, a trilateral treaty between Canada, Mexico and the US, was enacted. In December of that same year, as a consequence of a balance of payments crisis, the Mexican peso lost more than 60 percent of its value in terms of US dollars. This was the starting point of a profound economic crisis where GDP contracted by more than 8 percent and inflation passed from an annual rate of 7 percent in 1994 to 41 percent in 1995. The huge devaluation together with the contraction of the domestic market stimulated exports of Mexican produce. As we can see from Figure 2, between 1994 and 1996, the importance of international trade in the Mexican economy (measured as the ratio of exports plus imports to GDP) almost doubled, passing from a pre-crisis/NAFTA level of 38 percent to 63 percent in 1996. The export boom during the period 1994-2002 was led by manufacturing exports,

which accounted for 95 percent of total exports.

Figure 2: Mexico - economic integration (Source: Nicita 2004)



Some important elements emerge from Figure 2. First, the process of trade liberalization in Mexico started in the 1980s. When trade liberalization is measured as a reduction in tariffs, the most important reforms were undertaken during the second half of the 1980s (Peters 2000). A second interesting point, is that the response of the economy to this first wave of liberalization was rather slow, with trade volumes showing only a modest increase after large tariff reductions. On the other hand, the relatively small reduction in tariffs observed after NAFTA was followed by a substantial increase in the importance of trade volumes in the Mexican economy. These facts suggest that the substantial increase in economic integration between the Mexican and the US economies is explained by a *combination* of NAFTA and the peso devaluation. In other words, the peso devaluation *pushed* Mexican firms into the foreign markets that were opened via the window of NAFTA; once many of the Mexican manufacturers had absorbed the sunk costs of entering foreign markets, they remained integrated despite the revaluation of the Mexico peso during the late 1990s. This may explain the significant increase in the degree of openness that occurred after the devaluation, which was not reversed even when the real exchange rate revalued. A second complementary explanation behind the pattern followed by openness is that NAFTA implied much more than a tariff reduction scheme, involving deep regulatory and institutional

changes, representing a successful case of *deep integration*.[4]

3.2 Firm Size and Integration Status

In order to see how the post NAFTA/devaluation affected the performance of Mexican manufacturing firms, we use firm-level data from the Annual Industrial Survey (EIA) covering the period from 1993 to 2002. EIA surveys more than 5,000 firms covering 85 percent of total industrial production. The survey provides plant-level information on characteristics such as number of employees, hours worked, wages, value of production and sales, exports, value of intermediate inputs, inventories, investment, etc. (for more detail see Iacovone (2008)).

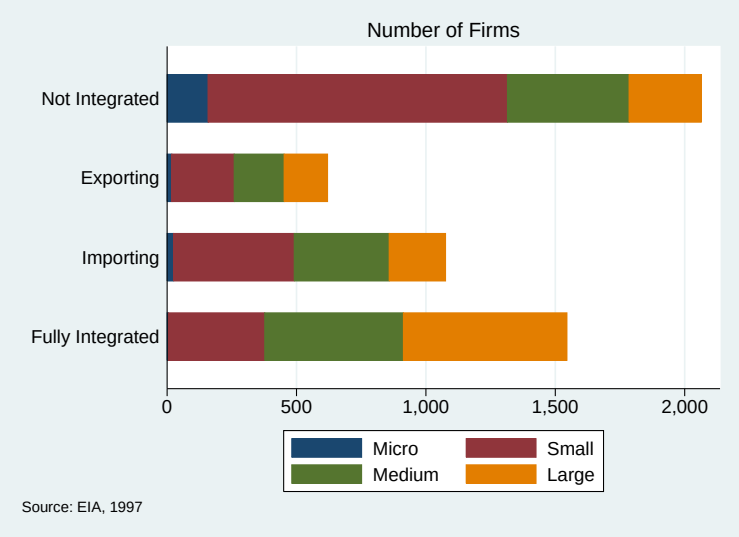
As we mentioned before, using the theoretical considerations discussed in Section 2 we allocate firms into one of the following four mutually exclusive groups according to their integration status: (1) exporters, (2) importers, (3) fully integrated, and (4) non-integrated firms. The first group consists of firms that are exporting into the foreign markets without importing intermediate goods; the second group is made up of firms whose only link with the global markets is via the import of intermediate inputs. The third group is formed by all those firms that sell part of their final production in the foreign markets while importing part of their intermediate inputs. Finally, the last group consists of firms that do not have any direct link with foreign markets.[5]

Figures 3 shows information regarding the number of firms and their size by integration status for a given year (1997). In 1997, 2,372 firms, representing more than 40 percent of the total manufacturing firms in Mexico, had no direct linkage with the international markets. In that same year, 10 percent of Mexican manufacturing firms were integrated to international markets via exports, 19 percent via imports, and 28 percent were importing intermediate inputs and exporting their final product (fully integrated).

[4]By means of an explicit econometric model linking tariff reduction and household real income, De Hoyos (2005) finds that measuring NAFTA just as the reduction in tariff brought about by the agreement would lead to the conclusion that the agreement had almost no impact on real household incomes in the economy.

[5]Notice that this is not entirely true. For non-integrated firms to be completely isolated from direct linkages with foreign markets they would have to be part of a sector that does not suffer from import-competition and at the same time is not receiving FDI. Even using detailed data such as EIA, it is impossible to define if and to what degree a firm is in an "import-competing" sector. Hence the import competition channel will have an effect on integrated and non-integrated firms according to our definition. Nonetheless, *a-priori*, trade reform will have a smaller impact on non-integrated firms *relatively* to integrated firms.

Figure 3: Size distribution by integration status



In 1997, the great majority of the numerous non-integrated firms were micro or small plants.[6] Both exporters and importers have a similar composition in terms of firm size, with around 40 percent being small and 30 percent being medium firms. Finally, the fully integrated firms, that simultaneously export and make use of imported intermediate inputs, are the largest ones, with virtually no micro firms being part of this category. In 1997, three and four out of 10 firms had a medium or large size, respectively.

