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THE PRO-COMPETITIVE EFFECT OF IMPORTS FROM CHINA: AN ANALYSIS OF FIRM-LEVEL PRICE DATA

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Abstract

The entry of China into world markets has been one of the strongest recent shocks to world trade and advanced countries' industrial sectors. This is particularly true for Italy where labour-intensive, low-technology production represents a large share of output. Using Italian manufacturing firm-level data on output prices over the period 1990-2006, we test whether increased import competition from China has affected firms' pricing strategies causing a reduction in the dynamics of prices and markups. After controlling for other price determinants (demand and cost, domestic competition and import penetration), we find that this is indeed the case. Comparing China's share of world exports to Italy with China's total world export market share proves the causal nature of the relationship we find. Inspired by and in line with recent advances in the literature on international trade, we also show that the price effects of Chinese competitive pressures are stronger in less technologically advanced sectors and, within these sectors, on smaller firms.

JEL Classification: F14, F15, L2, E31.
Keywords: import competition, China, firms' prices and productivity.

Contents

* Bank of Italy, Economics, Research and International Relations

1 Introduction[1]

Does product competition from China affect firms' pricing strategies in advanced countries? More precisely, does increased penetration of Chinese products cause a reduction of firms' (relative) prices and markups? Are these effects stronger in less technologically advanced sectors where price competition is prevalent? And are they stronger for smaller firms, likely less capable of improving product quality?

We answer positively to all these questions using a unique micro-level dataset of Italian manufacturing firms over the period 1990-2006. We find that increases in the share of Chinese products in total Italian imports have a negative causal impact on firms' price dynamics. This result is obtained estimating a reduced-form model of firm-level pricing that accounts for demand and cost shocks, for domestic competition and import penetration, for firms' size and productivity and for time and sector effects. The size of the impact of the Chinese import share is non-negligible: firms operating in a sector where such a share is 10 per cent higher tend to contain their output price growth by 0.3-0.4 percentage points per year.

According to the recent international trade literature, changes in prices and markups play a crucial role for enhanced foreign competition to increase aggregate productivity. The story goes as follows: stronger foreign competition forces domestic firms to reduce prices and profits until "weaker" firms get closer to their break-even and eventually exit the market, triggering a process of market shares reallocation that leads to sectoral productivity improvements. To the best of our knowledge, we provide the first empirical test of the very early stage of this chain of events.

Importantly, this paper is among the few based on data on firm-level prices, instead of sectoral prices or firm-level unit values. By focusing directly on firms' prices, we do not need to rely on possibly imprecise accounting figures on price-cost margins nor to adopt estimation methods such as the one proposed by Hall (1988) and implemented by various authors[2]. Moreover, the use of disaggregated data allows us to control and test for heterogeneity across both sectors and firms.

The advantages of concentrating on China are at least threefold. First, China represents a very important shock to external trade, one that is also temporally well-defined. Its increasing role in world trade has been impressive and has occurred during the time horizon

[1] We wish to thank Andrew Bernard, Andrea Brandolini, Sergio de Nardis, Giorgio Gobbi, John Haltiwanger, Saul Lach, Francesca Lotti, Francesco Nucci, Giuseppe Parigi, John Romalis, Fabiano Schivardi and participants at seminars at EEA2009, EIEF, ETSG2008, LMDG2008, ITSG2009, University of Perugia and Italian Ministry of Economy and Finance for their comments. We also thank Angela Gattulli for invaluable research assistance. We are solely responsible for all errors. The views expressed herein are those of the authors and do not necessarily reflect those of the Bank of Italy.

[2] On the drawbacks of the two approaches, see Tybout (2001).

covered by our firm-level data. According to the manufacturing trade data we use in the paper, China's total world export market share increased from 2.3 per cent in 1990 to 11.2 in 2005; the corresponding share in world exports to Italy increased from 0.6 to 6.2. China's potential growth in world trade is still very high. Second, competitive pressures exerted by Chinese products on world markets are considered to be mostly price-based, thus making the investigation of firms' price reactions particularly relevant. Finally, since both Chinese exports and Italian production are concentrated in less technologically advanced sectors (so called "traditional" sectors: textile, apparel, leather, footwear, furniture), the relationship we study is one of great relevance.

Moreover, we address potential endogeneity biases by instrumenting the Chinese share in world exports to Italy in a given industry - our variable of interest - with the corresponding share in total world exports. This identification strategy aims at isolating push factors determining China's exports related with industrial development and trade policy in that country, thereby excluding that the evolution of productivity and competitiveness of Italian firms feeds back into China's export patterns to Italy.

