Trade as an engine of creative destruction: Mexican experience with Chinese competition

Leonardo Iacovone, Ferdinand Rauch, L. Alan Winters

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a

---

Keywords: Competition, Trade, Firm-heterogeneity, Product-level, Mexico, China

---

1. Introduction

Between 1990 and 2007 Chinese exports grew from 62 billion US dollars to 1.2 trillion USD, at the staggering average rate of about 20% per year. China became the world’s largest exporter in 2009, and the second largest economy of the world in 2010. The emergence of China and its impact on producers worldwide has been a focus of attention for both policy-makers and researchers, and, at least among the former, has generally led to expressions of deep concern and calls for protection.2

While no set of countries is entirely insulated from competition from China, one might expect the effects to be most immediate on those middle-income countries whose established positions in manufactured markets have come under threat. This is the focus of this paper, in which we examine the impact of Chinese competition on Mexican manufacturing firms.3 We do not claim that the results we derive pertain to all middle-income countries, but we believe that they have a
Methodologically, the paper aims to close two gaps in the literature. First, we provide a careful investigation of the causal impact of competition on the intensive and extensive margins of Mexican firms, using detailed plant-level and product–plant-level data over time. Moreover, we recognize that competition may be felt as strongly in export markets as at home, and hence evaluate these causal links not only for Mexican firms serving their home market but also for those serving its main export market — the USA. On both markets we find strongly heterogeneous effects of the competitive shock on the extensive (exit and survival) and intensive (sales) margins, which provide evidence of resource reallocation between firms and of product reallocation within plants as competition obliges them to focus on their core competencies. Second, we show that, similar to the effect of competition, the effect of the increasing availability of cheaper Chinese intermediate inputs is highly asymmetric; however, taking this into account does not alter our main results on the effect of competition.

We reach these results by treating the emergence of China onto world markets as a quasi-natural experiment of a strong and sudden surge in the competition facing Mexican manufacturing producers. As depicted in Figure 1, Chinese exports to Mexico and the United States increased substantially in terms of both value and share during the period considered. China’s share of Mexican imports grew from around 0.5% in 1994 to 8% in 2004 — a factor of 16. This growth was primarily driven by the intensive margin, see Amiti and Freund (2010). In comparison, the import shares from Africa and Oceania to Mexico changed by a factor of 1.04, from other Asian countries by a factor of 1.35 and from South America by a factor of 1.46, while those of North America and Europe fell by factors of 0.96 and 0.84. In value terms, all these continental groups increased their exports to Mexico. This does not suggest that China has crowded out other developing countries’ imports, but rather that China appears to be the larger part of a broad tendency raising the importance of developing countries in Mexican imports. This sizable growth was matched by a relatively moderate increase in trade flows in the opposite direction: the share of Chinese imports from Mexico increased from 1.9 to 2.8% from 1994 to 2004. Hence we interpret the situation at hand as essentially a unilateral trade shock and not a mutual trade expansion.

The situation is similar in the USA — the third-country market where Mexico has confronted Chinese competition so strongly. China’s share of total imports more than doubled from 6.5% in 1996 to 13.4% in 2004 (USITC Trade Online), while the corresponding expansion factors for Mexico were 1.15 for developing Asia 1.46, other Latin America 1.09, for Europe 1.05 and for developed Asia 0.64. In both cases we would argue that the broad thrust of Chinese export growth was largely anticipated and exogenous to the countries we study. While those countries’ import policies had to be permissive to imports (and in a few specific cases were less than perfectly so), the increases in Chinese output and exports were generated by China’s internal policy changes which induced huge growth in productivity and investment, massive inflows of FDI and large increases in the labor force available to manufacturers.

Turning to the effect on export markets, Mexico is one of the countries that is likely to be most strongly affected by Chinese competition, given that within NAFTA Mexico has had a comparative advantage in the production of labor intensive goods and that China’s exports to the USA have increased so strongly (see di Giovanni et al. (2011) estimate that Mexico is the seventh most technologically

relevant country to China. Given that over 85% of Mexican exports go to the United States, Chinese expansion in the US market will have been a major shock to Mexican exporters; and given, in turn, that Mexico’s export to GDP ratio varied from 14% (1994) to 25% (2004) such competition is clearly likely to be a major issue for the Mexican economy as a whole.

The objective of this study is to provide an example of how trade can work as a force of creative destruction that leads to competition enhancing readjustments within and between firms. For this reason we focus on both reallocation between firms and within firms at the product level. We analyze how the rise of China affected production patterns in Mexico, and show that larger plants and core products are relatively shielded from the adverse effects that this competition generates. We interpret the size effect as a productivity effect, since size and productivity are strongly correlated, but we do not have the data required to make this link formally. Additionally, we show that it is important to take into account the role of intermediate inputs as additional channel through which the expansion of Chinese exports could influence Mexican firms, and that this channel reinforced the asymmetric effect of the Chinese competition shock.

The rest of the article is organized as follows. Section 2 discusses the empirical and theoretical context of our study. Section 3 describes the data and our empirical strategy. Section 4 describes the principal results, while Section 5 provides some additional robustness checks and extensions. Finally, Section 6 concludes.

2. Related literature

Our work is related to several areas of research. First, there exist a large number of studies that rely on sectoral trade flow data to assess the competitive threat from Chinese exports to Latin American producers (Freund and Ozden, 2006; Hanson and Robertson, 2007; Lederman et al., 2008; Sola et al., 2007; Devlin et al., 2006; Lall et al., 2005). Other studies have evaluated the impact of Chinese exports on wages and employment for various parts of Latin America, see Levinsohn (1999) and Pavcnik (2002) for Chile, Pavcnik and Goldberg (2005) and Esclava et al. (2009) for Colombia, and Pavcnik et al. (2004) for Brazil. A sectoral study of the effects of Chinese exports to the US on Mexican exports to the US finds some evidence for crowding out on this third market (see Irandouz and Ma, 2006). In a large study Jenkins et al. (2008) emphasize that the emergence of China brings about winners and losers in Latin America, and that its effect tends to be asymmetrical. However, while sectoral analyses are interesting, adjustment is ultimately undertaken by firms which find their market positions eroded or enhanced, and it is at the level of firms that we see most of the response in terms of innovation, the introduction of new products, changes in the product mix, new investment, etc. A shock that could have different impacts on different plants, or bring about a reallocation within plants cannot be adequately described at sectoral level. These are important elements in the discussion of the full impact of China’s emergence on incomes and growth and require the use of firm-level data.