3.3 Trade Shock, Integration Status, Labor Productivity

As we mentioned above, integration was mainly brought about by a combination of NAFTA and the peso devaluation. We have also shown that non-integrated and exporting firms tend to be smaller than importing and fully integrated ones. In order to explore how the patterns of integration may have affected the size of the firms, Figure 4 shows the time trend in the proportion of integrated firms (all three integration status groups) and their average size (measured as total employees). According to Figure 4, the proportion of integrated firms increased steadily from 1993 to 1997 (continuous line). Regarding the size of the firm (measured as the number of employees), apart from the change occurring between 1993 and 1995, the average size of integrated firms increased throughout the period. It is interesting to note that 1994 is the only year

[6]Micro firms are defined as plants with less than 16 employees, small plants have between 16 and 100 employees, medium are those firms with more than 100 but less than 250 employees, while large have more than 250 employees.

when NAFTA was at work in the absence of a devaluation effect.[7] Between 1993 and 1994, the average size of integrated firms remained constant, while the proportion of integrated firms increased. Therefore, NAFTA (in the absence of a devaluation) helped relatively small firms to incorporate into the global markets.[8] After 1995, when the devaluation effect was very strong, even smaller firms where *pushed* into the global markets, hence explaining the increase in the proportion of integrated firms and the reduction in their average size. After 1995, the changes in the distribution of size among integrated firms in the market can be attributed to a combination of NAFTA and the peso devaluation. The simultaneity of these two events resulted in an expansion of integrated firms but this time the small ones (many of the exporters and to a lesser extent the importers) were not able to survive the crises. Therefore, the average size of the integrated firms increased after 1995. This increase in the average size among integrated firms after the trade reforms is consistent with trade models à la Melitz (Melitz 2003, Bernard, Redding, and Schott 2007, Melitz and Ottaviano 2008).

Figure 4: Patterns of integration and firm size

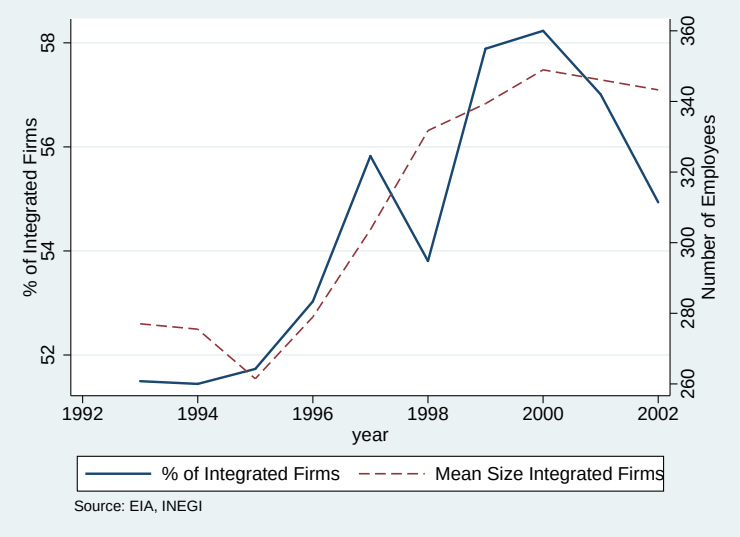


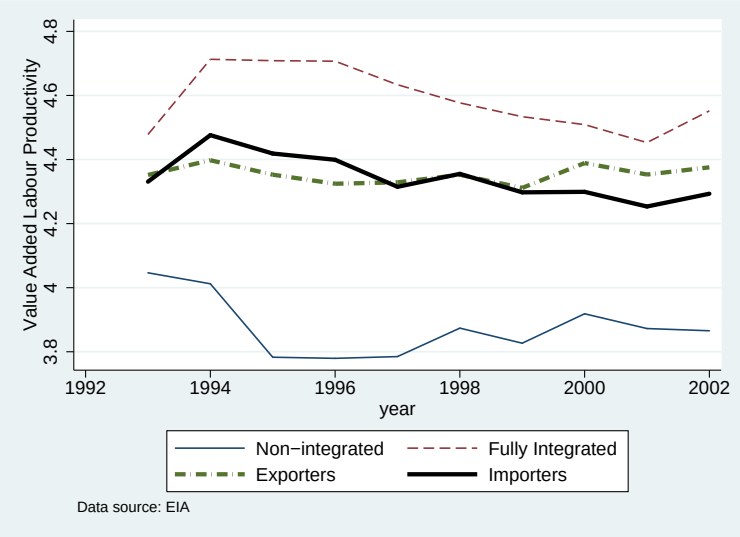
Figure 5 shows the performance in value added labor productivity per hour by integration status. Between 1993 and 1994 (the period of NAFTA without a peso devaluation), average productivity in all integration groups rose, with the fully integrated firms benefiting most. After the peso devaluation and until 1996, labor productivity of integrated and non-integrated firms decreased with the non-integrated firms experiencing

[7]Given that the peso crisis took place on the 20 December 1994, the effect of the devaluation is not captured by the data from year 1994.

[8]Yet another way of interpreting the increase in small integrated firms between 1993 and 1994 is by assuming that larger firms had a better chance of anticipating NAFTA, therefore integrating before the agreement was enacted.

the largest negative shock. Between 1996 and 2000, all integrated firms experienced a reduction in labor productivity as opposed to the non-integrated firms, that were catching up. This strongly suggests that the post NAFTA/devaluation trade expansion had asymmetric effects on firms based on their integration status, in particular in terms of their productivity performance.

Figure 5: Labor productivity performance by integration status



This Section shows that there is a great degree of heterogeneity in size, sector of specialization and productivity between firms with a different integration status. Exporting firms are similar in size to non-integrated firms although their level of labor productivity is higher with a level closer to the one exhibit by importing firms. Descriptive statistics also show that importers, as well as fully integrated firms, are concentrated in two capital intensive sectors: "machinery and equipment" and "chemical products". Finally, the labor productivity trends show that NAFTA marked a turning point in productivity performance between firms with different integration status.

The rest of this paper will try to explore how much of the differential in labor productivity shown in Figure 5 is attributable to the increase in trade integration observed between 1993 and 2002. In our empirical strategy we take 1993 as the base year (period before NAFTA), compare the productivity growth rate between integrated and non-integrated firms (controlling for firm-level characteristics and allowing for heterogeneous effects across integration status) and attribute these difference to the reforms. Since many other factors can influence the productivity growth rate differentials, a formal econometric analysis is needed to control for other variables potentially influencing the patterns observed in Figure 5.