Various extensions strenghten our confidence about the causal relationship we identify. As we deal with Chinese competitive pressures in Italy, we consistenly find that the effect is stronger for firms that sell their products mostly on the domestic market. We also exploit the theoretical predictions brought forward by the international trade literature and show that Chinese competition exerts stronger pressures on smaller firms belonging to sectors, like textile, apparel and leather, where price competition is relatively more important. Due to the presence of large fixed costs in R&D, innovation and marketing activities and to relatively more binding financial constraints, smaller firms are less capable of competing through non-price factors (e.g., product quality upgrading, technological innovation).

The paper is organized as follows. In the next section we review the background literature and discuss our contribution to it. Section 3 presents the estimating equation. Section 4 describes the firm-level and the trade data we combine in the empirical analysis. The results for the baseline specification are in Section 5, while extensions are in Section 6. Concluding remarks are left to the last section.

2 Background literature

The pro-competitive effect of trade is theoretically well-grounded. In the seminal paper by Krugman (1979) trade integration raises the number of product varieties available, thereby increasing competition. In the most recent models of international trade with heterogeneous firms (Bernard, Eaton, Jensen and Kortum, 2003; Melitz, 2003; Melitz and Ottaviano, 2008), stronger foreign competition and increased imports are followed by price reductions related to both decreases in markups and increases in average firm productivity (through reallocation effects).

The empirical support is growing. For developing countries, one-off trade liberalization events are shown to be followed by an intense resource reallocation that brings aggregate productivity growth and reduction in profit margins (Levinsohn, 1993; Harrison, 1994; Krishna and Mitra, 1998; Tybout, 2001; Pavcnik, 2002). These latter studies share the advantage of relying on a relatively exogenous, as a trade liberalization can be, increase in trade openness.

With regard to advanced countries, Bernard, Jensen and Schott (2006a) use US plant-level manufacturing data and show that a reduction of inbound trade costs is indeed positively associated with industry- and firm-level productivity growth, the probability of plant death, the probability of entry of new exporters, and export growth by incumbent exporters. Firm heterogeneity plays the predicted role: the impact on plant death is smaller for more productive plants. Bernard, Jensen and Schott (2006b) perform a similar exercise using as an external trade shock the sectoral exposure to increasing imports from low-wage countries. They find again that such a measure is positively (negatively) correlated with the probability of plant death (employment growth). Again, these effects are weaker for highly productive and relatively more capital intensive plants; moreover, plants tend to move away from industries more exposed to low-wage country competition to more capital intensive productions. Chen, Imbs and Scott (2009) use a panel of manufacturing industries for seven European countries during the 1990s and find significant pro-competitive effects of trade openness; in particular, they show that increased imports raise industry productivity, reduce industry markups, (temporarily) slow down (production) prices. Auer and Fischer (2008) find that US industrial sectors more exposed to competition from emerging countries record higher productivity growth, as well as lower price inflation. Abraham, Konings and Vanormelingen (2009) find that import competition from low wage countries reduces markups and workers' bargaining power among Belgium firms. Bloom, Draca and Van Reenen (2008) use firm-level data from 11 EU countries and show that Chinese import competition reduces employment growth and increases, though to a lesser extent, propensity to adopt ICT and plant exit.

This paper contributes to the literature in various ways. First, it focuses directly on prices and, contrary to Chen, Imbs and Scott (2009) and Auer and Fischer (2008), it does so using firm-level data. This approach somehow complements Bernard, Jensen and Schott (2006a, 2006b) and Bloom, Draca and Van Reenen (2008) by providing evidence on the price effects of foreign competition at the firm-level. As they do, we investigate the existence and extent of heterogeneity both across industries, testing whether changes in prices and markups are negatively correlated with the intensity of Chinese competition, and within industries, testing whether the response to increased competition is heterogeneous across firms as predicted by theoretical models. Alike Chen, Imbs and Scott (2009), our estimates refer to a short-run equilibrium, one that does not admit changes in firms' production location.

Second, like Bernard, Jensen and Schott (2006b), we precisely characterize foreign competition by focusing on increased import penetration by low-wage countries. We adopt an even more restrictive view and focus only on China, whose increasing role is undoubtedly the most relevant change occurred in world trade over the last decades.

Third, by relying on a reduced-form pricing equation that controls for all possible determinants of costs and markups, we estimate the impact of import competition on firms' markups without making use of indirect estimation methods as Abraham, Konings and Vanormelingen (2009).

This paper grazes an issue that has been the object of a vast and quite controversial debate over the last few years (before the 2007-09 international crisis), concerning the relationship between globalization and the worldwide very subdued inflation pattern, despite buoyant economic activity (Ball, Mankiw and Romer, 1988; Rogoff, 2003; Bean, 2006). We do not aim at contributing to this debate, as we focus on the effect that trade integration, through lower import prices and stronger competitive pressures, exerts on relative prices (Pain, Koske and Sollie, 2006, among others)[3].

