The Better You Are The Stronger It Makes You:
Evidence On The Asymmetric Impact of Liberalization*

Preliminary Version(Comments Welcome)

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Abstract

Economists agree on few things, one of them is that competition is good for economic performance (Nickell 1996). However competition can affect differently firms that are heterogeneous. And by doing so it will influence the industrial structure and the degree of domestic competition. This paper is an attempt to shed light on these questions. How did trade liberalisation, under NAFTA, affected productivity, competition and concentration in the Mexican economy? Was this impact identical for all firms?

These questions are motivated by the fact that after NAFTA reforms we observe a *surprising increase in inequality* across many industrial dimensions (e.g. productivity, output, investment, technological efforts) within narrowly defined sectors (e.g. 6 digits). To explain these findings we develop a Schumpeterian growth model predicting that the impact of liberalization on economic performance is positive, however more advanced firms benefit more. We test these predictions empirically using Mexican plant-level data and show that firms differing in their distance from "productive technological frontier" are affected differently from tariffs reduction. The further away from the frontier the less positive is the impact of increased competition. We also show that this *unequalising* effect of NAFTA liberalization also impacted on competition as larger tariffs reductions lead to lower price-cost margins, but also in this case the impact was heterogenous.

Keywords: *Heterogeneous firms, Schumpeterian growth model, Competition, Innovation, Liberalisation, Productivity, Mexico, NAFTA, Plant-level*

1 Introduction

The relationship between import liberalisation and economic performance and, more in general, between competition and performance, has been the focus of a large number of studies. In particular the studies making use of firm-level data normally found that an increase in import competition tends to have a positive impact on economic performance (Tybout and Westbrook 1995, López-Córdova 2003, Pavcnik 2002, De Hoyos and Iacovone 2006, Nickell 1996). However, these studies tend to focus on the "average" impact of liberalisation and implicitly assume that the effect of liberalisation is homogeneous across different firms. Differently, some recent work from Aghion, Blundell, Griffith, Howitt and Prantl (2004) show that the effect of competition is non-linear and heterogenous depending on the productivity level of the firms. Only *"good firms"*(e.g. close to the productive frontier) are positively affected by competition as their innovative effort is enhanced to respond to the increased entry threat of foreign competitors. Vice-versa *"bad firms"* (e.g. far from the productive frontier) are negatively affected because the expanded entry threat only reduces their expected profits as their efficiency is too low and cannot compete successfully with potential foreign entrants(Aghion, Burgess, Redding and Zilibotti 2004).

The Mexican liberalisation under NAFTA provides us with an excellent study case of a process of liberalisation and integration with global economy that increased the pressures from import competition and entry threat of foreign competitors. We will analyse this case and ask two questions. Is the impact of liberalisation the same for all firms or it is different depending on their productivity level? If this impact is asymmetric and the result is an increase in the inequality among Mexican firms, does this also negatively affect competition with larger firms expanding their market shares and driving up their markups?

The paper is divided into four sections. In the first section we discuss the existing literature related to our study. In the second section we present a set of stylised facts and sketch a model to set the basis for the following econometric analysis presented in section three. The last section concludes and highlights some avenues for further research.

2 Existing literature

This paper is related to the recent work of Aghion and Bessonova (2006) and Aghion, Burgess, Redding and Zilibotti (2004) arguing that liberalisation boosts innovative efforts, but only for those firms that are more productive while weakening the incentive to innovate for the less productive ones.

The core mechanism of these models is driven by three elements. First, innovation is the main

driver of firm-level growth. Second, a firm innovates as long as post-innovation profits are larger then pre-innovation ones. Third, the effect of a successful innovation is limited and a firm can only advance *"one step a time"* over the "productivity ladder". This implies that if one firm is close to the productive frontier by innovating it will prevent entry of potential foreign competitors.[1] However, if a firm is far from the productive frontier then it does not have any chance of preventing a foreign competitor from entering and taking over its market. In such a model, a reduction of tariffs increases the entry threat and boosts the incentives of incumbent firms, close to the frontier, to innovate and preempt the potential foreign entry. For these firms, the increased competition reduces more the pre-innovation profits than post-innovation profits because if the firm does not innovate it risks losing all its market due to the entry of the foreign competitor. At the same time the consequences for less productive firms are very different because the increased entry threat reduces the post-innovation profits more than the pre-innovation ones. In fact, the "laggard incumbents" (i.e. less productive) cannot prevent the entry of foreign competitors, even when able of innovating succesfully because they are too far from the productive frontier.

Also, related to this paper is the large set of studies arguing that competition puts pressures on "slacking managers" and pushes them to reduce the X-inefficiency (Martin 1978, Martin and Page 1983, Leibenstein 1978). However, all these studies rely on a set of restrictive assumptions and normally assume that firms are homogeneous.

Our work is clearly linked to previous empirical studies analysing the effect of competition on innovative activities and productivity growth even if the earlier studies could only rely on industry-level data (Gerosky 1990, Haskel 1992). Even more relevant to our study are the more recent analysis using firm-level data to evaluate the impact of competition on productivity and innovation (Nickell 1996, Disney, Haskel and Heden 2003) as well as the studies evaluating directly the impact of trade liberalisation on firm-level productivity (Tybout and Westbrook 1995, Pavcnik 2002, Fernandes 2002). However, as previously mentioned, these studies focus on the average effect of liberalisation and do not allow this effect to be different across heterogenous firms.

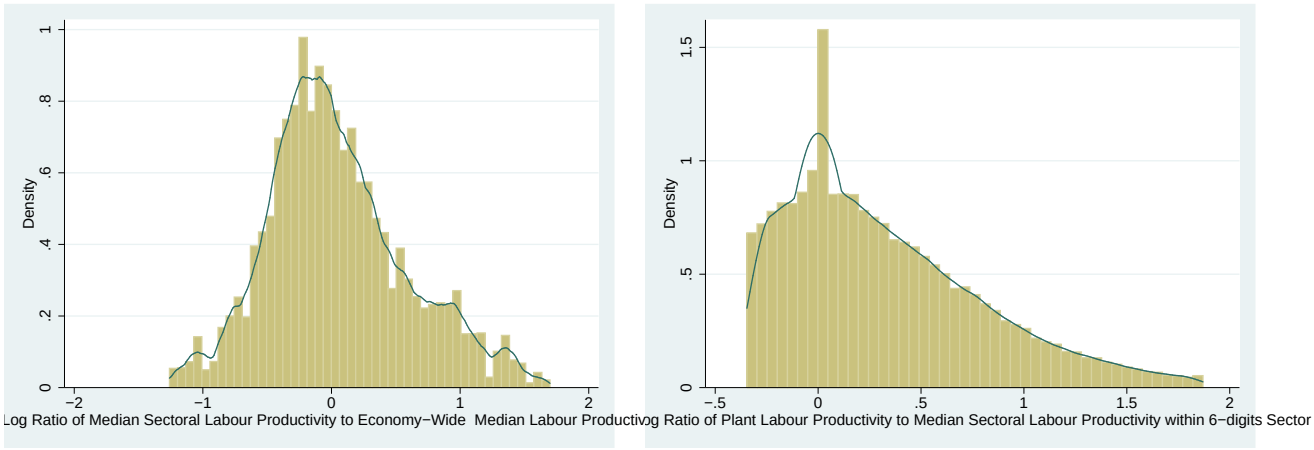
In the same spirit of our study, a couple of recent papers analysing the impact of FDI spillovers and foreign ownership explore the possibility of heterogenous impacts on firms with different productivity level(Griffith, Redding and Simpson 2003, Sabirianova, Terrell and Svejnar 2005).