4 Empirical Strategy

In this Section we formally evaluate the impact of NAFTA on firm-level productivity. There are two possible approaches that we can follow to disentangle the relationship between trade integration and firm-level productivity: (1) link tariff reductions with firm-level productivity whilst controlling for other possible effects; or (2) compare the differential of productivity growth rates between integrated and non-integrated firms before and after the reforms controlling for observables and unobservable fixed effects. Both approaches have their advantages and limitations hence, in this study, we combine both of them in order to identify separately all the channels discussed in Section 2.

Identifying the impact of trade reforms exploiting tariff reductions has one important advantage but also some serious drawbacks. On the positive side, this approach is able to isolate neatly the impact of an important element of trade reforms, such as tariff reductions, from all other trade-related exogenous shocks. However, this advantage can also be a source of weakness. If we believe that trade reforms involve much more than just a reduction in tariff rates, focusing solely on tariff variations will lead to an *under-estimation* of the impact of trade reforms. This appears to be a very important issue in the case of NAFTA since, as discussed in Section 3, the changes in tariff rates were relatively modest[9] . In fact, as it is argued in Kose, Meredith, and Towe (2004) and Lederman, Maloney, and Serven (2003), the major changes introduced by NAFTA took the form of new rules and institutions to promote integration among the trade partners.[10] Exploiting tariff reductions to identify the productivity impact of trade reforms introduces a further technical problem involving the identification of the impact of tariffs on intermediate inputs.

Although it is virtually impossible to identify NAFTA's full productivity impact by focusing only on tariff variations, the information contained in the post-reform reductions in import tariffs is enough to identify the effect of the reforms via the import-competing

[9]During direct interviews conducted with entrepreneurs, academics and policy-makers in Mexico, the argument that NAFTA's changes were much larger than those that could be measured by the change in tariffs came out as a consensus.

[10]An argument supporting the tariff-reduction approach would state that a small tariff change that is perceived as permanent can have a larger impact than a larger change that is perceived as unstable. The "bilateral nature" of NAFTA made the tariff change much more credible than the unilateral tariff liberalization that took place during the second half of the 1980s. Furthermore, NAFTA is considered by some scholars "as a way of locking in previous policy reforms" (Tomz 1997, Whalley 1993). Therefore, one can argue that the reduction in trade barriers could serve as a proxy for the legal and institutional change. Nevertheless, the nature of the exact relationship between changes in tariffs and changes in institutions is not clearly defined.

channel. As mentioned in Section 2.1, controlling for everything else, a reduction in import tariffs should increase domestic competition and hence boost labor productivity. The present study uses tariff variations to identify the link between NAFTA and labor productivity via the import-competing channel. Nevertheless, we complement this approach with a pseudo-experimental procedure that identifies all other trade-productivity channels discussed in Section 2.

As discussed in Section 2, theoretical models with heterogeneous firms suggest that trade reforms will impact asymmetrically on different types of firms. We expect *integrated* firms to be positively affected by the reforms *relative* to *non-integrated* firms. Moreover, the impact within integrated firms could be different depending on a firm's integrated status. This idea is not only based on theoretical considerations but also appears to emerge from the descriptive statistics presented in Section 3 suggesting that plants within different "integration status" show a different productivity evolution over time. Hence, a crucial identifying assumption behind the pseudo-experimental approach adopted in this paper is that the reforms introduced by NAFTA had a different effect on pre-reform integrated and non-integrated firms.

Our strategy builds on the previous work by Pavcnik (2002) and López-Córdova (2003) analyzing the impact of trade reforms in Chile and Mexico, respectively. While López-Córdova (2003) exploits tariff variations Pavcnik (2002) uses a quasi-experimental approach (i.e. treatment versus control group). The mayor difference between these two closely related studies and the empirical approach followed in this paper are the following:

1. Pavcnik (2002) defined a firm as being *integrated* when it belonged to a "integrated" sector—at 4 digits of the ISIC classification—regardless of the firm's integration status. Thanks to data availability, in this paper we define the integration status at the firm level.[11]

2. Within integrated firms, our approach allows for a heterogeneous impact of the reforms among firms with different integration status, i.e. exporters, importers or fully integrated.

3. Our econometric approach controls for possible endogeneity problems related to a firm's decision to change integration status; and it also attacks the attrition problem present in the Mexican industrial survey (EIA).

[11] We evaluated the correlation between the definition used by Pavcnik (2002) and our definition and found out this is only about .30.

4.1 Econometric Approach

The objective of the econometric strategy is to understand the impact of NAFTA on firm-level productivity. For this purpose we use the value-added per unit of hourly labor as productivity index.[12]. The reason of our choice lies in the simplicity in the interpretation of this index and in its transparency. Moreover, the direct link between value-added labor productivity and national welfare makes this index attractive from a policy perspective. However, this index also has some drawbacks, the principal one being that two firms may differ in their value-added labor productivity based solely on differences in their capital intensity. In order to address this issue, in our regressions we control for the stock of capital per worker

Let us define φ_{it} as the log of the value-added per hourly worker in firm i at time t. Similarly, let $\mathbf{X}_{ijt}$ be a vector containing a set of firm-level characteristics, as well as industry and location fixed effects. Let τ_{it} be the domestic import tariffs under NAFTA; in other words, τ_{it} are the tariffs faced by foreign competitors of firm i in time t. Productivity is assumed to be a function of a constant, time and integration status, the interaction between the former and the latter, import tariffs, and the vector with covariates $\mathbf{X}_{ijt}$:

$$\begin{aligned}\varphi_{it} &= \alpha + \sum_{t=94}^{2000} \delta_t Time_t + \sum_{s=2}^{4} \beta_s Integration_{i,t}^{s} \\ &\quad + \sum_{t=94}^{2000} \sum_{s=2}^{4} \delta_{t,s} \cdot Integration_{it}^{s} \times Time_t + \theta \cdot \mathbf{X}_{ijt} + \psi \tau_{it} + \varepsilon_{it} \qquad (1)\end{aligned}$$

Where $Time_t \;\; t = (1994, \ldots, 2000)$, are year dummies capturing economy-wide macroeconomic shocks; $Integration_{it}^{s} \;\; s = (2, 3, 4)$, are a set of binary or dummy variables taking zero/one values depending on the integration status of the firm. The reference category is the group of non-integrated firms in the pre-NAFTA year 1993. Therefore, the year dummies will capture overall trends affecting productivity with respect to the base year, 1993. On the other hand, the integration status dummies will pick up the differences between firms that are integrated versus non-integrated firms (the excluded category). The interaction term between these two sets of dummy variables is what is known in the literature as the difference-in-difference (DID) estimator capturing the

[12]For robustness check we tested all our regressions using a multilateral TFP index following Aw, Chen, and Roberts (2001) and Caves, Christensen, and Diewert (1982). The results are qualitatively similar in terms of their size and signs. These results are omitted for reasons of space but are available upon request.

treatment effect, in our case the impact of NAFTA. Finally, all the continuous variables are expressed in logs.