3 Empirical Specification

As our goal is to isolate the effect of import competition from China on firms' pricing strategies, we need to set up an empirical specification that accounts for all price determinants: demand, costs, productivity and market power. In a standard model with imperfect competition a firm's profit maximization yields an optimal price that is a markup over marginal costs (i.e., $p_{i,t} = \mu_{i,t} * c_{i,t}$), that, after taking logs and first-differencing, becomes:

$$\Delta \log p_{i,t} = \Delta \log \mu_{i,t} + \Delta \log c_{i,t}$$

While we observe prices at the firm level, we need to proxy for markups and unit costs. To this aim, we take stock of the rich industrial organization literature on markups (Domowitz, Hubbard and Petersen, 1988; Rotemberg and Woodford, 1992; for Italy, Marchetti, 2001) and define markups as a function of a time-invariant sector component related to

[3] On the basis of the same dataset we use here, Gaiotti (2009) argues that globalization has not induced a weakening of the link between prices and domestic economic activity.

technology and market structure, the level of demand (cyclical markups) (DEM) and competition. We make a distinction between domestic ($DCOMP$) and foreign competition, and we further break down the latter into Italy's import penetration ($IMPEN$) and the share of China in world exports to Italy ($CHINA\_IT$). In line with industrial organization models and related empirical evidence, we also assume markups to be increasing in firm size ($SIZE$). Notationally, we obtain[4]:

$$\begin{aligned} \Delta \log \mu_{i,t} &= \alpha_o + \beta \Delta \log DEM_{i,t} + \gamma_0 \Delta \log DCOMP_{s,t} + \gamma_1 \Delta \log IMPEN_{s,t} + \\ &\quad \gamma_2 \Delta \log CHINA\_IT_{s,t} + \delta \Delta \log SIZE_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where s indexes the 2-digit NACE sector a firm i belongs to. It is worth highlighting, as we discuss below, that we use a firm-level measure of demand, proxied by changes in the capacity utilization rate. Competition, both domestic and foreign, is measured at the sectoral level.

We then model changes in unit costs as follows:

$$\Delta \log c_{i,t} = \alpha_1 + \kappa \Delta \log W_{i,t} + \chi \Delta \log IC_{i,t} + \xi \Delta \log TFP_{i,t} + \psi_t + u_{i,t} \tag{2}$$

where W is the unit wage, IC is the unit cost of intermediate inputs, TFP is total factor productivity. Year dummies ψ_t capture changes in costs that are common to all firms. Importantly, IC controls for the effect of cheaper intermediate inputs, including those from China, on costs and prices (Abraham, Konings and Vanormelingen, 2009).

When we combine equations (1) and (2) to derive our base empirical specification, we take one-period lags of all the regressors. This choice is substantiated by the empirical evidence arising from a large number of recent studies on firms' pricing policies in the euro area, based on both survey and quantitative micro data (see Fabiani et al., 2007 and references therein). According to these studies, firms' prices do not react immediately to cost or demand shocks; both in Italy and in other European countries firms adjust prices on average once a year.

Given that the firm-level output price change recorded in our database is expressed in percentage terms, in the estimating equation we define all regressors as percentage changes. Notationally:

[4] The time-invariant sector components affecting the level of markups are swept away by first differencing.

$$\begin{aligned}\Delta p_{i,t} &= \alpha + \beta \Delta DEM_{i,t-1} + \gamma_0 \Delta DCOMP_{s,t-1} + \gamma_1 \Delta IMPEN_{s,t-1} + \\ &\gamma_2 \Delta CHINA\_IT_{s,t-1} + \delta \Delta SIZE_{i,t-1} + \kappa \Delta W_{i,t-1} + \\ &\chi \Delta IC_{i,t-1} + \xi \Delta TFP_{i,t-1} + \psi_t + \eta_{i,t}\end{aligned} \quad (3)$$

We always cluster standard errors by sector, as we aim at identifying the effect of a sectoral variable ($\Delta CHINA\_IT$) in a firm-level dataset. In order to account for the possibility that changes in costs are characterized by sectoral trends - induced, for example, by technological change - we also show an estimate of equation (3) that includes a full set of sector dummies (19 sectors from the 2-digit NACE-Rev.1 classification).

3.1 Causality

The key parameter of interest in equation (3) is γ_2. This is the coefficient of the percentage change in the Chinese share of world exports to Italy, which in our interpretation measures the effect of a change in competitive pressures from China (through imports) on Italian firms' price variations.