Firm-level studies have proliferated in recent years and we refer here only to a small selection of them to place our own work in context. Several studies highlight that foreign competition not only hurts producers but also pushes them to improve their efficiency and organization. For example, Chen et al. (2009) find that openness to trade squeezes margins and pricing among European firms but typically raises productivity as well. Autor et al. (2012) postulate the same sort of forces, but trace the effects of competition from imports from China directly into local labor markets in the USA. The degree of import competition that a local market is exposed to is mainly related to the share of Chinese imports from Mexico increased from 1.9 to 2.8% from 1994 to 2004 — a factor of 16.

For an excellent review of the importance of using firm-level data in analyzing responses to trade shocks see Bernard et al. (2007). For a survey, see, inter alia, Bernard et al. (2011b).
to the share of imports in total US sales of the types of manufactured goods that it produces, and Autor et al. (2012) find that labor market stress is directly related to this measure. Mion and Zhu (forthcoming) find that Chinese competition induces skill upgrading in Belgium, while finding no effect on firm exit. Bernard et al. (2007) document the link between tariff liberalization and plant productivity in Colombia, and Fernandes and Paunov (2011) in Chile. A common finding, in line with Aghion et al. (2005), is that responses to competition vary across firms, with stronger (variously, more productive, larger, exporting) firms more likely to survive and to respond positively to the competition shock. One example is Alvarez and Vergara (2010), who state that competition-enhancing reforms in Chile induce plant closures more strongly among smaller and less productive firms, although the way they model this heterogeneity relies on untested assumptions about functional forms and their result for tariff reforms is weak. Verhoogen (2008) studies the responses of Mexican plants to the peso devaluation in 1994. The devaluation led more-productive plants to increase exports, upgrade quality, and raise wages relative to less-productive plants within the same industry, but in doing so to increase the within-industry wage dispersion.

In a paper more closely related to ours, Bloom et al. (2011) find that in twelve European countries imports from China in a firms’ sectors of production (expressed relative to total sectoral imports) increased the innovative activity of surviving firms in Europe, while decreasing the chances of survival and employment. In heavily exposed sectors, low-tech firms suffered declines in jobs and survival while high-tech ones were relatively protected. The positive association between competition and technology upgrading was made by Bustos (2011) for Argentina. Bernard et al. (2004) show that Chinese competition in the US boosts high wage and high skill companies, and causes the decline of low wage and low skill industries. Bernard et al. (2006) investigate how US firms react to exposure to international trade and show that plant survival and growth are negatively correlated with competition, while skill intensity and industry switching are positively correlated with it.9

In the developing world, Fernandes and Paunov (2009), find that imports from China and India boost Chilean firms’ quality, but the only marked heterogeneity that they find is that this effect is stronger for firms in non-traded sectors. More recently Iacovone et al. (2011) provide evidence that competition from China raised the innovative activity of Mexican plants. They show that activities such as the use of ISO2000 certificates, just in Time activities, or worker participation programs are more likely given higher competitive pressure from China.

The impact of trade on product-level and within-firm reallocations has featured less prominently in the literature to date. Bernard et al. (2010) find that the impact of product switching on US manufacturing growth is as large as that of firm exit and entry to the market. In an interesting study, Liu (2010) shows that increases in import competition make US firms more likely to drop their less important products (those with smaller shares of total sales) and less likely to drop their core product (with the largest share of sales). He finds that core products increase their shares of sales while less important ones face declines. Turning to trade liberalization, Bernard et al. (2011a) and Baldwin and Gu (2009), find evidence that competition reduces the diversification of Canadian producers, while Eckel et al. (2010) show that Mexican producers tended to react to NAFTA trade liberalization by focusing on their core competencies. Relatedly, Goldberg et al. (2010a) analyze multi-product firm dynamics in India without finding any evidence of a link between product rationalization and output tariff declines following trade liberalization.

Fig. 1. Impact of Chinese exports on the US and Mexican market. Note: The left scales of both figures show the import values in billion US dollars, the right scales the share of Chinese imports in total imports of the stated market. The data source for both graphs is Comtrade.

9 Additional views of the issues we discuss are available in, for example, Yusuf et al. (2007) and Arroba et al. (2009), who offer a non-model-based discussion of adjustment to import competition from China, and Teshima (2010) who relates general import competition to innovation among Mexican plants.
In terms of theory, numerous theoretical articles on emerging trade models and multi-product firms are closely related to our analysis, and provide us with various hypotheses that closely inform our empirical analysis. Bernard et al. (2011b) develop a model of multi-product firms that predicts the demise of the smaller firms and products resulting from trade liberalization. This conjecture is consistent with our results. Their model however does not predict the asymmetric sales shifts across and within plants that we describe, since it relies on a CES demand and thus constant markups. The model by Eckel and Neary (2010), which suggests that within-firm adjustments resulting from trade reforms might generate substantial gains due to higher efficiency, also plays a role in generating our predictions. Further related models include the neo-Schumpeterian growth models pioneered by Aghion et al. (2005).

Mayer et al. (2011) is closely related to our study as it extends Melitz and Ottaviano (2008) by introducing a multi-product dimension. This model predicts that a bilateral trade liberalization leads to an increase in competitive pressure, which in turn leads firms to drop their marginal products (the ones that also have a lower share in production), and reallocate their resources towards increasing the production of the remaining goods. The inter-firm reallocations generate an additional channel for aggregate productivity growth. For export markets they predict that more competition will lead to the dropping of less substantial products and firms. This model does not, however, lead to these predictions when a unilateral trade shock is analyzed (for example a unilateral productivity shock, or decrease of trade costs). Additional short-run assumptions are required to reach hypotheses that are consistent with our findings.