The flexibility of specification (1) allows the impact of NAFTA to be different across integration status and these effects are allowed to vary over time. The coefficients of interest are the treatment effects $\hat{\delta}_{t,s}$ and, if correctly estimated, they capture the differences in productivity *growth* between treated (integrated firms) and controls (non-integrated) firms. The treatment effect is capturing what is known in the literature as ATT or "average treatment on the treated", that is, the impact of NAFTA on those firms that are already integrated and hence are being directly affected by the agreement. Notice that, as we mentioned before, NAFTA is likely to have some general equilibrium effects on all Mexican firms, including those that are not integrated. Nevertheless, these are not identified by our DID coefficient. Similarly, our estimates cannot be used to quantify the impact of NAFTA on non-integrated firms had they been integrated unless we are willing to accept the assumption that the "average treatment on the non-treated" is equal to the ATT.

If trade reforms had a positive effect on the productivity of integrated firms the difference-in-difference coefficients should be positive. Therefore, exploiting the heterogeneous impact introduced by NAFTA (both across firms with different integration status and over time), our coefficients, $\hat{\delta}_{t,s}$, capture the impact of the reforms on productivity separating the various trade-productivity channels without restricting the effect to take place only via tariff reduction. Analytically, the treatment effects are defined by the following equation:

$$\begin{aligned} \delta_{DID}^{Int} = \Delta\overline{\varphi}_{Int} - \Delta\overline{\varphi}_{NInt} &= \left(\overline{\varphi}_{Int}^{after} - \overline{\varphi}_{Int}^{before}\right) - \left(\overline{\varphi}_{NInt}^{after} - \overline{\varphi}_{NInt}^{before}\right) \\ &= \left(\overline{\varphi}_{Int}^{after} - \overline{\varphi}_{NInt}^{after}\right) - \left(\overline{\varphi}_{Int}^{before} - \overline{\varphi}_{NInt}^{before}\right) \end{aligned} \tag{2}$$

The DID approach makes two important assumptions that need to hold in order to properly identify the treatment effect (Wooldridge 2002, Blundell and Costa Dias 2000). The first assumption is that the treatment is not correlated with time-varying unobservables. The second assumption is that the macroeconomic shocks affect all firms in a similar fashion. The time dummies capture economy-wide macroeconomic changes, such as the sharp devaluation of the Mexican peso in December 1994. Intuitively, it is plausible that exchange rate movements will have different impacts on firms with different integration status. Hence, this could potentially introduce a bias into our treatment estimates.[13] Assessing the plausibility of the underlying assumptions is complex and

[13]Formally, as explained by Blundell and Costa Dias (2000), if the macro trends captured by the

we will discuss this further when presenting our results.

Bearing all the assumptions and limitations in mind, the DID is a powerful tool able to identify the impact of a particular policy on a specific outcome variable. The DID framework captures the impact of policy interventions controlling for status-specific characteristics that are time-invariant (see equation 2). Therefore, all the time-invariant initial firm characteristics that may have influenced the selection of the firm into a specific integration status will not influence our results.

As is clear from equation 1, the DID framework is complemented with a tariff reduction approach capturing the impact of import competition via coefficient ψ. If lowering import tariff rates increases domestic competition and this, in turn, has a positive effect on productivity, then coefficient ψ should be negative.

4.2 Results

4.2.1 Naive OLS

The first set of models use all the firms in our sample to run OLS for two different specifications of equation (1). All the results presented here correct for potential auto-correlation across firms using clustered-robust standard errors at the firm-level. Given the large number of model specifications and coefficients estimated, the detailed results are presented in Table 1 of Appendix A. We start off with a parsimonious version of equation 1, which includes only the treatment effects with no controls (model (1) in Table 1). In the second column we add the Mexican tariffs under NAFTA to capture the competition channel. In the following two specifications we respectively add industry and location fixed effects – model (3) – and also plant-level controls in model (4).

A first remark when comparing these four specifications is that, as we would expect, the inclusion of fixed effects and extra controls tends to decrease the size of the DID estimates.

year dummy impacts asymmetrically "treated" and "non-treated" firms our estimated difference-in-difference coefficients, $\hat{\delta}_{DID}^{Int}$, recovers not only the effect of the treatment on integrated firms but also the differential effect of the macro-trend across the two groups. If we define this differential effect of the macro trend as $\left(k^{\text{int}} - k^{\text{Nint}}\right)$ our estimates may be biased in the following way:

$$\hat{\delta}_{DID}^{Int} = \delta_{Treatment}^{Int} + \underbrace{\left(k^{\text{int}} - k^{\text{Nint}}\right)(Time_{after} - Time_{before})}_{Bias}$$

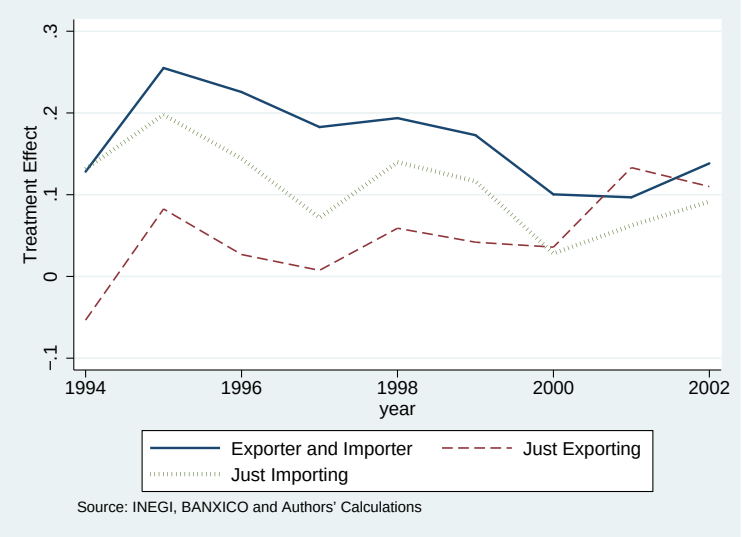
Let us first concentrate on the the results for the dummy variables identifying the productivity effects of the three integration status (β_s in equation 1). According to our parsimonious specification, in 1993, integrated firms (regardless of their integration status) had an average productivity higher than non-integrated firms. This result contrasts with the parameter estimated from the full specification with all the controls (model 4). In fact, once all the control variables are included, it is apparent that the initial *integration premium* is actually explained by differences in the values of the plant-level characteristics between integrated and non-integrated firms and not by integration *per se*. Plant characteristics such as size, capital per worker, investment in research and development, and foreign participation are all positively correlated with productivity, however, we need to emphasise that these variables may be endogenous and are not the main focus of our study. Indeed, we are including them here to avoid an omitted variable bias on our main coefficient of interests that are the δs of the treatments.