Even after controlling for other determinants of firm-level price dynamics, the distribution of the changes in the Chinese share across sectors could still be correlated with the error term, thus inducing a bias in the estimate of γ_2. The main concern is reverse causality: Chinese products may gain larger market shares in those sectors where Italian firms are expected to raise prices more (or decrease them less). Hence, we would expect an upward bias in γ_2. A second concern is related to the potential omission, among our set of controls, of time-varying sectoral factors that affect at the same time both output price dynamics and the Chinese share in Italy.

We address these two issues by instrumenting the variable $\Delta CHINA\_IT$ with the equivalent figure computed on total world export flows, that is with the percentage change in China's total world export share computed excluding exports to Italy ($\Delta CHINA\_WRL$). Since Italy's weight over total world imports and exports is relatively small (less than 4 per cent), we are confident that $\Delta CHINA\_WRL$ is not affected by developments in the Italian economy. It is rather the result of push factors related to industrial development and trade policies in China. If any demand or competition effects influence China's world exports, these are very likely localized in the Asian region and in the US, which overall absorbed two thirds of Chinese total exports in 1998 and still 65 per cent in 2006[5]. This is true even in sectors where Italian firms hold a comparative advantage.

[5] From a complementary perspective, the EU15 market, where Italian firms sell more than 50 per cent of their exported products, accounts for less than 15 per cent of China's exports.

Having argued that $\Delta CHINA\_WRL$ evolves indipendently of Italian developments, we need to account for the possibility that some unobserved time-varying sectoral factors could still bias our estimates. Such factors must have an impact on trade at the worldwide level in order to simultaneously affect both China's world share and firms' pricing strategies in Italy. For instance, coordinated changes in tariffs and other import restrictions may indeed affect both Chinese exports and Italian prices. To the extent that such international factors eventually affect world trade sectoral developments, we can investigate whether the latter are correlated with the evolution of the Chinese world share. We find that the correlation (equal to -0.025) between $CHINA\_WRL$ and sectoral world trade (that is, the denominator of $CHINA\_WRL$) is statistically not significant, supporting the hypothesis that our instrument is not driven by time-varying factors affecting world trade. In other words, such unobserved sectoral factors are unlikely to be a source of bias.

A final issue is the possible weakness of our instrument. In our view, this is not a real concern. As shown in the last panel of Figure 1, the evolution of $CHINA\_WRL$ and that of $CHINA\_IT$ (the market share levels) for the manufacturing industry as a whole (excluding tobacco, petroleum and computing) are quite close. The importance of China has been growing since the beginning of the '90s in both markets (world and Italy) with a slight acceleration after about 2000. The other panels of Figure 1 show that the world figure traces the Italian one quite well even at the sectoral level, with a correlation coefficient above 0.9. Most importantly, in our base regression the F-statistic of excluded instruments is well above the rule of thumb threshold of 10 recommended by Staiger and Stock (1997) to avoid weak instrument concerns.

For the same reasons outlined above, reverse causality could also plague the estimated coefficient of import penetration. We empirically deal with this potential problem by instrumenting import penetration in Italy at the sectoral level with the corresponding figure computed for the US. The results, presented in section 5.2, indicate that the estimated bias is not large. Moreover, an Hausman test comparing an IV model with only $\Delta CHINA\_IT$ instrumented to an IV model with both $\Delta CHINA\_IT$ and $\Delta IMPEN$ instrumented does not reject the null hypothesis that the estimate from the former model is consistent. Hence, we choose to show all the robustness exercises and extensions using the IV model where only $\Delta CHINA\_IT$ is instrumented.

4 The Data

We combine data from various sources and merge firm-level information with sectoral trade figures. Firm-level data, available from 1982 through 2006, are obtained from the Bank of Italy's Survey on Investment in Manufacturing Firms (SIM) and the Company Account

Data Service (CADS). Sectoral trade data, available from 1990 through 2005, are from the World Trade Analyzer (WTA) database developed by Canada Trade Statistics. In both data sources, we focus only on 2-digits Nace Rev.1 manufacturing sectors and exclude three sectors: "Tobacco products", which is in Italy mostly government-owned, "Petroleum & Coal Products", whose performance is too sensitive to international oil prices, and "Computing and office equipment", which is too thin (almost inexistent) in Italy.

Since we estimate a lagged differenced model, in the regression the dependent variable (i.e., the annual rate of change in firms' output prices) ranges from 1992 to 2006, and the regressors from 1991 to 2005. After excluding observations below the 1st and above the 99th percentile of the distributions of the growth rate of each firm-level regressor, we are left with about 6,300 observations.