Finally this paper is very much part of the growing literature on heterogeneous firms showing how

[1]Foreign competitors are assumed to be at the frontier therefore when they enter the domestic market they force domestic firms that are not at the frontier to exit because they can produce the same good more efficiently. Another possibility is that even if foreign firms don't produce exactly the same good their entry on the domestic market can increase the elasticity of substitution of domestic consumers and push mark-ups of domestic firms down, in this case only more productive firms would be able to survive in the more competitive environment.

firm heterogeneity interacts with external policy changes generating dynamics that fits much better the empirical evidence (Melitz and Ottaviano 2003, Melitz 2003, Helpman, Melitz and Yeaple 2004, Bernard, Redding and Schott 2004). In particular these studies show how the impact of liberalisation and globalisation is highly asymmetrical depending on the initial productivity of the firms, with more productive firms benefitting disproportionately more from globalisation than less productive ones.

Indeed, heterogeneity is a fundamental element of this paper as we confirm based on our data the existence of a very large productivity heterogeneity even within narrowly defined sectors, interestingly the heterogeneity within sectors is even larger than the heterogeneity between sectors[2] (see fig. 1). For this reason in the following subsection 2.1 we will review theoretical and empirical studies addressing these characteristics that contradict the basic tenet of "representative firms" in more classical economic models.



(a) Heterogeneity Between Sectors

(b) Heterogeneity Within Sectors

Figure 1: Firms Heterogeneity (Source: INEGI, Aguascalientes)

2.1 Why firms are heterogeneous?

In this section we are going to review various models characterised by firm heterogeneity, some of these models introduce heterogeneity exogenously while othera model it as an endogenous process. All these models are an attempt to make sense of the heterogeneity we found when analysing firm-level data. To conclude the section we will discuss how empirical studies have tried to explain the sources of this heterogeneity.

Jovanovic (1982) and Hopenhayn (1992) were among the first to provide some original contributions to model the coexistence of heterogeneous producers in a framework characterised by perfect competition. In both models firms are initially uncertain about their productivity and learn about their real productivity through time. Heterogeneous firms can coexist because of uncertainty while

[2]Sector is defined at the most disaggregated level, i.e. 6 digits

at the same time we observe entry and exit of heterogeneous firms. This model would predict that younger firms tend to be smaller and, in average, less productive than older ones. Hopenhayn's (1992) model also allows for the initial productivity not to be static but to evolve through time following an exogenous Markov process.

Other models emphasize technology diffusion as the main source of heterogeneity. At any point in time firms can invest and endogenously influence their costs by adopting new technologies, however the probability of being successful depends not only on the individual firm's efforts but also on the number of firms that have invested and upgraded because of learning externalities (Mansfield 1961). In this same line of thought Jovanovic and Lach (1989) develop a model where the innovation decision is driven by solving the trade-off between costs and benefits with early innovation being more costly, as there are no spillovers by existing adopters, but also potentially much more lucrative because early adopters enjoy higher monopolistic profits.

Building on Jovanovic (1982) and Hopenhayn (1992), Melitz (2003) introduces heterogeneity exogenously and innovatively merge it with a system characterized by monopolistic competition and fixed market entry costs as used in previous new trade theory models (Baldwin and Krugman 1989, Dixit 1988). In his model, ex-ante, all firms are identical and have the chance of drawing a certain productivity type from a known distribution of productivity. Once they have already taken their draw, they discover their true productivity and decide if it is viable to produce or export. In this model the productivity can be thought as managerial ability of the entrepreneur, which is a sort of "random attribute" of the firm.[3] In this model the coexistence of heterogeneous firms in equilibrium is the result of uncertainty about productivity level before incurring in the initial sunk costs, indeed firms may earn positive profits conditional to their entry but their ex-ante expected profits, net of initial sunk costs, are zero in equilibrium.

In Aghion, Blundell, Griffith, Howitt and Prantl (2004) and Aghion, Burgess, Redding and Zilibotti (2004) the heterogeneity is initially imposed because in each period the firms can be in two different "states": (1) high productivity (close to the frontier) or (2) low productivity (far from the frontier). Each firm decides then if to innovate or not and, if successful at innovating, moves closer to the frontier. Given that in each period the frontier moves forward (i.e. technology advances) the heterogeneity endogenously expands because some firms are unsuccessful or decide not to innovate while others succeed at innovating. In this model the heterogeneity is a result of the discrete and uncertain nature of the innovation process.

In Yeaple (2005) heterogeneity emerges endogenously as a consequence of specific firm's decisions. In fact each firm can choose two alternative technologies (high and low tech) and two types of work-

[3]The productivity can be also re-interpreted as product quality

ers (high and low skilled). Given the fixed cost of adopting the high tech production method and the scarcity of high skilled workers there are equilibria where some firms will be using the low tech method and hiring low tech employees. Therefore, in this model even if firms are ex-ante identical, the heterogeneity emerges as a consequence of the qualities of factors (i.e. technology and workers) adopted by the firm.

Heterogeneity is not only a feature of theoretical models, in fact it is even more a constant finding of many empirical papers. Tybout (2000) notices how one of the distinctive features of LDCs manufacturing sector is its dualism where "large numbers of microentreprsises and a handful of modern, large-scale factories produce similar products side by side". However, the productivity dispersion is not necessarily a feature of developing countries as remarked by Tybout (2000) and Bartelsman and Doms (2000). Previous empirical studies for both developing and developed countries have confirmed the persistence of a high degree of heterogeneity even after a profound liberalization process. For example, in the case of Chile during the 80s and 90s Crespi (2005) found that firms in the top decile have labour productivities that are 256% above those in the bottom decile, while Disney et al. (2003) found a difference of 155%.

The explanations for this heterogeneity can be divided into two mayor groups. Traditionally, researchers have pointed towards supply-side explanations such as technological efforts and uncertainty surrounding technological investments (Nelson 1981), management of ownership , human capital but also complementary investments in organizational capital and matching between skills and organisation (Bartelsman and Doms 2000). For example the findings that productivity ranking tends to be relatively stable seems to imply that managerial skills, or some other persistent productivity shocks, are an important determinant of this heterogeneity (Baily, Hulten and Campbell 1992). Another potential explanation, hard to pinpoint convincingly, points toward the existence of external economies as documented by Krizan's (1995) findings that there is a positive correlation between plant level productivity and regional economic activities in various developing countries.[4] More recently, Syverson (2004) suggested that also demand side reasons can be important to explain this heterogeneity, in particular product heterogeneity and their substitutability plays an important role. Finally, external to the firm, regulations and exposure to international competition can be important in explaining part of the observed heterogeneity (Tybout 2001, Tybout 2000, Bartelsman and Doms 2000).

2.2 Market Power and Import Liberalization

If liberalization has an asymmetrical effect on incumbent firms and increases the inequality in terms of market share with more productive and larger firms enjoying expanded market power, this may indirectly reduce the degree of competition on domestic markets. On the other side, liberalization

[4]This study covers Chile, Mexico and Morocco.

clearly increases the competitive pressures from foreign firms which is expected to make the domestic market more competitive. Which of these two effects (see fig. 2) prevail is an empirical question that has been analysed already in some previous studies resulting in mixed findings. In this section we will briefly review the results of these studies and discuss their principal limitations.

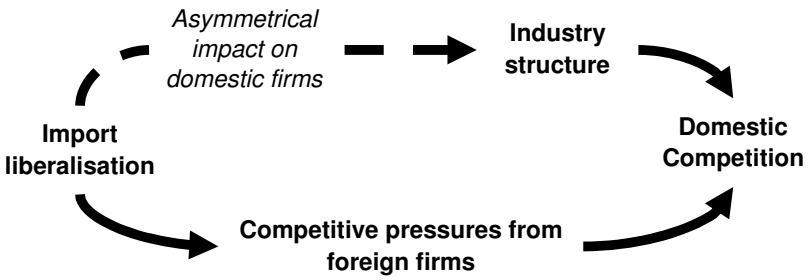


Figure 2: Relationship between import liberalisation and domestic competition

Haddad, de Melo and Horton (1996) analysing the case of Morocco in the second half of the 80s, found that firms enjoying larger market shares tend to have higher markups, however they found no statistically significant relationship between import penetration and markups at firm level. Similarly, analysing the Chilean case during the 80s, Tybout (1996) found little evidence that foreign competition, measured with the degree of import penetration, disciplines market power of domestic firms.