Although a firm's integration status cannot account for initial productivity differentials, it might still explain differences in productivity *growth* across firms, which is our variable of interest. In order to concentrate our discussion on the coefficients capturing the heterogeneity in productivity performance across integration status, i.e. the treatment effects, in Figure 6 we plot the evolution of $\delta_{t,s}$ over time.[14] Although we do not report confidence intervals for the plotted coefficients (the significance of the parameters is reported in Table 1), Figure 6 captures the trends followed by the treatment effects. As is apparent from Figure 6, the treatment effects for importer and fully integrated firms are positive and significantly different from zero in all post-NAFTA years, except 2000-2001 for the importers. On the other hand, the effect of NAFTA on productivity growth of exporters was not significantly different from the agreement's effect on non-integrated firms' productivity performance, the control group, in most of the years. Another finding that is important to underscore is that the coefficient for "fully integrated firms" are always larger than the others, this seems to point the importance of the complementarity between exports and imports activities as channels to promote productivity growth.

In order to put the treatment effects into context, our results show that during the post-NAFTA period, annual labor productivity of fully integrated plants grew between 10 and 25 percent *faster* than labor productivity of non-integrated ones. The treatment effect was somehow smaller for importers, with an annual growth differential between 12 percent and 20 percent with respect to non-integrated firms. The results from the full

[14]The coefficients are taken from the full model, i.e. those reported in the fourth column of Table 1 of Appendix **??**.

Figure 6: Impact of NAFTA on productivity by integration status for all firms



specification highlight important elements of heterogeneity related to the integration status of the firm. Hence splitting integrated firms in different groups taking into account their integration status (i.e. exporter, importer, or fully integrated) allows us to capture heterogenous treatment effects that would otherwise be ignored if we were lumping together all integrated firms regardless of their integration status as some previous studies did (Pavcnik 2002, López-Córdova 2003).

Regarding the import-competing channel, as expected *a priori*, the coefficient on the log of import tariffs (ψ in equation 1) is negative. Everything else constant, a firm facing a tariff reduction equal to, say, 10 percent tends to increase its productivity by 1 percent. Under NAFTA, Mexican tariffs were reduced from an average of 16 percent to 5 percent, or 11 percentage points, representing a reduction of almost 69 percent on average tariff. According to our results, this policy decision, fostered competition and increased firm-level productivity by 6.8 percent (69*0.099).

Another concern that we try to control for is the issue of exit from the sample. Every year about 5-10 percent of plants exit the sample because of attrition and not taking this into account may generate a bias. In order to control for this we follow Amiti and Konings (2007) and re-estimate our equation by adding a dummy that is equal to one when the plant is going to exit in $t+1$ and zero otherwise. The results are shown in column (5) of Table 1 and confirm that future exiting firms tend indeed to have a significatively lower productivity than other plants, however our results are substantially unchanged.

As it was mentioned before, an important methodological difference between the present

study and that of (Pavcnik 2002) is that the treatments here are identified at the firm-level as oppose to (Pavcnik 2002) who identifies it at the sector-level. What kind of biased was imposed in (Pavcnik 2002) while aggregating different firms in the same sector? Estimating an specification including Mexican import tariffs as controls, similar to (2) in Table 1, but identifying treated firms at the 4-digit sector level, shows that sector-level identification leads to *smaller treatment effects*. Hence the productivity effects of Chilean integration is higher than the results presented in (Pavcnik 2002).

4.2.2 Controlling for Potential Endogeneity of Treatment and Evaluating the Role of Switchers

As mentioned before, if the assumption of exogeneity of the treatment (being integrated within a trade liberalization period) is violated and our treatments are correlated with some unobservable characteristics, the OLS estimated coefficients will be biased. So far we have tried to alleviate this endogeneity problem by including firm-level variables as controls. If the decision to become integrated (treatment) is correlated with any of the observable characteristics used as controls, our results are still consistent. However, the problem of endogenous treatment is especially acute in our case because we have to deal with what is an established finding in the literature: most efficient (and productive) firms *self-select* into export markets (Bernard and Bradford Jensen 1999, Melitz 2003). It is therefore reasonable to expect a causal relationship from productivity levels to integration status. If this is true, the coefficients presented in the previous Sections may be biased.

Table 1 presents the number of firms that change status in each of the years of the sample distinguishing between those that begin importing or exporting and those that stop importing or exporting. We can see that there is a substantial number of plants, about 20 percent, that switch integration status every year.

In order to tackle this potential endogeneity problem, we re-estimate our model using a reduced sample that includes only firms that remain within the same integration status throughout the period of analysis and exclude "switchers" or firms that at some point change integration status. By excluding the switchers, we artificially avoid the problem of self-select into the treatment.