4.1 Firm-level data

SIM is an open panel (managed by the Bank of Italy) of about 1,200 firms representative of Italian manufacturing firms with at least 50 employees. Given the strict, personal relationship between officials of the Bank of Italy and the single firms, the intense process of data revision carried out by statisticians of the Bank of Italy and the special effor to keep information as closely comparable across time as possible, SIM turns out to be a very high quality dataset. SIM's questionnaires, submitted to companies at the beginning of each calendar year and relative to the previous year's data, collect a wide range of information: year of foundation, nationality, location, sector of activity, ownership structure, employment (yearly average), investment (realized and planned), sales (domestic and foreign), capacity utilization rate, indebtdness. Every year the survey is enriched with additional sections covering specific issues. CADS is the organization in charge of gathering and managing firms' account data in Italy. It was established in the early 1980s jointly by the Bank of Italy, the Italian Banking Association (ABI) and a pool of leading banks with the aim of collecting and sharing information on borrowers. Balance sheets are re-classified in order to reduce the dependence on accounting conventions used by each firm to record income figures and asset values.

Descriptive statistics on the merged CADS-SIM dataset are presented in Tables 1 and 2. The number of firms is not constant over time, due to the fact that SIM is an open panel and to the requirement we impose that each firm participates to the survey for at least three years in a row. The sectoral composition is broadly representative of the specialization of the Italian economy, with most firms operating in machinery, textile, apparel and chemical products. The sample tends to be biased towards relatively large and old firms reflecting the fact that, as stated above, we observe the balance sheets only of those firms that obtain bank loans. All in all, as the firms included in the database are better than average ones - thus especially able to survive on the market -, our analysis may somehow underestimate the effect of Chinese competition.

Importantly, since 1987 the SIM survey has collected quantitative information on firms' output price change with respect to the previous year. The price change is expressed in percentage terms, euro-denominated and averaged across destination markets. It is also averaged across the different products sold by each firm. Given that firms are classified according to the sector which the main product belongs to, the last aspect could represent a problem if firms were selling products falling into different 2-digit categories. Fortunately, as shown by ISAE (2009), this is almost never the case for Italian firms at the 2-digit disaggregation level.

We use this firm-level average output price change as our dependent variable. Figure 2 shows its distribution across firms by year: the overall average is about 2 per cent, but there is quite a high degree of variability, both over time and across sectors and firms. The largest price increases are reported by firms operating in the metal industry and are concentrated in 2003 and 2004 −characterized by sharp rises in raw material prices− and in 1993 and 1995 −following devaluation episodes. The largest price cuts are recorded in the metal industry and in the production of paper and chemical products in 1996. In the empirical analysis we control for these time and sectoral effects.

The advantage of working with firm-level price data can be appreciated in Figure 3 that reports the overall (all years) distribution of price changes under three specifications: raw data, controlling for year fixed effects and controlling for year and sector fixed effects. Allowing for year and, to a much lesser extent, sector fixed effects helps smooth out some spikes in the raw data but does not seem to have a large explanatory power. In other words, there is still a lot of heterogeneity to be exploited within years and sectors, that is, across firms.

The reliability of our firm-level price measure can be assessed by comparing it with its macroeconomic counterpart, the official Producer Price Index (PPI), available since 1996, computed and published by the Italian National Statistical Institute (ISTAT). Figure 4 shows, for each 2-digit NACE and for the whole manufacturing sector, the PPI (excluding energy) annual growth rate and the average annual price change computed on the basis of our firm-level data. It is quite evident that the two measures are highly correlated, despite the fact that the PPI is a weighted average and refers only to industrial products sold on the domestic market, whereas SIM price changes reported by firms are simple averages computed irrespectively of the destination market.

All the regressors at the firm level are constructed from the merged CADS-SIM dataset.

Firm size ($SIZE$), measured as the number of employees, is from SIM[6]. Unit wage (W) is obtained as the ratio between total labor costs from CADS balance sheets and the number of employees from SIM. The short-run changes in firm-level demand (ΔDEM) are proxied by changes in the firm's capacity utilization rate from SIM[7]. The intensity of domestic competition ($DCOMP$) is measured by a concentration index (the market share of the four largest firms in terms of sales), computed on the basis of CADS data at the 3-digit level. Total factor productivity (TFP) is Bank of Italy's internal computations based on the method proposed by Levinsohn and Petrin (2003)[8] and applied to CADS data on value added, capital stock, intermediate inputs and labor; it also entails the correction for imperfect competition proposed by Klette and Griliches (1996) and adapted further to firm-level production function estimation by Melitz (2004)[9].