### 3. Data and empirical strategy

The main source of data is the Monthly Industrial Survey (EIM) data on Mexican plants provided by the Mexican Institute of Statistics (INEGI). This dataset covers about 85% of all Mexican industrial output. This unique survey contains detailed information on sales and imports. It is collected through a voluntary survey of plants and imports from the Mexican government as well as information on employment broken down by skills.10 The data tracks plants and products throughout the sample period including their introduction and exit from the market. The information on the entry of new plants, however, is not complete, as new plants are not systematically included. Further, we use trade data from Comtrade at the 6-digit level of the World Customs Harmonized System (HS-1996).11 For bilateral trade transactions we rely on reported imports since it is generally believed that importer-reported data tend to be more accurate.

10 This survey does not include data on maquiladoras as these are separately collected by another unit within INEGI and maintained in a different location, hence making the access to both datasets at the same time difficult. In addition, there are confidentiality restrictions to the joint use of these datasets.

11 These datasets have been used and described in previous studies, see for example Iacovone and Jawor (2008).

The main source of data is the Monthly Industrial Survey (EIM) data on Mexican plants provided by the Mexican Institute of Statistics (INEGI). This dataset covers about 85% of all Mexican industrial output. This unique survey contains detailed information on sales and imports. It is collected through a voluntary survey of plants and imports from the Mexican government as well as information on employment broken down by skills. The data tracks plants and products throughout the sample period including their introduction and exit from the market. The information on the entry of new plants, however, is not complete, as new plants are not systematically included. Further, we use trade data from Comtrade at the 6-digit level of the World Customs Harmonized System (HS-1996). For bilateral trade transactions we rely on reported imports since it is generally believed that importer-reported data tend to be more accurate.

After merging the trade and plant–product level datasets we are left with information on 2744 products and a number of plants varying between 6219 and 4439 because of attrition during our sample period (from 1994 to 2004). The main variables of this dataset are described in Table 1. The specific measure of exposure to foreign competition, calculated at individual product-level and applied to each plant producing that product, is the share of Chinese in total imports in the market concerned, while at the plant level we compute the weighted average of this measure for the products of each plant, where the weights are equal to the sales shares of products. At a product level, the average share of Chinese competition in Mexico in our data is only around 2%, since the full sample includes the years 1994–1998, during which Chinese competition was less intense, and gives more weight to these years because of attrition in the sample. Plants face similar level of competition. The average share of exports in sales is 10.5%, the share of white collar workers averages 31%. On average a plant produces three different products, the maximum number on this statistic we observe is 33. The Herfindahl index, which we compute as the sum of the squares of domestic firms’ market shares on product level, gives a value of 0.08 on average.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Descriptive statistics. This table presents main variables used in the regressions. Among subscripts, M denotes the Mexican market and U the US market, i the plant, k the product, so that ik denotes plant–product level observations, and t time. Ch – compU, and Ch – compM, denote the shares of China in Mexican and US imports of product k; these vary only by product but we use the notation ik here to denote that they are averaged here over plant–product observations. Shareik is the share of product k in i’s sales. For plants, denoted by subscript i alone, product-level data are weighted averages over the products produced by the plant, while Skillshareik is ratio of white collar workers and N-Prodik is the number of products the plant produces. Herfindahlk is constructed as a weighted average of product level Herfindahl indices.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product data variables</strong></td>
<td>Mean</td>
</tr>
<tr>
<td>Ch – compU</td>
<td>0.02</td>
</tr>
<tr>
<td>Ch – compM</td>
<td>0.08</td>
</tr>
<tr>
<td>Shareik</td>
<td>0.32</td>
</tr>
<tr>
<td>LnSalesi</td>
<td>8.49</td>
</tr>
<tr>
<td>LnExportSalesi</td>
<td>8.14</td>
</tr>
</tbody>
</table>

12 INEGI manufacturing survey relies on the Mexican Industrial Classification CMAP-1994 (Clasificacion Mexicana de Actividades y Productos) at product level (i.e. 8-digit), while the trade data is based on the HS-1996 classification provided by the World Customs Harmonization System (HS-1996). For bilateral trade transactions we rely on reported imports since it is generally believed that importer-reported data tend to be more accurate.
of $X_{ik}$. $D_t$ denotes a year fixed effect and $F_{ik}$ is a plant or plant-product fixed effect.\footnote{Our measure of Chinese competition $Z_{ik}t=1$ is the share of Chinese imports in total imports to either the US or Mexico, constructed from Comtrade data. Several other studies have used the import penetration rate from China or broader classes of low-wage countries, for example Broda and Romalis (2009), Bernard et al. (2006) or Bloom et al. (2011).} The control variables that we use for the firm-level regressions are plant size measured by log sales, the Herfindahl index of product market competition, which we compute as the sum of squared market shares of all CMAP – 8 digit products (at plant level this is again a weighted average), the export share and the ratio of white collar workers (skill share). In the product-level regressions we also control for the scope of the firm, proxied by the number of manufactured products, the export share of the product and the share of sales that the product has within the firm (which is a proxy of the extent to which the product can be considered a “core product”). Additionally in some equations we control for log total imports of the product to Mexico or the US respectively. The two outcomes of interest in this study, both at plant–product and plant level, are sales and exit. Exit is defined as:

$$y_{ik} = \begin{cases} 1 & \text{in the last year that the plant or plant–product is observed in the sample} \\ 0 & \text{in all other years}. \end{cases}$$

For the firm-level regressions, a change of ownership would not count as exit in the dataset we use. In fact the data are collected and designed in such a way that the only reason for a product to disappear from the data is that it is no longer produced by the plant. Similarly, a plant that disappears from the dataset can only have closed down. Additionally, we drop the last year of the sample (2004) in the exit regressions, since for this year we can’t distinguish plants (products) that exit from those that do not. We focus on these two outcomes, since hypotheses in recent theoretical papers have focused on sales and exit probability in their hypotheses, see the discussion in Section 2.