When we re-estimate our main equation by excluding the switchers we also include a dummy identifying those plants that in $t+1$ will switch to a different integration status. The results are reported in Column (1) of Table 2 and are qualitatively similar to the results of our basic model discussed previously in Section 4.2.1. The fact that our

Table 1: Number of "switchers"

Year	Begin Import	Begin Export	Stop Import	Stop Export
1994	341	355	336	343
1995	291	566	432	186
1996	321	399	340	224
1997	359	346	278	249
1998	208	196	404	329
1999	295	296	216	251
2000	220	237	191	277
2001	172	182	277	322
2002	114	128	250	286
Total	2,321	2,705	2,724	2,467

results are robust when excluding switchers is encouraging and seems to point towards the idea that our findings are indeed not driven by endogenous treatments. However, by excluding non-random observations we may be potentially biasing our coefficients. For this reason, we address this selection problem using a Heckman selection model for switchers. We impose the condition that φ_{it} is missing for the switcher and estimate the following model.

$$\varphi_{it} = \alpha' + \beta' \cdot \mathbf{X}'_{ijt} + \psi'\tau_{it} + \lambda'(\hat{\gamma}' Z'_{ijt}) + \varepsilon'_{it} \quad (3)$$

$$P(Y'_{it}) = \kappa' + \gamma' \cdot \mathbf{Z}'_{it} + \psi'\tau_{it} + \mu'_{it} \quad (4)$$

$$\text{Where } Y'_{it} = 1 \text{ if firm } i \text{ is not a switcher}$$
$$\text{or } Y'_{it} = 0 \text{ if firm } i \text{ is a switcher}$$

Following Heckman (1979) we proceed in two steps. First, we estimate equation 4 with a probit. Second, we estimate our main equation 3 using the $\hat{\gamma}$ obtained from the first step to construct the inverse Mills ratio. Equation 4 is the selection equation where $\mathbf{Z}'_{it}$ is a superset of $\mathbf{X}'_{ijt}$ includes all the explanatory variables in the primary equation plus the exclusionary restriction. Melitz's (2003) model suggests that a plant will be domestic if its productivity is under a certain threshold and will start exporting if its productivity is above that threshold. In general, a plant will be in a specific integration status to the extent that its productivity falls within a certain range. We will re-interpret this model by arguing that we expect a plant is more likely to be a switcher if

its productivity is "too different" from the productivity of those plant that are similar in terms of integration status and sector. Therefore, we calculate the absolute value of the difference between the productivity of a given plant and the median within the same status and sector. Hence, the exclusionary restriction (instrument) in system (3) and (4) is a dissimilarity index which measures the absolute productivity distance from "similar plants".

The results are reported in column (2) of Table 2 and confirm that there is evidence of a selection bias as λ, the coefficient of the Mills Ratio, is statistically significant. Analyzing the coefficients from column (2), and comparing them with the "naive results" or column (4) from the previous Table, we can conclude that when we exclude the switchers and account for the selection bias our coefficients get larger, in particular the coefficients for "exporters" become significant. Basically, except for the coefficients of exporters, these results confirm our previous findings. Another interesting point to observe is the result of the first-stage selection equation, consistently with our expectation we find that an increase in productivity dissimilarity reduces the probability of selecting into the sample, that is those plants which productivity was in 1993 "distant" from the median plant with their same integration and within the same sector were consequently more likely to switch to a different integration status. Interestingly this relationship between "productivity dissimilarity" and probability of switching is non linear.

Finally, if we were to think that the "switching" status is some attribute that is not time varying but instead a fixed characteristic we can re-estimate our model by introducing a dummy that identifies switchers irrespectively of when these plants actually switch. We do so in column (3) of Table 2. Even further, we generalize this model by re-estimating using a fixed-effect estimator which would control for unobservable time invariant characteristics, and present the results in column (4) of the same Table. These results are substantially similar to the "naive results" or column (4) from Table 1 and suggest that our main results do not appear to be driven by the self-selection into the integration status.

Concluding this Section we want to underscore a final regarding how are attempt at controlling for endogenous self-selection into the treatment. Modeling adequately this switching process is extremely complex because of two main reasons. First, because it is very difficult to adequately capture, with a single reduced-form model, all the twelve different possible processes of switching. Second, even within a single switching process (e.g. switching from domestic to importer), there are different types of switchers. There are firms that change status and remain stably in the new status ("stable switchers")

and there are firms that only temporary switch status before returning to their original status after one or two years. In fact, in Table 2 we can see that if we adopt a relatively liberal definition of "stable switchers" by imposing the condition that they remain for at least 2 years in the new status, including the year of switching, we see that about 25 percent of plants are temporary switchers. If we impose the condition that to be defined as "stable switcher" a plant needs to remain at least three years in the new status, including the year of switching, then we see that about one third of switchers do so only temporarily. However, modelling the process of switching goes certainly beyond the scope of this paper.

Table 2: Switchers: Stable vs Temporary

		At least 2 years in new status (including year of switching)		*At least 3 years in new status (including year of switching)*	
Year	**All**	**Stable**	**Temp**	**Stable**	**Temp**
1994	1,290	984	306	860	430
1995	1,356	1,051	305	909	447
1996	1,176	901	275	759	417
1997	1,133	847	286	714	419
1998	1,050	776	274	670	380
1999	9,58	739	219	628	330
2000	8,57	636	221	555	302
2001	8,58	681	177		
2002	7,01				
Total	9,379	7,316	2,063	6,477	2,902

4.2.3 NAFTA or Devaluation?

One final point that we need to tackle is the extent to which our results are driven by NAFTA or by the 1994 peso's devaluation. The reason we need to discuss this is twofold. First, from a policy perspective, distinguishing between the two is extremely important. Second, this question is important for the reliability of our estimates. Unfortunately, the timing of the devaluation is particularly bad, from the perspective of a study analysing the impact of NAFTA, because NAFTA was enacted on January 1st 1994 and the devaluation occurred in December 1994. Therefore, we can count only on one year where NAFTA effects were not contaminated by the devaluation: 1994.

This is the first piece of evidence that we can use to address this question. The second piece of evidence is based on economic reasoning: what do we expect to be the impact of the devaluation on firms with different integration status?

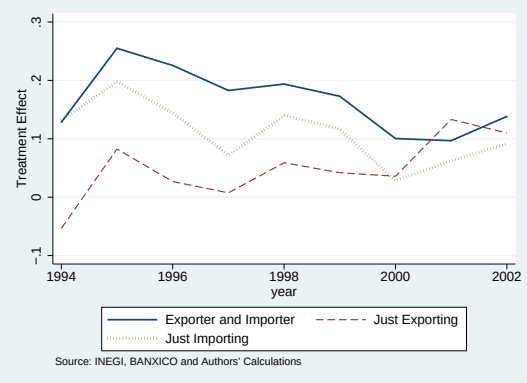
Analysing the results for 1994, we notice that the impact of NAFTA is positive and statistically significant in all our models for fully integrated plants. During 1994, their productivity grew by about 15 percent more than the productivity of domestic firms. The same can be said for firms that made use of imported intermediate inputs even if the coefficients are smaller compared with that of fully integrated plants in the full sample but are larger in the restricted sample (e.g. when excluding switchers).[15] However, the opposite result emerges for exporter plants as in all models the coefficients are statistically non significant. It follows that if we analyze the year immediately subsequent to the implementation of NAFTA we observe that for plants that are fully integrated and that make use of imported intermediate inputs their productivity grew substantially more than that of domestic firms. It could be argued that one year is too short to evaluate the benefits of NAFTA, and we substantially agree with this interpretation. Having said that, the objective here is just to show that the results previously presented for a period when NAFTA and the effect of devaluation overlap are consistent with the results in the year when the effects of NAFTA are "non-contaminated" by the effects of the devaluation.