Differently, the analysis of the case of Colombia during 1977-85 (Roberts 1996) and Turkey during 1976-1985 (Foroutan 1996) show some evidence that firms facing higher import penetration tend to have lower markups. Finally, a similar analysis performed for the Mexican case during the period 1985-90 shows that firms facing lower tariffs tend to have lower markups even if this effect is mostly significant for firms with larger market shares (Grether 1996).

These studies however have two important shortcomings. First they tend to use, except for Grether (1996), import penetration at sectoral level as a proxy for foreign competition. Unfortunately we

can reasonably expect that this variable is endogenous because in those sectors where firms are more productive and able to mantain higher market power we would normally observe lower import penetration. The second limitation of these studies is that they tend to ignore the existence of firm-specific time invariant unobservables and do not control for firm fixed effects. In our empirical analysis presented in section 4.3 we will tackle both these two problems.

3 Trade Liberalisation and Productivity

3.1 The Facts

During the 90s Mexico underwent a process of deep integration with the global economy. This process marked the completion of a liberalisation already started during the second part of the 80s. However, it is important to notice that, differently from the unilateral liberalisation of the 80s, the liberalisation under NAFTA locked in Mexican policy makers much more than the previous reforms because of the credibility imposed by the agreement with US and Canada. Therefore, when considering the scope of the liberalisation under NAFTA we need to take into account also the importance of this credibility effect (Tomz 1997). In this perspective, NAFTA implied a deeper liberalisation process than it would appear from the relatively modest drop in average tariffs. Furthermore in figure 3 we show that the NAFTA tariffs[5] drop was not really negligible in fact even if the average tariffs went down from about 16% in 1993 to less than 5% in 2002, the tariffs' peaks were reduced from about 70% in 1993 to about 20% in 2002.

In this section we want to document that during the period of NAFTA reforms we observe a remarkable increase in industrial inequality with good firms getting better, large firms getting larger and distancing themselves even more from the median firm.

If we analyse the evolution of productivity[6] during the period 1993-2002 we observe two fundamental trends: a shift in the mean productivity, Mexican firms became in average more productive, and an increase in the spread of the productivity distribution.[7] These trends are evident if we look at figure 4 where we present the distribution of the gap between each individual firm-level productivity and the "productive frontier" , in years 1993 (dashed line), 1998 (dotted line) and 2002 (continuous line). The gap is defined as the log of the ratio between the average productivity of the top five firms in

[5]Tariff rates for commodities produced in US or Canada

[6]We use as productivity index the value added labour productivity

[7]We also test the hypothesis that the productivity spread got larger more formally by regressing the variation coefficient, calculated within each narrowly defined sector at six digits, on a linear trend. We find that the coefficient on the linear trend estimated with a FE model is positive and statistically significant confirming that dispersion of productivity among firms even within narrowly defined sectors got larger during the period under analysis.

Figure 3: Import Tariffs Drop under NAFTA (Source: Secretaria de Economia, Mexico)

the sector[8] and the individual firm labour productivity. The larger this ratio is, the more distant the frontier is. This expansion of productivity inequality is even more interesting if we consider that during this period we observe the exit of a significant number of firms which productivity is clearly below the average as shown in figures 5 and 6.

The increased inequality during this period does not only emerge when we analyse productivity dispersion, but also when we analyse market shares or normalised total sales.[9] Figure 7 shows exactly this, as in the top panel it depicts the distribution of market sales in 1993 (dashed line) and in 2002 (continuous line), while in the bottom part of the panel we show the distribution of normalised sales again in 1993 (dashed line) and 2002 (continuous line). In both cases we observe an increase in the dispersion and inequality among Mexican firms in fact during the period 1993-2002 the standard deviation of market share grew from .066 to .098 while the standard deviation of individual sales normalised to the median went from 42 to 49 (Source:INEGI, Aguascalientes).

After having documented this increase in industrial inequality we will now move on and try to explain it by building up on recent theoretical contributions of Neoschumpeterian models.

[8]As before sector is defined at the most disaggregated level, i.e. 6 digits.

[9]Sales are normalised to their respective sectoral median (we consider the median more representative than the mean because the distribution is strongly skewed towards the right however the results normalising to the mean are very similar.

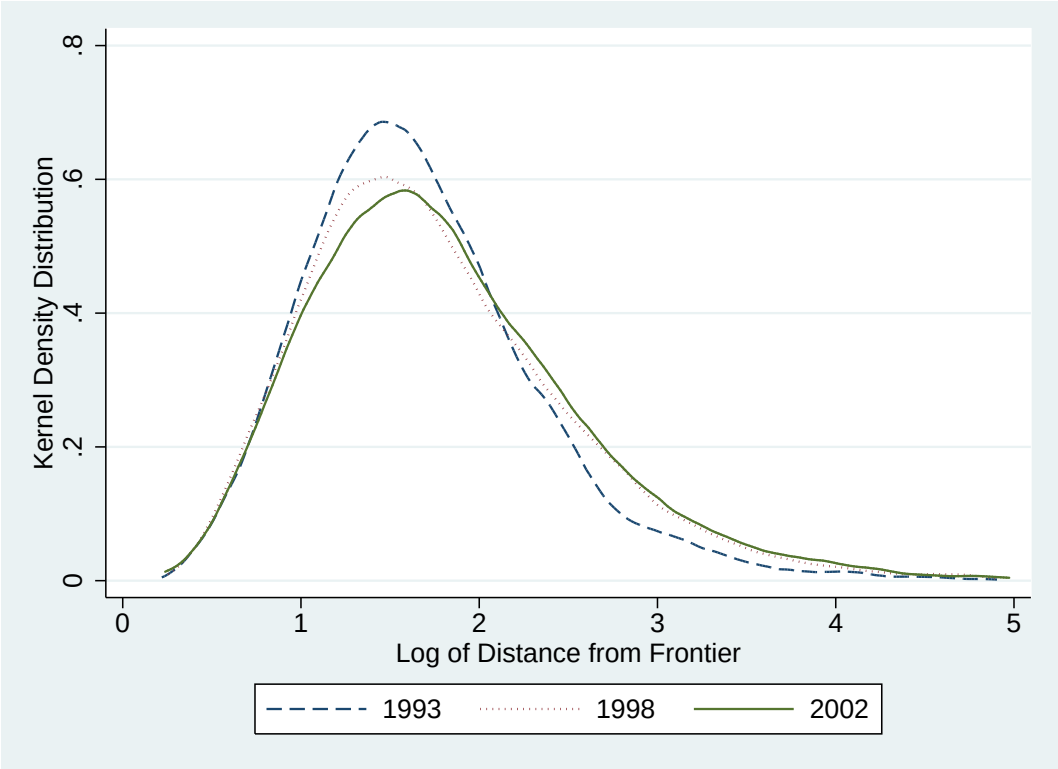


Figure 4: Distance From Frontier (Source: INEGI, Aguascalientes)

Figure 5: Average Productivity of Exitors vs Remaining Plants (Source: INEGI, Aguascalientes)

(a) Exiting firms

(b) Surviving firms

Figure 6: Firms Demography (Source: INEGI, Aguascalientes)

3.2 The Theory

As already mentioned, previous studies analysing the impact of trade liberalisation on productivity already showed that increased competitive pressures tend to have a positive effect on average productivity. However, the evidence that after liberalisation the productivity distribution gets wider is not easily explained by traditional models with homogeneous firms. Assuming heterogeneity among firms gets us closer to explaining these facts but may not be enough. In fact, theoretical models analysing the relationship between competition and productivity may suggest that an increase in competition can affect especially the laggards because these are the ones who potentially benefit more from a protected environment. Therefore, once the protectionist barriers are scrapped, the less productive firms are either forced out of the market or must make dramatic improvement in order to survive.