The measure of unit input costs (IC) is computed by dividing the balance sheet figure on total costs for intermediate inputs (from CADS) by the number of employees (from SIM). This is not a precise measure of the unit cost of inputs, since the average price of inputs is multiplied by the ratio between the physical quantity of intermediate inputs and the number of employees. In other terms, the changes in IC we include in our base regression can be due either to changes in input prices or to changes in factor (intermediate inputs vs labor) proportions. This has two important implications. On the one side, we are able to estimate the effect of changes in input prices only under the assumption that factor proportions are fixed: this seems somehow reasonable in the short run analysis we conduct. On the other side, we do not necessarily consider the possible violation of the fixed proportions assumption a drawback of our approach. As we aim at isolating the pro-competitive effect of imports from China, we do want to control for the effect of Chinese imports on input

[6] As a measure of firm size, we prefer to use employment instead of total sales. Being the product between output and prices, sales could be positively correlated with prices, even with their changes, simply because prices appear on both terms. Given the personal relationship between Bank of Italy's official and firms' entrepreneurs and managers, the reliability of the employment figure in SIM is particularly high. Its correlation with the CADS's figure is close to 95 percent.

[7] The firm-level rate of capacity utilization is derived as answer to the following question: "What is the ratio between actual production and the level of production which would be possible by fully using the available capital goods without changing labor inputs?". The correlation between its annual across-firm average and a standard macro measure of capacity utilization in manufacturing (computed by the Bank of Italy on the basis of industrial production and ISAE's quarterly surveys) is about 0.8. Gaiotti (2009) shows that movements in SIM's capacity utilization also track quite well the behavior of the output gap in the whole economy.

[8] Along the lines traced by Olley and Pakes (1996), Levinsohn and Petrin (2003) proposed to solve the simultaneity bias stemming from the unobservability of TFP by adding intermediate inputs to the production function estimation.

[9] Klette and Griliches (1996) note that a production function estimation where value added is deflated through a sectoral deflator potentially suffers from an omitted variable bias, where omitted is the difference between the sectoral deflator and individual firms' prices. In an imperfectly competitive world, this difference is non-zero. The same authors suggest as a correction to add the *sectoral total* deflated value added as proxy for such a difference.

prices and on the decision of firms to outsource activities. This is precisely what ΔIC is doing: it jointly controls for both the dynamics of intermediate inputs prices (possibly due to cheaper Chinese products) and for firms' changes in outsourcing strategies (again, possibly due to cheaper Chinese products).

4.2 Trade data

The main source of our trade data is the World Trade Analyzer developed and managed by Statistics Canada, which provides clean data on export and import flows, in current dollars, for a very large set of countries, disaggregated by destination market and type of product over the period 1985-2005. The product breakdown corresponds to the 4-digit SITC-Rev.3 classification. Since firms in the CADS-SIM dataset are classified according to the NACE-Rev.1 system, we mapped the SITC-Rev.3 classification into the 3-digit NACE-Rev.1 using the concordance tables provided by the United Nations. Due to the limited size of SIM we then aggregated the 3-digit Nace-Rev.1 trade data at the 2-digit level. This choice has the advantage that, at this level of product disaggregation, the percentage of multiproduct firms, falling into two or more different categories is very low, less than 2 per cent according to ISAE (2009). On the other hand, we cannot control for the potential relocation of firms within a 2-digit category. In our case, this might be particularly relevant if firms avoid Chinese competition by changing their product mix within the same product category: we will come back to this issue in section 6.

We construct two measures of China's importance in world trade: the Chinese share of total world exports and the share of Chinese exports in world exports to Italy ($CHINA\_WRL$ and $CHINA\_IT$, respectively). While the latter represents the variable of interest, that is a sectoral indicator of competitive pressures exerted from China on Italian firms on the Italian market, the former acts as instrumental variable. We restrict trade data to the 1990-2005 period since data on Chinese exports to Italy display some strange figures during the '80s. Table 3 reports the actual sectoral figures for 1992, 1995, 2000 and 2005. In traditional sectors the Chinese share of world exports to Italy has grown significantly, getting close to 15 per cent in 2005; the same share computed over total world exports has reached even higher values, especially in apparel and leather goods (around 25-30 per cent). Since 2000 the increase has been also very significant in the other transportation sector, with the Chinese share of total world exports standing at 23.3 per cent in 2005.

Sectoral import penetration ($IMPEN$) in Italy is derived combining production series from the OECD STAN database for Industrial Analysis with export and imports from the OECD STAN bilateral trade database; figures are recorded at the 2-digit Nace-Rev.1 classification and available until 2006. In the same way we measure import penetration in the U.S. ($IMPEN\_US$), that we use as instrument for $IMPEN$. The two measures are reported in Table 4. As of 2005, in Italy it is highest in motor vehicles, TV and communication equipment, chemical goods and iron and steel, lowest in metal products, publishing and products from non-metal minerals. The pattern is different for the U.S. which is a much closer market for motor vehicles but very import-dependent in leather products and apparel. $IMPEN$, whose correlation with $IMPEN\_US$ is positive and equal to 0.34, displays instead a negative correlation (of about -0.15) with $CHINA\_IT$.