The model we estimate for the product level regressions is similar to the one we estimate for the plant-level analysis. The only difference is that we rewrite the equation in terms of plant–product $ik$, which involves product specific outcomes, control variables on product and plant level, and plant–product level fixed effects. In all our regressions we cluster standard errors on the level at which we observe the competition from China.\footnote{At the product level the competition varies at 8 digit CMAP codes, which is the cluster we apply. At the plant level competition varies at plant level only, since competition for each plant is a weighted mean of the competition faced by each one of its products and thus plant specific. Such clustering treatment is consistent with Moulton (1990).}

Although we believe that the huge growth of Chinese exports is largely exogenous to our outcomes of interest, there is clearly a possibility that its details are influenced by Mexican plant and product behavior or by third variables that influence both Chinese exports and Mexican firms. Hence to try to avoid any resulting biases in our estimates of $\beta_2$ and $\beta_3$, we instrument the Chinese share of Mexican imports, and in the export equations, the Chinese share of US imports. Our instruments are the Chinese share of EU imports and, separately, the Chinese share of the imports into all countries in the world except the US, the EU and Mexico. These should reflect various product-specific developments in China that are shared by our main variables of interest. This strategy is similar to that adopted by Autor et al. (2012). In the regressions that use the interaction we create the interactions of these export instruments with $X_{ik}$, which provides us with additional instruments for the regressions that involve interaction terms.

China’s export strategy has mainly been to enter the market with products similar to existing ones but at lower prices (see for example Broda and Romalis, 2009). Thus, as is widely believed, at the heart of the rise of China as a global exporter lie the domestic policies of China that increase its output and reduce its costs — for example, high investment rates, infrastructure development, the mobility of labor from rural to manufacturing areas, the successful attraction of FDI and the establishment of joint ventures with Western firms (see Keefer, 2007 or Huang, 2003). All these are largely independent of strategic decisions of Mexican plants. Ideally an instrument would measure production or productivity within China directly, but absent detailed Chinese production data, we have to rely on Chinese exports to the instrumental destinations as a correlated measure.

A potential concern about the exogeneity of the instruments is that product–year specific global technological trends might affect both Chinese exports and Mexican firms and thus invalidate our instruments. While one can never be sure, two arguments suggest to us that this may not be an overwhelming difficulty. First, given that China is still catching up in manufacturing technology rather than driven by technological shocks at the frontier, its productivity is mainly determined by its incentives to imitate, which will tend to be somewhat idiosyncratic, rather than developments at the frontier, which could have common elements. Second, in robustness tests (see Table 11 below), we re-run our main specifications including two-digit industry–year fixed effects which should pick up sector-specific global supply and demand shocks. As discussed below, apart from being less precisely estimated, the results are little changed by the inclusion of these additional fixed effects.

Another typical concern in related studies is the comparability of treatment and control groups, i.e. if plants and products affected by competition from China differ initially from those that are not. As depicted in Fig. 1, Chinese trade to Mexico increased considerably after 1998, while the Chinese shock before that period was less dramatic. To test the similarity of firms affected by future Chinese competition to those that were not, we create an indicator of Chinese competition that firms face during the years 1998–2004, and regress log sales at firm level for the years 1994–1998 on that variable. In this sample we do not find statistically significant differences in initial sales between firms facing later competition and firms that do not (with a p-value of 0.114 using industry fixed effects on the domestic market, and a p-value of 0.132 on the export market).\footnote{A similar exercise for exit cannot be undertaken in the same way, given that competition is plant-year specific, and we do not observe future competition for plants that exit.}

A final concern is that when we estimate the equation with sales as outcome, we use a lag-dependent variable and an interacted lag-dependent variable alongside fixed effects. As shown by Nickell (1981), the fixed effect estimator of the coefficient on the lagged variable is likely to be downward biased, while the bias for the interaction of the lagged dependent variable with an exogenous one is, to our knowledge, unknown. The former bias is asymptotically decreasing in the number of time periods and to try to gauge its size in a sample of ten years (as we have), as well as to explore the latter bias, we have conducted an illustrative simulation in Appendix 1. In this the estimated coefficients on the lag-dependent variable, its interaction and the exogenous variable used in the interaction are all biased towards zero, with the strongest effect being felt on the first. If this were to be replicated in our actual estimates it would lead us to under-estimate the true magnitude of the impacts of the included variables on sales and hence make us less likely to reject the null hypothesis of ‘no effect’. Without much more research one cannot be sure that this result applies to our actual estimates, but the simulation offers at least a little comfort. One consequence of the under-estimation of the lag-dependent effect would be that we...
would over-estimate the long-run effects of our independent variables, but since our interest is more in testing for the presence of such effects than their precise long-run value, this is not a fundamental problem.

4. Results

4.1. Product level

We start by considering a simple transition matrix. Table 2 focuses on plants in 1994 and tracks their development over time. Block 1 refers to firms facing below median competition from China and block 2 to those facing median and above competition, where competition is measured by the change in China’s share of Mexican imports between 1994 and 2004. The blocks report the probabilities of firms starting with n products in 1994 (along the rows) finishing with m products in 2004 (the probabilities sum to unity along the rows). Although such unconditional transition probabilities inevitably reflect many forces, several features of the table suggest the sort of outcomes we have postulated. For example, comparing the high competition sample with the low competition one, there is higher exit overall (column 1), the probability of one-product firms evolving into two or more product firms is lower (row 1), the probability of five-plus product firms cutting back below five products or of exiting altogether is higher (row 5), and the probability of a change in product numbers is greater, with slightly larger chances of moving below the diagonal (cutting back) than moving above it (expanding).

Following Bernard et al. (2010) we can decompose a product’s output according to the type of firms producing it. In the first panel of Table 3 we decompose output at the product level over the period 1999–2004, classifying products by their history: column (1) reports the share of output produced by “incumbents of five years’ standing” (i.e. output of products by firms that have existed and produced the product for at least five years); column (2) is the share of “new products” (where the firm has existed for five or more years, but the product was introduced during the past five years) and column (3) the share of “new” firms (output by firms that entered during the past five years). In the second panel we again decompose output by year but this time looking forward, distinguishing the output of products that continued to be produced by the same firm for at least five years, of products that were dropped by their firms over the following five years (but where the firm continued to exist), and of products produced by firms that ceased to exist over the following five years. The table shows considerably higher shares for incumbent and continuing firm/product combinations than was found for the USA. This suggests that Mexico may be a less dynamic economy than the USA, but drawing such a conclusion requires great caution. The INEGI data is precise on the entry and exit of products, and on the exit of plants but is less precise on the entry of plants because INEGI does not always manage to readily identify entry of smaller plants. In addition, the INEGI sample includes only partial coverage of small firms and so may miss the more dynamic ones.17 More relevant for our study, in Table 4 we recompute the entries and exits recorded in Table 3 for CMAP4 sectors, and regress these margins on competition from China. We find that in industries with higher competition products are more likely to enter and exit the market, and less likely to continue. This suggests a higher dynamic in markets where Chinese competition is stronger.