When considering the relationship between competition and productivity it is important to distinguish, at least analytically, two different channels through which productivity can be affected: innovation and efficiency. Successful innovation would normally push the production frontier outward while efficiency improvement would move the firm closer to the existing frontier.

If models with heterogeneous firms are not enough, the theoretical literature analysing the relationship between innovation and competition tend to provide us with answers that are more ambiguous. Some studies suggest that higher competition hampers innovative efforts by reducing the firm expected profits (this effect is referred to as *"Schumpeterian effect"* by Aghion, Bloom, Blundell, Griffith and Howitt (2002)). Other studies focus instead on the *"escape competition effect"* indicating that incumbent firms react to the increased competition by increasing their innovative efforts

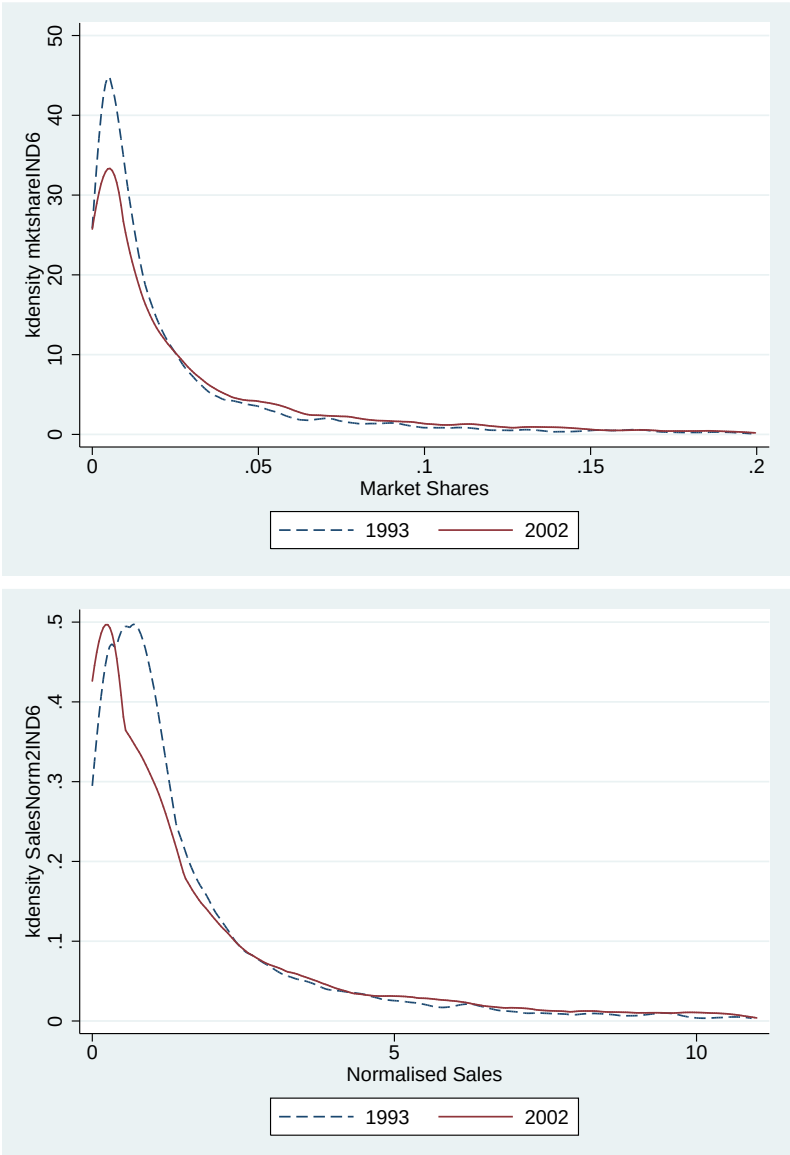


Figure 7: Increase in the inequality

in order to escape the potential entry threat of competitors.[10] However, these two effects are not necessarily exclusive, both can be present and which one prevails may depend on the level of competition and on the characteristics of the incumbent firms. Indeed the synthesis provided by the neo-shumpeterian growth models provides us with the basic theoretical underpinnings that could explain the stylised facts presented in section 3.1 and generate a testable hypothesis: the effect of competition is asymmetric on heterogenous firms. For the more productive firms the *"escape competition effect"* prevails while for the less productive ones it is the *"Schumpeterian effect"* that dominates. Consequently, after liberalisation, good firms tend to engage more in the extra efforts to improve their productivity while the laggards tend to fall behind because catching up is harder for them. The results of this dynamics are an increase of the productivity spread between good and bad firms with the productivity inequality expanding.

3.3 The Model

Now we will briefly sketch the model that expands the model originally presented by Aghion and Griffith (2005) and Aghion, Burgess, Redding and Zilibotti (2004). The principal innovation of our model is that we will allow backward firms to catch-up with the productive frontier, even if this catch-up is much harder because of their initially disadvantaged condition. We characterise this model by defining (a) domestic production, (b) innovation decision, (c) foreign competition, (d) equilibrium innovation.

3.3.1 Domestic production

In the economy we have a final good that uses a continuum of intermediate goods and the production function is described by equation 1 where $x_t(v)$ is the quantity used of the intermediate input v and A_t measures its productivity, finally α is a parameter between 0 and 1. This output can be consumed, used to produce intermediate inputs or invested in innovation.

$$y_t = \frac{1}{\alpha}\int_0^1 A_t^{1-\alpha}(v)x_t^{\alpha}(v)dv \tag{1}$$

Each intermediate good is produced by a monopolist[11] at a constant marginal cost equal to one unit of the final good. The monopolist maximises its profit but its monopoly power is restricted by the existence of a set of "fringe firms" that do not operate in equilibrium but could produce the same input using χ unit of output where χ is a parameter capturing the competition intensity and is larger than 1. Therefore the maximum price charged (in terms of the output good that is numeraire) for the intermediate good v by the monopolist is

$$p_t(v) = \chi \tag{2}$$

[10] For a comprehensive review of this literature refer to Aghion and Griffith (2005)

[11] This assumption can be changed and have two producers competing for example under Bertrand competition

Because the final good product market is perfectly competitive the price of the inputs has to equate their marginal productivity:

$$MP_t(v) = \frac{dy_t}{dx_t(v)} = \alpha \left(x_t(v)/A_t(v)\right)^{\alpha-1} \tag{3}$$

The model can be then solved and Aghion and Griffith (2005) show that the profit function is inversely related to the strenght competition (χ) and positively correlated to the productivity of the firm producing the intermediate input v as described in equation 4:

$$\pi_t(v) = A_t(v)\delta(\chi) \tag{4}$$

where

$$\delta(\chi) = (\chi - 1)\,\frac{\chi}{\alpha}^{\frac{1}{\alpha-1}} \tag{5}$$

3.3.2 Innovation decision

In each period the technological frontier evolves exogenously at a rate g as described by equation 6

$$\overline{A}_t = \overline{A}_{t-1}\,(1+g) \tag{6}$$

and there can be two types of firms as explained by the following equation

$$\text{Firm type} = \begin{cases} \text{Advanced or type 1} & \text{if at the end of } t-1 \quad A_{t-1} = \overline{A}_{t-1} \\ \text{Backward or type 2} & \text{if at the end of } t-1 \quad A_{t-1} = \overline{A}_{t-2} \end{cases}$$