It is reasonable to expect that the exchange rate devaluation can affect firms with different integration status differently. In particular, we would expect that the first order impact on firms that just export will be positive, while the opposite would be the impact on firms that just import. The first order effect on fully integrated firms is harder to predict *a priori*. Based on this reasoning, we can expect that the coefficients for firms that just export could be upward biased, in particular during the period 1995-1998, and the bias should decrase over time when the exchange rate appreciate. Figure 7 suggests that our results, if anything, follow the opposite pattern, with the coefficients becoming increasingly large for this group of firms. It could be said that if it was not for the devaluation, these coefficients would have otherwise been negative, but we have no empirical basis to confirm this claim. We can only say that the trend of our coefficients appears inconsistent with what we would expect if the bias arising from the devaluation was driving our results. The opposite pattern of bias should be expected for firms that just import, but also in this case Figure 7 suggests that our

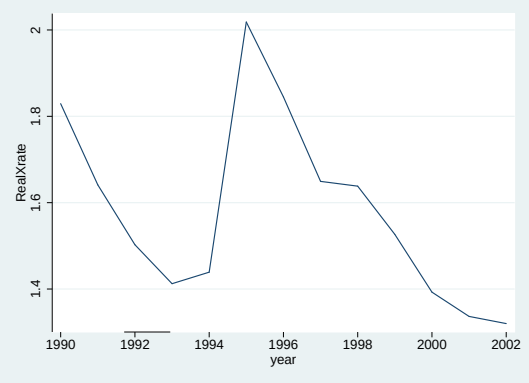
[15] A caveat to our argument is that to the extent that the exchange rate appreciate between 1993 and 1994 this may have given to users of imported inputs some "unnatural" advantage. However the figure 7 (b) shows that between 1993 and 1994, if anything, there was a small devaluation of the exchage rate.

results seem not driven by the bias. If anything, the devaluation should be biasing the estimates against us finding positive coefficients. Finally, as already mentioned, the sign of the bias is hard to predict for fully integrated plants. However we would expect this to be negligible after 1997-1998 and inexistent for 1994. Once more Figure 7 seems to suggest that our results do not follow the dramatic trend of the exchange rate.

Figure 7: Real exchange rate and treatment effects (Source: Penn World Tables 6.1 and authors' calculations)



(a) Treatments - All Firms



(b) Exchange Rate

We conclude that on the basis of the economic reasoning and the inspection of our results, we do not find evidence that these are driven by the exchange rate devaluation. If anything, the bias does not appear to be the main driver of our findings. We cannot exclude that our results are influenced by the devaluation but we have no basis to believe that our results are driven by the exchange rate fluctuations. In fact, because of their timing, and the similarity in some of their effects, it is very difficult to be able to disentangle the effects of NAFTA from those of the devaluation. Overall, if we adopt a more general perspective we can, however, say that our results do not apply narrowly to NAFTA but more generally to a move towards higher integration and openess of the overall Mexican economy. In this sense, the devaluation was part of this move and we are capturing its effects jointly with those of the NAFTA reforms.

5 Conclusions

This paper answers two questions: (1) Did NAFTA reforms make Mexican plants more productive? (2) If so, through which channels? As opposed to previous studies, we have been able to identify the trade integration status at the firm level and not at the sectoral level (Pavcnik 2002). Also, improving on previous studies that analyze the

impact of NAFTA, we have attempted to identify an "overall NAFTA impact" (through the various channels) and not just the impact of tariff changes (López-Córdova 2003). Furthermore, our empirical analysis overcomes two principal hurdles: endogeneity and potential sample selection bias. A further complication was generated by the timing of the peso's devaluation, which occurred in December 1994 and overlapped with the period of implementation of NAFTA enacted in January 1994. The papers tries to tackle all these empirical issues and our results appear to be robust and not driven by these issues.

The results of this paper confirm the importance of the import-competition channel. As previously suggested in various empirical studies (Tybout and Westbrook 1995, Pavcnik 2002, Fernandes 2007), an increase in import competition, measured by a reduction of import tariffs under NAFTA, had a positive effect on stimulating the productivity of Mexican plants. We also found that the impact of trade reforms is not identical for all integrated plants. Consequently, it is important to distinguish between firms based on the way these are actually integrated to the international markets. In fact, we found that the benefits to firms that are fully integrated are normally larger than the benefits accruing to other types of integrated firms. In contrast with the findings of López-Córdova (2003) but in line with some more recent studies (Amiti and Konings 2007), our results suggest that imported intermediate inputs can be a crucial source of productivity growth for firms, and trade reforms that enhance access to these inputs can be an important source of a country's competitiveness. As it was the case in (Pavcnik 2002, Bernard and Bradford Jensen 1999), we cannot find evidence that exporting is a channel of productivity growth. However, a possible explanation for the lack of evident improvements in the productivity growth of exporters, as opposed to importers, could be that the extra market access for Mexican exporters after NAFTA has been modest given that US tariffs were already low. In contrast, the changes for importers have been more substantial. Furthermore, with the boom in FDI and the expansion of exports after NAFTA, many of the importers may have found themselves in the new situation of having to supply MNCs or exporters with far higher demand standards. The process of catching up with these new demands may be an important explanation behind the significant productivity growth of importers. Unfortunately, we have no hard evidence to support this hypothesis except some facts presented in our descriptive analysis (Section 3).

Finally, consistent with various previous studies (Djankov and Hoekman 2000, Evenett and Voicu 2001), the FDI channel also appears to be an important source of productivity growth for plants acquired, or with participation shares, by MNCs. However, data limitations do not allow us to investigate this channel in more detail because the data

only allow us to identify the foreign ownership of Mexican plants in 1994. For this reason, we decided not to pursue further the study of the impact of FDI and the potential vertical and horizontal spillovers in this study, even if we are aware of their importance as drivers of productivity changes in Mexico during the period under analysis.