In Table 5 we provide evidence on sales growth and exit of products from long-run regressions. In the first column of this table we consider only plant–products that were produced in both 1994 and 2004, the first and last year of our sample. For these products we compute the change in Chinese competition in Mexico, Δch – compMk, and find that products that faced greater competition from China grew by less. In the second column we additionally interact this competition with the initial share of the product in its plants sales. The interaction coefficient is positive, which suggests that the competitive effect was less strong for larger products. In columns (3) and (4) we repeat the exercise looking at the exit of products from the market. In this sample we consider all plant–products that existed in 1994. We find that Chinese competition correlates with exit, and we find again some evidence that more important products (those with larger shares of total output) were less subject to this effect. In columns (5) to (8) we repeat this exercise for products that are sold on the export markets using competition in the USA, ΔCh – compUK, as the driver variable. The results are substantially the same.

To exploit the information of the full panel, and to evaluate the shorter run dynamics of the Chinese shock, we now run similar regressions using annual data, exploring all combinations in plant/product, exit/sales and domestic/export market space. Table 6 shows one example – the overall exit of products from the Mexican domestic market as a consequence of Chinese competition – and the online appendix provides the tables for the remaining combinations (Tables A2–AB). In this exercise we restrict the sample to multi-

---

17 Unfortunately, the degree of under-representation varies by year and since we do not have enough information to quantify it we cannot apply sample weights in our results.
product plants, those plants that produce more than one product. In all the product regressions we use plant–product fixed effects, such that product \( p \) produced by plant \( i \) differs from product \( p \) produced by plant \( j \), and also from product \( q \) produced in plant \( i \) and cluster robust standard errors by product categories at the level of CMAP-8-digit. In the first column of Table 6 we use our dummy for product exit on the left hand side, and our measure of Chinese competition in Mexico \( (Ch\text{– comp}_{\text{Mex}}) \) – the Chinese share of Mexico’s \( (M)\text{‘s} \) imports of product \( k \) in year \( t \) – on the right hand side. We find a positive significant coefficient of the competition variable, which suggests that products that face more competition from China are more likely to be dropped.

In order to exploit the possibility that this impact is asymmetric between products, the second column introduces an interaction with the share of product \( k \) within the plant \( i \)’s total sales \( (Share_{ikt}) \). We use sales shares instead of sales to get closer to predictions from the multi-product literature. We think of a product with a larger share of sales as a more profitable product \( (\text{Mayer et al., 2011}) \) or “core products” \( (\text{Eckel and Neary, 2010; Eckel et al., 2010}) \). We find that the impact of Chinese competition is highly asymmetric between products. The interaction between the proxy measuring the extent to which a product can be considered a core product, the share of the plant’s sales, and Chinese competition is negative. Products that represent a larger share of plant’s sales, are less likely to be dropped. In columns (3) and (4) we repeat the exercise, but use IV as the estimation method instead of OLS. The estimates retain the same size and statistical significance as with OLS, and increase in absolute size. Columns (Fs 3) and (Fs 4) show the first stages associated with columns (3) and (4). The variable \( Ch\text{– comp}_{\text{Mex}_{t-1}} \) is the Chinese export share to the rest of the world, while \( Ch\text{– comp}_{\text{Mex}_{t-1}} \) is the Chinese export share to the EU. The p-value of the Sargan test of the over-identifying restrictions and the F-statistic of the first stage are also displayed. The F-statistics suggests a strong explanatory power for the first stage, with strong positive correlations between the Chinese import shares in the EU and the rest of the world with those in Mexico. In the first stages for column (4), the interaction instruments have more explanatory power than the mean effects; the joint effect remains positive. Sometimes some of the instrumental variables are statistically insignificant, but they always show the expected sign.

In the online appendix we provide similar tables for product exit from the export markets, for product sales domestically and on the export markets, and we repeat the four exercises at the plant-level. We also reproduce all eight exercises including control variables such as the share of white collar workers, a Herfindahl index of product competition and the export share of plants. Our results consistently provide evidence of the asymmetric effect of Chinese competition on Mexican firms: smaller plants and products are more likely to exit, while larger plants and core products are largely shielded from the competitive shock. The outcome is summarized in Figs. 2 and 3. The x-axis shows sales centile or sales share centiles for plants and products respectively, while the y-axis gives the marginal effect of competition, derived from the corresponding IV regressions using the coefficient on Chinese competition and on the interaction term multiplied by the corresponding size. The shapes and significance of these curves reflect the results previously described: larger plants and products are less affected by Chinese competition in terms of sales and exit probability. Magnitudes can be readily obtained from these graphs; for example the exit graph in Fig. 3 suggests that an increase of one percent in imports of a specific product from China increases the probability of a Mexican producer of that product withdrawing it from the domestic market by 0.6 for a product at the 10th centile of plant sales, but has no effect on the exit probability for a product at the 90th centile of plant’s sales. The interaction terms are large enough to reverse the sign of the competitive effect at the top end of the distributions; however, the positive effects significantly exceed zero only for the extensive margin of the top 10% of

---

18 We focus on multi-product plants since we interpret our results as within plant reallocation. The results remain substantially unchanged when we include all plants.