In this framework innovation is the result of a research effort z_j where j is the firm type

$$z_j = z + (j-1)\,s \qquad j \in 1, 2 \tag{7}$$

The probability of being successful and moving one step ahead in the innovation ladder is exactly z_j while s is the extra-effort required to catch-up with technological frontier for a backward firm. The probability that this extra-effort is successful is a function of z and to simplify it we assume that

$$s = \theta z$$

Where θ is a parameter that we assume smaller than one but not smaller than g. Basically we allow that also backward firms can actually be able to catch up with the productive frontier with probability θz where θ positive and small, but not smaller than g to compensate for the lag with respect to the technological frontier.

$$g \leq \theta \leq 1 \tag{8}$$

Following Aghion, Burgess, Redding and Zilibotti (2004) we assume that the cost of innovating is quadratic in the probability of success (z) and linear in the current technological level as in equation

9. However, for backward firms we need to take into account also the cost of the extra-effort. So the innovation cost function is

$$c_{jt} = \frac{1}{2}z^2 A_{t-j}(v) + (1-j)\,\frac{1}{2}s^2 A_{t-j}(v) \tag{9}$$

At the end of every period, all firms that remain backward will then be upgraded automatically, assuming there are spillovers from mature technology, and move up one step in the technology ladder[12]. Also, at any moment t there is an exogenous probability h that one firm exits and is replaced by a a new firm at time $t+1$ that is advanced.

3.3.3 Foreign competition

In every period foreign competitors can enter the domestic market and decide if entering after having observed the outcome of the innovation decion of domestic firms. Foreign firms are assumed to be at the technological frontier. To enter, the foreign company needs to pay a sunk cost equal to ξ and will be able to enter the domestic market with probability μ.[13] If the foreign firm enters and faces a backward domestic firm, then it gains the entire market if, otherwise, it faces a domestic firm at the frontier then they engage in Bertrand competition and both firms will see their profits go to zero. Consequently the entry threat simplifies into the following condition

$$\text{Entry Threat}_t = \begin{cases} 0 & \text{if domestic firm is at frontier in } t-1 \text{ and innovates succesfully in } t \\ & \text{or is backward in } t-1 \text{ but able to reach the frontier in } t \\ \mu & \text{otherwise} \end{cases}$$

3.3.4 Equilibrium innovation

The solution of the profit maximisation problem for backward firms is obtained by solving equation 10

$$\max_z \pi_{2t} = \delta\left[z(1-\mu)\overline{A}_{t-1} + (1-z)\,(1-\mu)\,\overline{A}_{t-2} + s\overline{A}_t + (1-s)\overline{A}_{t-2}(1-\mu)\right] - \frac{1}{2}\left(z^2+s^2\right)\overline{A}_{t-2} \tag{10}$$

because when this firm is successful in moving one step ahead and obtain a productivity $\overline{A}_{t-1}$ it will retain its domestic market if the foreign firm does not enter with probability $1-\mu$. Similarly, when it is unsuccessful at innovating with probability $1-z$ and mantains productivity $\overline{A}_{t-2}$, it will retain its market only if the foreign firm does not enter with probability $1-\mu$. Backward firm also engages in an extra-effort to catch-up with productive frontier and, if successful, with probability s, obtains a productivity equal to $\overline{A}_t$ and retains the market. While if unsuccesful, with probability $1-s$, it mantains productivity $\overline{A}_{t-2}$ and retains its domestic market as long as the foreign firm is unable to

[12] This allows us to have only two types of firms to deal with

[13] μ is a proxy that captures how easy is to enter the domestic market, e.g. tariffs and regulations directly affect μ.

enter with probability $1-\mu$. Solving this maximisation problem we obtain the optimal innovative effort z_{2t}^{*} of the backward firm 11

$$z_{2t}^{*}=\frac{\delta}{1+\theta^{2}}\left[g\left(1+2\theta+\theta g\right)+\mu\left(\theta-g\right)\right] \tag{11}$$

At the same time the advanced firm choses its optimal innovation effort z_{1t}^{*} maximising its profits π_{1t} as in equation 12

$$\max_{z}\pi_{1t}=\delta\left[\overline{A}_{t}+\left(1-z\right)\left(1-\mu\right)\overline{A}_{t-1}\right]-\frac{1}{2}z_{t}^{2}\overline{A}_{t-1} \tag{12}$$

because it retains the market when it successfully innovates, with probability z, and obtains a productivity $\overline{A}_{t}$, in which case the foreign firm stays out of the market. The advanced firm will still mantain its market if unsuccessful at innovating, with probability $1-z$, and a resulting productivity of $\overline{A}_{t-1}$ as long as, with probability $1-\mu$, the foreign firm is unable to enter. The optimal innovation effort of this type of firm is equal to z_{1t}^{*}

$$z_{1t}^{*}=\delta\left(g+\mu\right) \tag{13}$$

What is the effect of a reduction in import barriers that increase the entry threat? We can immediately obtain this from equations 11 and 13 and show that this is positive for both types of firms but larger for advanced firms as $\frac{\theta-g}{1+\theta^{2}}$ is positive but smaller than 1.

$$\frac{dz_{2t}^{*}}{d\mu}=\frac{\delta}{1+\theta^{2}}\left(\theta-g\right) \tag{14}$$

$$\frac{dz_{1t}^{*}}{d\mu}=\delta \tag{15}$$

The predictions of our model are consistent with those of Aghion, Burgess, Redding and Zilibotti (2004) at the industrial level because it generates an increase in the gap between advanced and backward firms. However, when we analyse it at firm level, our model suggests that the effect of liberalization is, on average, positive for both advanced and backward firms. This is in general consistent with all the previous literature on x-inefficiency (Leibenstein 1978) and various empirical studies (Tybout and Westbrook 1995, Fernandes 2002, De Hoyos and Iacovone 2006, Nickell 1996). In other words, our model extends that of Aghion, Burgess, Redding and Zilibotti (2004) and Aghion and Griffith (2005) by making it in line with various previous empirical and theoretical studies but mantains intact its central feature that liberalization has an unequal effect and that more advanced firms benefits disproportionately more from it.

4 Econometric analysis

The econometric analysis is split into two sub-sections. In the first we analyse the relationship between liberalisation and productivity, while in the second we study the relationship between

liberalisation and competition. In both sections we will build our models in order to explore the potential hidden heterogeneity in these relationships allowing the impact of liberalisation to be different for different types of firms. [14].

4.1 Data

The data used in this analysis are provided by INEGI and cover the entire period of NAFTA reforms, 1993-2002. The data are collected at plant level, and individual establishments are identified through a unique key[15] that allow us to build a panel. After having cleaned the dataset the number of establishments varies between 6,500 and about 5,000 because of attrition.[16] The sampling structure of the survey is such that the data tend to be more representative of larger firms, overall the survey covers 85% of industrial output excluding the *"maquiladoras"*. The survey frequency is yearly and the variables collected cover various aspect of the firm's operations: workers, wages, electricity usage, intermediate inputs usage[17], production, inventory, sales[18], investment in different types of physical assets, investment in R&D and in technology transfers.[19]

4.2 The asymmetric impact of liberalisation

In this section we will address two related questions. What is the impact of increased import competition on productivity? And is this impact different for "heterogenous" firms?

It is a well documented feature of various firm-level studies that firms are heterogeneous in terms of their productivity level (Tybout 2000). At the same time various firm-level studies have shown that trade liberalisation tends to influence positively the productivity level of domestic firms (Pavcnik 2002, Roberts and Tybout 1996). However, based on the theoretical model previously described, we expect the impact of increased foreign competition to be different across firms that have different productivity levels.