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A Appendix 1: Regression Tables

Table 1: Estimations of DID Model

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
DMX	0.414***	0.398***	0.412***	-0.147***	-0.140***
DnMX	0.274***	0.273***	0.237***	-0.02	-0.015
DMnX	0.284***	0.280***	0.258***	-0.095***	-0.090***
DMX1994	0.254***	0.261***	0.254***	0.128***	0.129***
DMX1995	0.463***	0.469***	0.489***	0.255***	0.257***
DMX1996	0.468***	0.479***	0.503***	0.226***	0.229***
DMX1997	0.300***	0.312***	0.354***	0.183***	0.187***
DMX1998	0.247***	0.263***	0.309***	0.194***	0.192***
DMX1999	0.232***	0.249***	0.297***	0.173***	0.161***
DMX2000	0.118***	0.136***	0.184***	0.100***	0.089**
DMX2001	0.096**	0.107**	0.154***	0.097**	0.089**
DMX2002	0.227***	0.244***	0.281***	0.138***	
DnMX1994	0.077*	0.078*	0.06	-0.053	-0.053
DnMX1995	0.294***	0.297***	0.333***	0.083*	0.085*
DnMX1996	0.240***	0.243***	0.292***	0.027	0.03
DnMX1997	0.115**	0.118**	0.162***	0.007	0.011
DnMX1998	0.173***	0.177***	0.197***	0.059	0.059
DnMX1999	0.164***	0.169***	0.180***	0.042	0.033
DnMX2000	0.137**	0.140**	0.155***	0.036	0.025
DnMX2001	0.186***	0.189***	0.211***	0.133**	0.124**
DnMX2002	0.238***	0.247***	0.257***	0.110*	
DMnX1994	0.186***	0.188***	0.188***	0.132***	0.133***
DMnX1995	0.338***	0.339***	0.337***	0.198***	0.201***
DMnX1996	0.343***	0.346***	0.348***	0.144***	0.148***
DMnX1997	0.146***	0.153***	0.162***	0.072**	0.076**
DMnX1998	0.193***	0.202***	0.203***	0.140***	0.140***
DMnX1999	0.169***	0.178***	0.194***	0.116***	0.116***
DMnX2000	0.075*	0.082*	0.097**	0.028	0.022
DMnX2001	0.081*	0.077*	0.102**	0.062	0.056
DMnX2002	0.163***	0.161***	0.177***	0.092**	
TariffsMXNafta		-0.032*	-0.127***	-0.099***	-0.101***
Exit in t+1					-0.811***
Plant Controls	No	No	No	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes
Location FE	No	No	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes
N	52621	52151	52151	37825	34634
r2	0.081	0.08	0.152	0.341	0.347

Note: The plants control include age, sales, capital per worker, R&D, payments for technology transfers, foreign ownership

Table 2: Controlling for Switchers

	Eliminate ALWAYS switchers			Eliminate switchers AFTER first switch		
	OLS	heckman	heckman B	OLS	heckman	heckman B
	(1)	(2)	(3)	(4)	(5)	(6)
DMX	-0.146***	-0.309***	-1.063***	-0.167***	-0.164***	-0.168***
DnMX	0.095	-0.633**	-4.008***	-0.029	-0.030	-0.028
DMnX	-0.007	-0.719***	-4.020***	-0.092***	-0.100***	-0.086***
DMX1994	0.242***	0.227***	0.155	0.189***	0.230***	0.162***
DMX1995	0.481***	0.368***	-0.159	0.373***	0.497***	0.293***
DMX1996	0.385***	0.218**	-0.560	0.347***	0.454***	0.278***
DMX1997	0.219***	0.004	-0.997**	0.198***	0.280***	0.145***
DMX1998	0.164***	0.040	-0.536	0.171***	0.187***	0.161***
DMX1999	0.135***	-0.021	-0.746*	0.100***	0.133***	0.078*
DMX2000	0.026	-0.150	-0.973**	0.025	0.063	0.001
DMX2001	0.032	-0.071	-0.551	0.051	0.060	0.045
DnMX1994	0.133**	0.154	0.245	0.034	0.198***	-0.072
DnMX1995	0.438***	0.393***	0.185	0.239***	0.452***	0.102
DnMX1996	0.314***	0.202	-0.319	0.177***	0.372***	0.051
DnMX1997	0.203**	0.104	-0.352	0.052	0.225***	-0.059
DnMX1998	0.371***	0.339**	0.178	0.068	0.177**	-0.002
DnMX1999	0.105	0.070	-0.097	0.012	0.142**	-0.071
DnMX2000	0.115	0.126	0.172	0.004	0.110	-0.064
DnMX2001	0.208*	0.247	0.422	0.129**	0.227***	0.067

	Eliminate ALWAYS switchers			Eliminate switchers AFTER first switch		
	OLS	heckman	heckman B	OLS	heckman	heckman B
DMnX1994	0.266***	0.264***	0.253	0.181***	0.291***	0.110***
DMnX1995	0.465***	0.584***	1.134***	0.267***	0.316***	0.235***
DMnX1996	0.269***	0.412***	1.075***	0.234***	0.363***	0.151***
DMnX1997	0.146**	0.309***	1.065**	0.049	0.173***	-0.031
DMnX1998	0.167***	0.448***	1.755***	0.087**	0.151***	0.045
DMnX1999	0.139*	0.389***	1.553***	0.041	0.147***	-0.028
DMnX2000	0.034	0.266**	1.341***	-0.017	0.126**	-0.109**
DMnX2001	-0.002	0.258*	1.466***	0.052	0.183***	-0.032
TariffsMXNafta	-0.099***	-0.096***	-0.080	-0.102***	-0.103***	-0.101***
lambda		0.912***	5.142***		-0.783***	0.502***
FIRST STAGE - LHS: Firm is no Switcher (= Firm Select into the sample)						
Distance from average productivity similar firms		0.042*	0.016		0.051**	0.008
Distance squared		-0.010			-0.017**	
Plant controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
N	19,010	50,347	50,347	42,266	50,347	50,347
R^2	0.411			0.392		

Notes: The distance from average productivity of "similar" plants is in absolute value.