19 While the endogeneity which we feared above would suggest that the absolute size of the coefficients might decline, instrumenting potentially compensates for a variety correlations in the actual data as well as increasing the standard errors of the estimates, so we do not find these increases unduly surprising. Liu (2010), Lièvremont and Treffer (2010) and Autor et al. (2012) all find the same outcome. The last suggest that it might, in part, be because actual imports contain an element related to positive demand shocks which raise sales and reduce the chances of exit at the same time as raising imports from China, whereas the instruments do not.
products on the export market and the top 10% of products of the intensive margin on the domestic market.\textsuperscript{20}

In Table 7 we provide a less parametric approach to evaluate the existence of heterogeneous responses. Using just the plants that produced at least five products in 1994, we rank these products by their sales share. Then for the products with each rank in turn (i.e. for all those ranked first in their plants sales, and then for all those ranked second, etc.) we regress the probability that a product is dropped from production by 2004 against competition from China, measured as the change in the Chinese share of Mexican imports of that product. We find that this probability is significantly positive for the smaller products with initial ranks of 3, 4 and 5, while it is significantly negative for the core product (rank 1).\textsuperscript{21}

### 4.2. Quantile regressions

In the previous section we have shown that the impact of competition from Chinese exports operates as a force for creative destruction in the sense that it induces a reallocation of resources within plants and between plants within sectors, in a way similar to that predicted by models such as Melitz and Ottaviano (2008) and others. Our previous model is affected by two shortcomings. First, we imposed a linear restriction on the heterogeneous effect of size, and second, our results are subject to biases arising from the use of a lagged dependent variable in a fixed effect estimator. To explore the nature of these asymmetries further but without imposing a strong functional restriction or requiring a lagged dependent variable we perform quantile regressions and quantile IV regressions for domestic sales.\textsuperscript{22}

These results are presented in Table 8 and a similar table with OLS results is given in the online appendix, see Table A17. In this exercise we de-mean our variables at the plant level to mimic the inclusion of plant fixed effects.\textsuperscript{23} The outcome variable in the quantile regressions is plant-level sales. The tables show quite clearly a concave relationship between competition and sales, with the regression coefficients on Chinese competition becoming progressively less negative or more positive as we consider larger plants.

So far we have used size as our indicator of firm strength and found that it explains a good deal of heterogeneity in the response to Chinese competition. In the context of the quantile regressions we can consider a further dimension of difference — plants’ average skill levels. Table 9 adds the interaction between Chinese competition and the ratio of white collar workers to the previous one, and finds that responses to competition differ at the different decile points of size. Specifically, although among smaller firms, firms with higher skills show no difference from other firms, at the 30th percentile and above skilled firms weather the competitive pressure better than less skilled ones. At the top end of the range the effects are not quite significantly different from zero statistically but that probably arises because larger firms tend to have higher skills ratios so that at that point in the sample there is insufficient variance to identify the effects precisely. Fig. 4 plots firms’ responses to Chinese competition against both size and the skills ratio; it shows that the greatest resilience to competition occurs when both are high.

The coefficients show a monotonically increasing relationship between plant size and the response of sales to Chinese competition and for the 90th percentile of firms, this response is significantly larger than zero. That is, in this case we find direct evidence not only of sales destruction, but also of sales creation — i.e. genuinely creative destruction.\textsuperscript{24}

### 4.3. The role of intermediate inputs

Some of our results suggest a beneficial impact of Chinese competition for larger plants and core products. In addition to the responses to increased competition discussed above, Chinese exports might have an additional effect if they expand firms’ access to cheaper and a larger variety of imported intermediate inputs (see Amiti and Konings, 2007; Goldberg et al., 2010b). To account for this possibility we generate a measure of the Chinese shares in firms’ inputs using Mexican input–output tables and Chinese exports to Mexico.\textsuperscript{25}

---

\textsuperscript{20} In the case of the product regressions the cutoffs are as follows: The graph crosses the x axis at 75% for domestic sales, 70% for export sales, 65% for exit from export markets and 90% for exit from the domestic market. These positive effects are not statistically significantly different from zero, however. The cutoffs where the crossing becomes significant are 85 for domestic sales and 80 for exit from the export market, and they do not become significant for export sales and exit from the domestic market.

\textsuperscript{21} We verify that the results hold qualitatively also for other cutoffs on the number of products produced such as four or six.

\textsuperscript{22} For the implementation of the quantile IV regressions we use the strategy and codes developed by Chernozhukov and Hansen (2006).

\textsuperscript{23} Quantile regressions require balanced panels, hence we exclude plants that exited at any point in time during the period studied. This requirement also means that we cannot repeat the same exercise for plant exit.

\textsuperscript{24} The relationship between size and sales response is slightly concave, but the linear interaction postulated above seems to be a good approximation.

\textsuperscript{25} Mexican input–output tables are available from the INEGI webpage. Given their level of disaggregation the Chinese share of inputs can be computed only at a 32 sectors level.
the computation we weight the input–output coefficient of each sector listed as an input by its import share, and then by the Chinese share in imports for that sector. Summing these measures, we arrive at a measure that gives on average the weighted sum of inputs imported from China at a sectoral level, where the weights are given by the coefficients of the input–output table.

In Table 10 we introduce this measure of the Chinese weight in inputs and its interaction with the product share to the OLS specification above (only the coefficients of direct interest are reported). For product exit (column 1) we find that the inputs and interacted inputs have a similar effect to that found for competition, with positive coefficients on the non-interacted effects and negative coefficients in the product share interaction. This suggests that firms make better use of the availability of Chinese inputs for their core products, and that expanded access to cheaper Chinese inputs helps them to improve the competitiveness of their core products. The sales results are similar: output of core products expands more as a consequence of increased penetration of imported Chinese inputs, while marginal products less so or not at all. The coefficients on Chinese competition remain similar to our previous estimates in terms of signs, and in terms of statistical significance for sales; however, for product exit, they become statistically insignificant. This suggests that differences in ability to use imported Chinese intermediate inputs contribute crucially to the heterogeneity of the impact of Chinese competition. Columns (3) and (4) of Table 10 show similar results at plant level; again, the input coefficients follow the same pattern as the competition coefficients, which suggests that larger plants are better able to make use of Chinese inputs. We find similar effects in IV regressions, which we omit for reasons of space. Since the issue here is to disentangle the two possible effects of Chinese exports to Mexico

Fig. 2. Marginal effect of competition, plant level. The figure shows the marginal effects computed in the fourth column of the corresponding IV regressions similar to Table 6, as reported in the web appendix. From these columns we also compute 95% confidence intervals, which are shown in thin dashed lines.