Therefore, we first calculate the domestic production frontier equal to the average value added labour productivity[20] of the top five firms within each sector[21] and for each firm we measure the distance

[14]We will explore two particular elements of heterogeneity: productivity and market share

[15]This work was carried out while I was in Aguascalientes and in compliance with Mexican Laws protecting the confidentiality of the data

[16]It is important to note that entry is not systematically captured by INEGI as the sample is refreshed only once every ten years. However a specific department of INEGI tends to follow up on newspapers and other sources of information the entry of new plants, in this way the most important new firms tend to be included even if entry is not systematically captured.

[17]The intermediate inputs used are split into imported and domestic inputs

[18]As for intermediate inputs also the sales are split into domestic and foreign sales

[19]For more details on the data see appendix A

[20]The value added labour productivity is calculated as the ratio between deflated value added and number of workers

[21]Sector is defined at six digits, the most disaggregated way allowed by the Mexican Classification of Manufacturing

from its domestic frontier as in equation 16. For the firm i belonging to sector j this is equal to the ratio between the frontier in sector j (π^F_{jt}) and its own labour productivity π_{it}. The larger the gap between the firm and the *"top firms"* in its sector, the wider this distance index will be.

$$DLF_{ijt} = \frac{\pi^F_{jt}}{\pi_{ijt}} \tag{16}$$

To answer the questions outlined above we estimate equation 17. Our explanatory variable is the growth of labour productivity of firm i between t and $t+1$, and our main explanatory variables are the distance from the frontier (DLF_{ijt}), the tariffs faced by its foreign competitors in sector j and the interaction between these two variables. We also add a number of firm level controls and year dummies to absorb the effect of macroeconomic shocks. All variables are in logarithm[22] and we estimate the model using both OLS and FE estimators . Because we have a lagged dependent variable in this equation appearing on the denominator of the distance index, our estimates will be biased (Cameron and Trivedi 2005, p.764). In particular the OLS coefficient will be downward biased while the FE coefficients will be upward bias (Arellano 2003).[23]

$$\Delta\pi_{ijt} = \beta_0 + \beta_1 DLF_{ijt-1} + \beta_2 T_{jt-1} + \beta_3 T_{jt-1} \times DLF_{ijt-1} + \beta_4 X_{ijt-1} + \beta_5 Year + \mu_{it} \tag{17}$$

We expect β_1 to be positive as firms lagging behind tend to catch up with their respective frontier, instead based on our theoretical model we expect β_2 to be negative as lower tariffs should promote higher productivity growth spurred by the increased competitive pressure. Finally, we expect β_3 to be positive, because, as discussed in section 3.2 the impact of increased liberalisation is less positive for firms that are more distant from the technological frontier.

The results are presented in table 3. In the OLS model we also include, beside the variables previously discussed, six digits industry FE[24] to control for time-invariant industry specific unobservables. Consistently with what mentioned above, the coefficient on the variable measuring the distance from frontier, that contains a lagged dependent variable in its denominator, appears to be upward biased in the FE and downward biased in the OLS. However it is important to underline that the qualitative results do not change between the two models. In fact, in both models these variables are positive and significative.

Table 3 here

Activities (CMAP94)

[22] When performing the log transformation we add 1 to the value of the original variables to avoid that zero values are transformed into missing values

[23] A possible extension to try to address this issue is to use a GMM estimator which makes use of the longitudinal dimension of the data to build appropriate instruments using the lagged variables. However in our case the reduced size of the longitudinal dimension makes the use of GMM difficult, therefore we will not use this strategy.

[24] As before industry here is defined at six digits, *"clase"*, and we have 205 *"clase"*

Our main finding is that the productivity of firms facing lower tariffs tends to grow faster but this productivity effect is lower the larger is the firm's distance from its frontier because the coefficient on the interaction is positive. The coefficients of the remaining variables are consistent with what we would have expected a-priori. In particular, we find evidence of catching up as distance from frontier positively affects subsequent productivity growth. It is also interesting to notice that the productivity of larger and more capital intensive firms tends to grow faster. Also, as expected, the productivity of firms paying higher wages, a proxy for the quality of human capital, grows faster. And finally, higher expenditures in R&D and technology transfers promote faster productivity growth. However, these control variables are likely to be endogenous; therefore, we do not want to push too much on their interpretation. In fact the principal purpose of introducing them is to control for firms characteristics that may be correlated with the productivity growth and therefore, if omitted, could bias our principal coefficients of interests.

Finally, we want to underline that we could have expanded this analysis by introducing more interactions between the distance from the frontier and other plant's characteristics. The reason we omit them is because we think this would be outside the scope of this paper. This is analysed in another paper where we study in details the characteristics explaining why a plant is able to converge faster and catch-up with with domestic and global productive frontier (Crespi, Hesse and Iacovone 2007).

4.3 The impact of liberalisation on domestic competition

In the previous section we have shown that NAFTA liberalisation had an unequal impact on the Mexican firms with the more productive firms benefitting more. We also showed in section 3.1 that during this period there was an increase not only in the productivity spread but also in the dispersion of market shares and sales. From a policy perspective this increase in inequality is worrying if it is associated with an expansion of market power of largest firms and consequent drop of competitive conditions in domestic markets. At the same time, import liberalisation is expected to enhance competitive pressures on domestic producers and increase the elasticity of substitution of domestic consumers as they now face more options and cheaper prices for foreign goods. Therefore, as discussed in section 2.2 which one of these two mechanisms prevails is an empirical question that we address in this section where we ask *what has been the impact of import liberalisation on domestic competition?*

To answer this question, first of all, we need to decide which index of domestic competition to use. Many studies in the past have used an index linked to market shares concentration, in particular the Herfindal index. The problem with such an index is that we need to define an appropriate relevant market. However for an economy that is open to trade this is particularly complicated, if

not arbitrary. Let us consider the example of a firm exporting 90% of its output, obviously for this firm it would be incorrect to consider the domestic market as the relevant one. For this reason we opt for a different indicator of competition and, building on previous studies (Aghion et al. 2002, Roberts and Tybout 1996), we use the Lerner index described in equation 18.

$$\eta_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{18}$$

Ideally, to calculate the Lerner index we would need to observe both prices and marginal costs at plant level, unfortunately this is not possible. Nevertheless, we can still calculate the Lerner index by assuming that marginal costs can be approximated by average costs ($MC_{it} \approx AC_{it}$). Once we have made this assumption we can calculate the Lerner index as described in equation 19 using observed revenues and total costs.

$$\eta_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \approx \frac{P_{it} - AC_{it}}{P_{it}} \approx \frac{P_{it} \times Q_{it} - AC_{it} \times Q_{it}}{P_{it} \times Q_{it}} = \frac{Sales_{it} - TotalCosts_{it}}{Sales_{it}} \tag{19}$$

To answer the question stated above we will estimate the model described in equation 20. Our explained variable is the markup of firm i at time t and our main explanatory variables are the tariffs change in sector j, to which firm i belongs, its market share and the interaction between these two variables. Following some previous studies that found evidence of a non linear effect of market share markup (Haddad et al. 1996, Tybout 1996, Foroutan 1996) we also allow the market share to enter non-linearly in the equation adding the squared market share. Furthermore, we include a large set of firm characteristics: TFP, capital intensity, wages, age, expenditures for R&D and expenditures for technological transfers. As before we include year FE to take care of macroeconomic shocks because this period was characterised by a sharp devaluation and subsequent contractionary macroeconomic policies. Finally, in order to control for time invariant firm-specific unobservables characteristics, we estimate the model using a FE estimator.

$$\eta_{it} = \beta_0 + \beta_1 \Delta T_{jt} + \beta_2 S_{it} + \beta_3 \Delta T_{it} \times S_{it} + \beta_4 X_{ijt} + \beta_5 Year + \mu_{it} \tag{20}$$

Based on economic reasoning we expect β_1 to be positive, a reduction in tariffs should increase competitive pressures on domestic firms and force them to reduce their markups. We also expect β_2 to be positive as firms with larger market share should be able to exploit their market power and charge higher prices. Finally the sign of β_3 is a priori not well defined because on one side we expect the reforms to hit harder on firms with larger market shares, the *"oligopolistic dinosaurs"* of the Mexican economy, in which case the sign should be positive. On the other side, it is possible that these firms have more political clout and are able to escape competition because they may rely on other sort of domestic regulatory protections that can somewhat insulate them from foreign competitors, in which case the sign of β_3 should be negative.