5 Empirical Results

Before turning to estimates of equation (3), we assess whether the raw data provide any preliminary descriptive evidence suggesting that the Chinese export share in Italy has a bearing on Italian firms' pricing strategies. We split the sample into two groups according to the size of the average sectoral annual change in the Chinese share over the period examined (1990-2005), using the median as the cutoff point. Simple unconditional means indicate that indeed the average annual price increase in the group of sectors that recorded a larger increase in competitive pressures from China is equal to 1.7 per cent, against 2.5 per cent in the other group.

Another way to examine the data is to check whether the relationship we are looking for holds already in a simple regression framework. Table 5 reports the coefficients of an OLS regression of the firm-level price change on the lagged change in the Chinese share of total world exports to Italy. The results display a statistically significant relationship only when we control for year fixed effects (columns 2 and 4); in such cases, the R-squared rises significantly, too. The contribution of sector fixed effects, despite being statistically significant, is very limited.

5.1 Base regression

We now focus on the estimates of equation (3). The first two columns of Table 6 report OLS estimates without (column 1) and with (column 2) sector fixed effects. The estimated coefficient of $\Delta CHINA\_IT$ is always negative: it is not statistically significant when we control for sector fixed effects.

As discussed in Section 3.1, if the entry of Chinese products on the Italian market is, *ceteris paribus*, more intense in sectors where Italian firms are less price competitive, i.e. where domestic prices increase relatively more, then the OLS estimate of the parameter γ_2 is upward-biased. We therefore turn to IV estimation, using China's total world export market share as instrument. The results, reported in the same Table, are again displayed without (column 3) and with sector fixed effects (column 4). It is worth emphasizing that the F-statistics of excluded instruments, reported in the bottom panel of the Table, is always above the rule of thumb value of 10, to say that weak instrument is not a concern.

In the IV estimations the coefficient of $\Delta CHINA\_IT$ becomes highly statistically significant and much smaller, thereby confirming an upward bias in the OLS estimates. The pro-competitive effect of imports from China on firms' output prices amounts to about 0.03-0.035, to say that a 10 per cent increase in the Chinese share brings about a 0.3/0.35 percentage points reduction of price dynamics. It is quite a sizeable effect as the average price change across years and sectors in our sample is 2 per cent.

Turning to the other regressors, OLS and IV specifications yield very similar results. As expected, import penetration has a negative effect on price growth, too. The estimated effect, though, is much smaller than the one of $\Delta CHINA\_IT$: according to the IV estimation, a 10 per cent increase in import penetration reduces price dynamics by 0.06 percentage points, less than a fifth the effect of China.

A size increase ($\Delta SIZE$) raises market power and therefore the firm's ability to charge, *ceteris paribus,* higher prices. According to Kugler and Verhoogen (2008), a positive correlation between firm size and output prices might also follow from the fact that larger firms are those producing better quality goods sold at higher prices. The dynamics of intermediate input costs has also a positive impact on price changes.

The remaining coefficients are not significant. In particular, the price elasticity to labor costs (ΔW) is not only statistically not significant but also very small. This result is quite consistent with previous empirical evidence showing that the finer the disaggregation, the lower the estimated response of prices to changes in wages (Bils and Chang, 2000). Similar results, based on Italian firm-level data, are obtained by Rosolia and Venditti (2009) using wages[10] and by Gaiotti and Secchi (2006) and Gaiotti (2009) using contractual wages. Moreover, according to firm surveys conducted recently in a wide number of European countries (in the context of the Eurosystem Wage Dynamics Network), prices are on average adjusted more frequently than wages and only around 15 per cent of firms acknowledge a strong relationship between the timing of price changes and that of wage changes (Druant et al., 2009). In particular, in the case of Italy, the low frequency of wage changes and the scarce variability across firms as compared to other countries is largely explained by the wide coverage of the highly centralized collective bargaining system.

As to the effect of TFP, the statistically insignificant coefficient may reflect the fact that the sign of the relationship between price and TFP changes is a priori ambiguous: as clearly pointed out by Melitz (2004), it captures both increases in productivity (with a negative

[10] If we regress firm-level price changes only on wage dynamics, we obtain a significant coefficient of about 0.03, which is very close to the one estimated by Rosolia and Venditti (2009) over a longer time period. The coefficient becomes much lower (and statistical insignificant) once we control for time dummies.

effect on prices) and quality upgrades (with a positive effect).