Fig. 3. Marginal effect of competition, product level. The figure shows the marginal effects computed in the fourth column of the corresponding IV regressions similar to Table 6, as reported in the web appendix. From these columns we also compute 95% confidence intervals, which are shown in thin dashed lines.
(competitiveness and inputs) we do not reproduce this exercise for Mexican export markets.

5. Robustness and additional findings

To demonstrate the robustness and plausibility of our results, we perform various robustness tests. A first concern is that some plants and products did not face any competition from China during the period analyzed, which could generate noise in the results. To address this concern we rerun the results at plant level separately for the 20% of plants most affected by competition and the 20% least affected, measured by mean competition. When we rerun estimations similar to the second columns of Table 6 in the sample of plants that are most affected by competition, we find coefficients on Chinese competition and the interaction of size and Chinese competition that are statistically significantly different from zero, and similar to the

Please cite this article as: Lacovone, L., et al., Trade as an engine of creative destruction: Mexican experience with Chinese competition, Journal of International Economics (2012), http://dx.doi.org/10.1016/j.jinteco.2012.09.002
coefficients obtained in the full sample. In the sample of the bottom 20%, the competition coefficients are not significantly different from zero, which reflects the fact that in this sample there is little Chinese competition and so little information about competition effects.

A second robustness check is a response to concerns about potentially spurious results — specifically the possibility that sectors experiencing some other exogenous shock that affects plants asymmetrically, are also characterized by an increasing expansion of Chinese imports. To do so, we evaluate whether future competition from China has any impact on current plant sales — a sort of “placebo test”. We cannot reject the null hypothesis that the coefficients on competition from China and its interaction are equal to zero. This provides some assurance that the emergence of Chinese competition was not anticipated and our results are not driven by some other spurious third cause.

Third, Mexican policy makers were active in filing anti-dumping cases against Chinese competition early on, which we can see in the anti-dumping data from Bown (2009). A sixth of the products in our sample were subject to anti-dumping complaints in Mexico. Anti-dumping might create a different link between competition and our outcome variables to the one postulated above. To address this we repeat analysis for only those products where no anti-dumping cases were attempted. Our results remain similar in terms of size and significance in the subsample where no anti-dumping cases were filed. Hence anti-dumping alone cannot explain the patterns we observe above.

A fourth concern relates to specific developments in the technology of certain goods, which may affect all Chinese exports and Mexican firm behavior directly and thus invalidate the IV strategy. To confront this concern we include industry-year fixed effects in the main

---

**Table 10**

Chinese exports as inputs to Mexican production. This table exactly reproduces the main effects from the main tables, but adds the Chinese share in inputs and its interaction with the share of products or the size of plants. Robust standard errors are clustered on eight digit product level, stars denote significance at 1 (***) and 10% (*) level of significance.

<table>
<thead>
<tr>
<th>Product level</th>
<th>(1) Prod exitit</th>
<th>(2) Prod salesit</th>
<th>(3) Plant exitit</th>
<th>(4) Plant salesit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch — compMkt−1</td>
<td>0.103*</td>
<td>−1.510***</td>
<td>0.507</td>
<td>0.582</td>
</tr>
<tr>
<td>(0.0593)</td>
<td>(0.273)</td>
<td>(0.235)</td>
<td>(0.691)</td>
<td></td>
</tr>
<tr>
<td>Ch — compMkt−1 × Shareit−1</td>
<td>−0.0918</td>
<td>2.385***</td>
<td>−0.0467*</td>
<td>0.0390</td>
</tr>
<tr>
<td>(0.130)</td>
<td>(0.595)</td>
<td>(0.0277)</td>
<td>(0.0603)</td>
<td></td>
</tr>
<tr>
<td>Ch — shareinputMkt−1</td>
<td>0.239***</td>
<td>−0.708***</td>
<td>1.198***</td>
<td>5.165***</td>
</tr>
<tr>
<td>(0.0788)</td>
<td>(0.315)</td>
<td>(0.263)</td>
<td>(0.501)</td>
<td></td>
</tr>
<tr>
<td>Ch — shareinputMkt−1 × Shareit−1</td>
<td>−0.632***</td>
<td>0.159***</td>
<td>−0.0981***</td>
<td>0.416***</td>
</tr>
<tr>
<td>(0.115)</td>
<td>(0.376)</td>
<td>(0.0216)</td>
<td>(0.0422)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>85,770</td>
<td>94,035</td>
<td>35,628</td>
<td>39,254</td>
</tr>
<tr>
<td>R-squared</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
</tr>
</tbody>
</table>

---

specifications, to account for shocks such as to transportation costs, demand patterns or technology that might affect both Chinese exports and our outcome variables in one industry in one year. The main results are reported in Table 11. They correspond to column (4) of Tables A13 to A16, respectively and are clearly similar to those in the original tables. That is, our main results are not due to the presence of common shocks at the 2-digit HS sector-year level.

A fifth concern relates to the use of the Chinese competition measure we employ. In Table 12 we repeat the annual exercise at the product level with different measures of competition. First, to address concerns about the functional form we replace the competition variable with a measure that just indicates whether competition is above or below the mean level of competition. Second, we provide a measure that just indicates whether competition is above or below the mean level of competition. Third, we keep the imports to address concerns about the timing. Fourth, we repeat the annual exercise at the product level. Such heterogeneous micro-level dynamics are hidden by our results cannot describe how the advent of China as a world trading country, a finding of potentially considerable relevance to policy makers and firms worldwide. By forcing plants to drop marginal products, and forcing some smaller and less productive plants to close down, the heterogeneous effect of competition not only increases average productivity at plant and sectoral levels but also appears to make room for some expansion at the top of the size distribution. In the long run, higher productivity underpins higher real incomes, and thus contributes to higher economic welfare, but our results cannot describe how the advent of China as a world trading power has affected overall economic welfare in Mexico. They pay no regard to consumers’ benefits, nor to the extent to which competition in manufacturing has led to growth in other sectors, and nor do they describe any distributional consequences. What the results

6. Conclusions

The substantial rise of Chinese exports in recent decades provides us with a quasi-natural experiment to evaluate the impact of a surge in competition on the extensive and intensive margins of firms at both the plant and the product levels. In this study we analyze the impact of such competitive pressures on Mexican manufacturing firms on both the domestic market and the export (US) market at sectoral, plant and product level.