The results of this estimations are presented in table 4. We estimate two slightly different models. Model 1 is estimated using contemporaneous regressors while model 2 is estimated using lagged regressors to alleviate potential endogeneity problems.The results are consistent across the two models

and the coefficients, at least for the main variables of interest, are very close.

Table 4 here

We confirm that there is a positive relationships between tariffs and markups. Firms facing a sharper reduction in tariffs tend to have lower markups. As expected, the relationship between markups and market share is positive; however, it is interesting to notice that, consistently with findings of the studies previously discussed, this is not linear as the coefficient on squared market share is negative in both models. What is especially interesting is the finding that the coefficient of the interaction between tariffs and market share is negative suggesting that firms with larger market shares were able to escape some of the competition effect imposed by the reduction of domestic tariffs.

5 Conclusions

In this paper we have shown that during the period of NAFTA liberalisation there was an increase in the productivity dispersion among Mexican firms: better firms were able to distance themselves even further from the laggards. We showed that this finding is not necessarily surprising and can be interpreted in the light of the recently developed neo-shumpeterian models (Aghion et al. 2002). To confirm this building on previous work of Aghion, Burgess, Redding and Zilibotti (2004) we build a model predicting that the impact of liberalisation is asymmetric across different types of firms, with "good firms" benefitting more from the increase in competitive pressures than "bad ones" and we test it using plant-level data. Our results support this conclusion and show that tariffs liberalisation spurred higher productivity growth, but this effect was lower for firms that were more distant from the frontier.

We have also shown that the increase in productivity dispersion was accompanied by a general increase in market shares dispersions and inequality. This finding could be potentially worrying from the point of view of policy makers concerned with the degree of domestic competition. To shed light on this we also analysed the relationship between tariffs liberalisation and a typical measure of market competition, i.e. the markups index (or Lerner index). Our findings are on one side consistent with our expectation that liberalisation enhances domestic competition and forces Mexican firms to reduce their markups, but on the other side they raise a red flag as we find that firms with larger market shares were able to escape some of this "pro-competitive effect".

These findings open the avenue to further research to shed light on the drivers of these results. In particular, what are the drivers behind the heterogeneous reaction to liberalisation of different types of firms? Are they traditional innovative efforts as measured by R&D, technology purchases, etc.

or is it about product innovation, reorganisation of the productive processes and training of the workforce? Also, it would be interesting to understand why larger firms, or as we defined them, the *"oligopolistic dynosaurs"*, were able to escape part of the effect of the increased competition due to tariffs liberalisation. Was this because of ineffective domestic regulatory environment or was it because of some successful strategies pursued by these firms?

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A Appendix: Data

The Encuesta Industrial Anual (EIA) is an annual industrial survey that covers the Mexican manufacturing sector, with the exception of "maquiladoras." The EIA was originally started in 1963 and then expanded in subsequent years, with the last expansion taking place in 1994 after the 1993 census. The post-1993 EIA includes 6,867 plants spread across 205 classes of activity representing the most important sector of manufacturing activities in Mexico based on the 1993 industrial census. In our analysis, we use the information for the 1993-2002 period and after cleaning the number of plants is reported in table 1

Table 1: Number of plants and products

Year	**No of plants**	
	All	**Exporting**
1994	6299	1586
1995	6070	1880
1996	5786	2061
1997	5572	2161
1998	5400	2106
1999	5255	1967
2000	5118	1914
2001	4952	1780
2002	4782	1696
2003	4626	1691

The sampling scheme is deterministic and based on the 1993 industrial census. For each one of the 205 selected "clase" the largest plants are selected up to the point when at least 85% of industrial output has been covered. In those cases where the average size of plants is very small (e.g. "fragmented classes") up to a maximum of 120 plants are included and the coverage may fall to about 60-70% of the total industrial output in that specific "clase". At the same time, for those cases where the "clase" is highly concentrated (i.e. less than 20 plants) all plants are included with a coverage of 100%.

The unit of observation is a plant described as *"the manufacturing establishment where the production takes place"*. Each plant is classified in its respective class of activity based on the basis of its principal product. The class of activity is equivalent to the 6-digit level CMAP (Mexican System of Classification for Productive Activities) classification.

In the EIA plants can be tracked through time thanks to a specific plant identifier.

A.1 Data Cleaning and Deflation

The original data have been deflated using appropriate deflators provided by Banco de Mexico. The values of domestic sales was deflated using the domestic price producer index and the value of exports sales was deflated using the export price index. We also deflated separately the intermediate inputs using for the domestic inputs the price index published by Banco de Mexico[25] while for the imported inputs we used the index of exported intermediate inputs and raw materials published by the Bureau of Labor Statistics[26]. We also separately deflated the wage bill using the domestic consumer price index. Finally we deflated the value of investment in fixed assets by using four different deflators for each one of the different types of assets kindly provided by Banco de Mexico (i.e. machineries, office equipment, transport equipment, buildings and land).

In order to clean the data and correct for eventual inputing mistakes and outliers we trimmed the data and eliminated the largest and smallest 1% of the observations.

Also, because the EIA only provides information on capital stock at book value, we use the information from the Industrial Census of 1993 to obtain the exact value of capital stock at its replacement value as the initial capital stock.

We complement the data obtained from the industrial survey with information on Mexican tariffs obtained by Secretaría de Economía[27] and on US tariffs obtained by Romalis[28].

[25] www.banxico.gov.mx
[26] www.bls.gov
[27] www.economia.gob.mx
[28] http://faculty.chicagogsb.edu/john.romalis/research/TariffL.ZIP

Table 2: Variables description

Variable Name	**Description**
Domestic Frontier Growth	Growth of the average labour productivity of top five firms in the sector
Distance from Frontier	Ratio of domestic frontier to plant specific labour productivity
Employment	Total number of workers (white collars and blue collars)
Average Wages	Total wage bill divided by number of emplooyees
R&D	Expenses in in-house research and development
Technology transfers	Expenses to acquire technology (patents, engineering services, consultancy, etc.)
TFP Index	Index of total factor productivity
MX NAFTA Tariff	Mexican tariffs applied to US and Canadian products agreed under NAFTA

B Appendix: Regressions

B.1 Main Results

Table 3: Asymmetric effect of liberalisation

	(1)	**(2)**
	OLS	FE
Domestic Frontier Growth	0.260***	0.392***
	(0.015)	(0.014)
MX Tariffs NAFTA (lagged)	-0.012***	-0.015***
	(0.002)	(0.002)
Distance from Frontier (lagged)	0.173***	0.499***
	(0.008)	(0.011)
Distance x Tariffs (lagged)	0.002***	0.006***
	(0.001)	(0.001)
Employment (lagged)	0.045***	0.086***
	(0.003)	(0.013)
Capital Intensity (lagged)	0.021***	0.004
	(0.002)	(0.003)
Average Wages (lagged)	0.083***	-0.026
	(0.009)	(0.016)
R&D (lagged)	0.004***	0.006***
	(0.001)	(0.002)
Technology Transfers (lagged)	0.006***	0.004***
	(0.001)	(0.002)
Industry FE	Yes	No
Location FE	Yes	No
Year FE	Yes	Yes
Plant FE	No	Yes
N	44178	44178
r2	0.075	0.217

Notes:
The dependent variable is the growth of labour productivity.
Robust SE are showed in parenthesis.
*** denotes significant at 1%, ** at 5%, * at 10%.

Table 4: Impact of liberalisation on competition

	(1) OLS	**(2)** FE	**(3)** OLS-lagged	**(4)** FE-lagged
Market Share	0.146***	0.533***	0.156***	0.164***
	(0.027)	(0.048)	(0.032)	(0.058)
Squared Market Share	-0.190***	-0.572***	-0.217***	-0.225***
	(0.040)	(0.062)	(0.048)	(0.070)
TFP	0.269***	0.253***	0.183***	0.078***
	(0.003)	(0.004)	(0.006)	(0.005)
Δ MX Nafta Tariffs	0.006***	0.005***	0.005***	0.004***
	(0.001)	(0.000)	(0.001)	(0.001)
Market Share X Δ Tariffs	-0.010**	-0.009***	-0.023***	-0.017***
	(0.004)	(0.003)	(0.004)	(0.004)
Technological Transfers	0.003***	0.001***	0.003***	0.000
	(0.000)	(0.000)	(0.000)	(0.001)
R&D	0.001	-0.001	0.001*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Capital Intensity	0.085***	0.082***	0.060***	0.028***
	(0.001)	(0.001)	(0.002)	(0.002)
Average Wages	-0.076***	-0.115***	-0.047***	-0.048***
	(0.002)	(0.004)	(0.003)	(0.005)
Industry FE	Yes	No	Yes	No
Location FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
Plant FE	No	Yes	No	Yes
N	38678	38678	32800	32800
r2	0.558	0.398	0.434	0.100

Notes:
The dependent variable is the markup at plant level.
In columns (3) and (4) all variables are lagged.
Robust SE are showed in parenthesis.
*** denotes significant at 1%, ** at 5%, * at 10%.

B.2 Robustness Checks

Table 5: Robustness checks of asymmetric effect of liberalisation: controlling for exiting plants

	(3)	**(4)**	**(5)**	**(6)**
	OLS	FE	OLS	FE
	Unbalanced Panel		**Balanced Panel**	
Domestic Frontier Growth	0.263***	0.394***	0.276***	0.391***
	(0.015)	(0.014)	(0.014)	(0.013)
MX Tariffs NAFTA (lagged)	-0.012***	-0.015***	-0.015***	-0.014***
	(0.002)	(0.002)	(0.002)	(0.002)
Distance from Frontier (lagged)	0.180***	0.510***	0.197***	0.513***
	(0.008)	(0.011)	(0.008)	(0.011)
Distance x Tariffs (lagged)	0.002***	0.005***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Employment (lagged)	0.040***	0.063***	0.030***	0.020
	(0.003)	(0.012)	(0.003)	(0.012)
Capital Intensity (lagged)	0.019***	0.002	0.014***	0.002
	(0.002)	(0.003)	(0.002)	(0.003)
Average Wages (lagged)	0.087***	-0.034**	0.085***	-0.074***
	(0.009)	(0.016)	(0.008)	(0.015)
R&D (lagged)	0.004***	0.006***	0.004***	0.004***
	(0.001)	(0.002)	(0.001)	(0.002)
Technology Transfers (lagged)	0.006***	0.004***	0.007***	0.004***
	(0.001)	(0.002)	(0.001)	(0.002)
Dexitcorrect	-0.648***	-0.652***		
	(0.039)	(0.038)		
Industry FE	Yes	No	Yes	No
Location FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
Plant FE	No	Yes	No	Yes
N	44178	44178	38234	38234
r2	0.098	0.237	0.112	0.244

Notes:

The dependent variable is the growth of labour productivity.

Robust SE are showed in parenthesis.

In column (4) and (5) we exclude plants that will exit at some point (balanced panel).

*** denotes significant at 1%, ** at 5%, * at 10%.

Table 6: Robustness checks of impact of liberalisation on competition: controlling for exiting plants

	(5)	**(6)**	**(7)**	**(8)**
	OLS	FE	OLS-lagged	FE-lagged
Market Share	0.145***	0.527***	0.150***	0.150***
	(0.027)	(0.048)	(0.032)	(0.058)
Squared Market Share	-0.188***	-0.567***	-0.208***	-0.207***
	(0.040)	(0.062)	(0.048)	(0.070)
TFP	0.269***	0.252***	0.183***	0.078***
	(0.003)	(0.004)	(0.006)	(0.005)
Δ MX Nafta Tariffs	0.006***	0.005***	0.005***	0.004***
	(0.001)	(0.000)	(0.001)	(0.001)
Market Share X Δ Tariffs	-0.010**	-0.009***	-0.023***	-0.017***
	(0.004)	(0.003)	(0.004)	(0.004)
Technological Transfers	0.003***	0.001**	0.003***	0.000
	(0.000)	(0.000)	(0.000)	(0.001)
R&D	0.001	-0.001	0.001*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Capital Intensity	0.085***	0.082***	0.060***	0.027***
	(0.001)	(0.001)	(0.002)	(0.002)
Average Wages	-0.077***	-0.116***	-0.046***	-0.048***
	(0.002)	(0.004)	(0.003)	(0.005)
Dexitcorrect	-0.023**	-0.020***	-0.052***	-0.049***
	(0.009)	(0.007)	(0.012)	(0.010)
Industry FE	Yes	No	Yes	No
Location FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
Plant FE	No	Yes	No	Yes
N	38678	38678	32800	32800
r2	0.559	0.399	0.435	0.101

Notes:
The dependent variable is the markup at plant level.
In columns (7) and (8) all variables are lagged.
Robust SE are showed in parenthesis.
*** denotes significant at 1%, ** at 5%, * at 10%.

Table 7: Robustness checks of impact of liberalisation on competition: excluding exiting plants (balanced panel)

	(5A)	**(6A)**	**(7A)**	**(8A)**
	OLS	FE	OLS-lagged	FE-lagged
Market Share	0.081***	0.456***	0.100***	0.136**
	(0.027)	(0.047)	(0.034)	(0.059)
Squared Market Share	-0.101**	-0.503***	-0.137***	-0.203***
	(0.043)	(0.066)	(0.053)	(0.078)
TFP	0.273***	0.253***	0.184***	0.084***
	(0.003)	(0.004)	(0.007)	(0.006)
Δ MX Nafta Tariffs	0.006***	0.006***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Market Share X Δ Tariffs	-0.008*	-0.011***	-0.020***	-0.020***
	(0.005)	(0.004)	(0.005)	(0.005)
Technological Transfers	0.003***	0.001**	0.003***	0.001
	(0.000)	(0.000)	(0.000)	(0.001)
R&D	0.000	-0.001	0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Capital Intensity	0.088***	0.083***	0.061***	0.029***
	(0.001)	(0.001)	(0.002)	(0.002)
Average Wages	-0.077***	-0.116***	-0.045***	-0.049***
	(0.002)	(0.004)	(0.003)	(0.005)
Industry FE	Yes	No	Yes	No
Location FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
Plant FE	No	Yes	No	Yes
N	33963	33963	29448	29448
r2	0.578	0.396	0.463	0.109

Notes:
The dependent variable is the markup at plant level.
Robust SE are showed in parenthesis.
In columns (5A)-(8A) we exclude any plant that will exit at some point (balanced panel).
In columns (7A) and (8A) all variables are lagged.
*** denotes significant at 1%, ** at 5%, * at 10%.