We find that the surge of exports from China challenged Mexican firms, and led to plant exit, product exit and sales contraction. However, these effects were highly asymmetric and implied a reallocation between products within plants and between plants. First, and most crucially, while smaller, and thus perhaps less productive, plants are forced to shrink and sometimes exit from the market, this effect is attenuated for larger plants. Second, this process of creative destruction and market selection operates not only at plant but also at product level. Such heterogeneous micro-level dynamics are hidden by average effects calculated at sectoral and even plant levels, pointing towards the importance of using plant- and product-level data. Third, we observe these effects not only on the domestic market, but also on the export market, which for Mexico effectively means the USA. Fourth, Chinese competition brings with it access to cheaper and possibly better and more diverse intermediate inputs. We show that larger plants and core products benefit disproportionately from such expanded access to imported Chinese intermediates. This explains part of the heterogeneous impact of the Chinese trade surge, but the main asymmetric competitive result remains clearly identifiable.

These results confirm that the rise in Chinese exports has significantly influenced production patterns in a major middle-income country, a finding of potentially considerable relevance to policy makers and firms worldwide. The main results are robust to using sales in the initial year as the interaction, and not sales that vary over time.

Table 11
Robustness, industry-year fixed effects, plant level.

<table>
<thead>
<tr>
<th></th>
<th>IV</th>
<th>IV</th>
<th>IV</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Exitit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch − compFinit−1</td>
<td>1.193*** (0.516)</td>
<td>−6.736*** (1.393)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lnsalesit−1</td>
<td>−0.0549*** (0.00241)</td>
<td>0.644*** (0.00653)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch − compFinit−1 × Lnsalesit−1</td>
<td>−0.134*** (0.0454)</td>
<td>0.623*** (0.130)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch − compFinit−1</td>
<td>1.562*** (0.593)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lnsalesit−1</td>
<td>0.00139 (0.00157)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch − compFinit−1 × Lnsalesit−1</td>
<td>−0.136*** (0.0516)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herfindahl−it−1</td>
<td>0.0017* (0.00373)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exportsharet−it−1</td>
<td>−0.0204 (0.0277)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skillsharet−it−1</td>
<td>−0.00367 (0.0465)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>35,376</td>
<td>12,089</td>
<td>38,774</td>
<td>11,771</td>
</tr>
<tr>
<td>Sargon p-value</td>
<td>0.0755</td>
<td>0.268</td>
<td>0.225</td>
<td>0.0918</td>
</tr>
</tbody>
</table>

Note: Robust standard errors are clustered on six digit product level, stars give significance at 1 (**), 5 (**) and 10% (*) level of significance. These regressions are identical to the fourth column of the main plant OLS regressions in the online appendix, except for the additional inclusion of 2 digit HS sectoral-year control variables. An example of such a control variable is fertilizers in the year 2000.
do show, however, is that despite understandable political resistance to competition from China, insulating the domestic market from competition is likely to be harmful to productivity as it would benefit less productive plants and marginal products. It would also be a partial solution to local economic stresses because competitive effects are also felt via export markets. While recognizing the possible distributional effects of competition, policy should aim to permit and facilitate change, rather than frustrate it by supporting failing firms. It should recognize the centrality of large and efficient firms to the national response, rather than focusing on less productive enterprises and marginal products and accommodate reallocation as a key to productivity growth.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jinteco.2012.09.002.

References


Table 12

Robustness to different measures of Chinese competition. The table exactly reproduces the main OLS results for product exit and sales, replacing the competition variable with different measures of competition. Only the main coefficients of interest are shown. Robust standard errors are clustered on eight digit product level, stars denote significance at 1 (‘***’), 5 (‘**’) and 10% (‘*’) level of significance.

<table>
<thead>
<tr>
<th>(1) Prod exitit</th>
<th>(2) Prod exitit</th>
<th>(3) Prod exitit</th>
<th>(4) Prod exitit</th>
<th>(5) Prod salesit</th>
<th>(6) Prod salesit</th>
<th>(7) Prod salesit</th>
<th>(8) Prod salesit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch - compMktit - 1 above/below mean ◦ Shareit - 1</td>
<td>0.0014 (0.0019)</td>
<td>-0.0019*** (0.00022)</td>
<td>0.191*** (0.0056)</td>
<td>-0.226* (0.127)</td>
<td>-0.725*** (0.214)</td>
<td>0.226*** (0.079)</td>
<td>0.0653*** (0.0116)</td>
</tr>
<tr>
<td>Ch - compMktit ◦ Shareit - 1</td>
<td>0.0570*** (0.0116)</td>
<td>0.0739*** (0.0194)</td>
<td>4.125 (7.299)</td>
<td>3.558*** (0.179)</td>
<td>51.19 (55.51)</td>
<td>55.51 (81.42)</td>
<td>87.50 (114.23)</td>
</tr>
<tr>
<td>AbsorptionMktit - 1</td>
<td>0.131** (0.0634)</td>
<td>-0.429*** (0.0795)</td>
<td>0.725*** (0.0208)</td>
<td>0.0376 (0.376)</td>
<td>1.290*** (0.422)</td>
<td>5.25 (5.25)</td>
<td>-0.0979** (0.0423)</td>
</tr>
<tr>
<td>Shareit - 1</td>
<td>0.0767*** (0.0172)</td>
<td>0.0873*** (0.0127)</td>
<td>0.0745*** (0.0194)</td>
<td>0.0578*** (0.0208)</td>
<td>4.125 (7.299)</td>
<td>3.558*** (0.179)</td>
<td>51.19 (55.51)</td>
</tr>
<tr>
<td>Observations</td>
<td>85,292</td>
<td>85,292</td>
<td>85,292</td>
<td>85,292</td>
<td>93,583</td>
<td>93,583</td>
<td>93,583</td>
</tr>
</tbody>
</table>