In the remainder of the paper we present robustness tests and extensions to the base estimation. To simplify the presentation of results, hereafter we focus only on the IV estimates, presented as in Table 6 under the two alternative specifications: with and without sector fixed effects[11].

5.2 Robustness

Import penetration may be endogenous for the same reasons as the Chinese share of Italian imports: import penetration may be simply more intense in those sectors where Italian firms are less price competitive. To deal with the related upward bias, we instrument the change in import penetration in sector S in Italy with the corresponding figure in the U.S. The chosen instrument is not affected by Italian firms' pricing strategies, but it is very likely correlated with import penetration in Italy as one can assume that developed countries have roughly similar demand patterns. Results, reported in Table 7, are very similar to those obtained in the base regression. The coefficient of $\Delta CHINA\_IT$ remains unchanged at -0.035. Moreover, an Hausman test that compares an IV model with only $\Delta CHINA\_IT$ instrumented to an IV model with both $\Delta CHINA\_IT$ and $\Delta IMPEN$ instrumented does not reject the null hypothesis that the estimate from the former model is consistent.

A second exercise deals with the presence of a possible survivorship bias. Since firms that are not able to compress margins enough may decide, or be forced, to exit the market, we could be overestimating the pro-competitive effect of $\Delta CHINA\_IT$. We address this issue using information on the firms' history, contained in CADS, that allows to explicitly control for exit from the market. In particular, we include among the regressors a dummy variable $EXIT$ [12], constructed in two alternative ways. In the first, more restrictive, definition, $EXIT$ takes value 1 if the firm is liquidated or go bankrupt after exiting the sample and 0 otherwise. In the second, $EXIT$ takes value 1 also if the firm is subsequently acquired by another firm. Results are displayed in Table 8: in both cases (columns 1-2 for the first definition, and 3-4 for the second) all the results are unchanged and the coefficient of $EXIT$ is never significantly different from zero.

Table 9 shows the robustness of our estimates to outliers. The first two columns present the estimates of equation (3) after eliminating sector-year cells with less than 20 firms. Again, the previous results, now based on 6,145 observations, fully hold. The last two columns refer to the results obtained estimating equation (3) on the sub-period 1996-2006.

[11] All the results hold unchanged in a specification with sector fixed effects but no clustering of standard errors.

[12] $EXIT$ can be interpreted as the hazard rate in a Heckman selection model. The difference is that here the probability of exit is perfectly observed and it does not need to be estimated.

The exclusion of the years 1993-95 is motivated by the large devaluation of the Italian Lira occurred in 1992, which provided a stronger shield to those sectors more exposed to foreign competition. Indeed, Figure 2 shows that price changes were especially large in that period. The estimates confirm the intuition: the coefficient of $\Delta CHINA\_IT$ increases, in absolute terms, by 50 per cent, to -0.053.

Other robustness checks carried out but not reported in the text are the following. To allow for price dynamics that are geographically heterogeneous, we controlled for firm's location including macro-area dummies (North-West, North-East, Center and South): results are unchanged and the dummies are overall not significant. We tested for the potential persistence in firm's price dynamics including the lagged price change as an additional regressor: again, results are stable and the lagged dependent variable is not statistically different from zero (p-value 0.13). We also estimated the baseline model with firm fixed effects, so as to capture firm-specific time trends, and allowing for clustering of standard errors at the firm level. In both cases, results hold through.

6 Extensions

The results presented so far show that the growth in the Chinese share of Italian imports affects the pricing strategies of Italian firms. They are remarkably robust across specifications and subsamples. We now propose some extensions aimed at improving our understanding of the mechanisms through which Chinese competitive pressures influence prices in Italy and further increasing the credibility of our results. For this, we take advantage of the availability of sector- and firm-level characteristics[13].

6.1 Domestic vs exporting firms

Since we measure Chinese competitive pressures through Italian imports, the effect we estimate should be stronger on firms' prices charged on the domestic market. In the absence of information on prices broken down by destination, we perform two indirect tests (always IV): i) we exclude from the sample firms exporting more than 30 per cent of their total sales at (t-1); ii) we estimate a weighted version of equation (3) where the firm-level weights are constructed as the share of domestic sales in total sales. In both cases, we expect a lower coefficient of $\Delta CHINA\_IT$ (higher in absolute value)

Results are reported in Table 10. As shown in columns 1 and 2, which refer to the first

[13] Despite the absence of any evident structural break in the expansion of China into world markets (fig. 1), we tested whether the coefficient of $\Delta CHINA\_IT$ is larger after China's entry into WTO in 2001 or after 1998 when the European Union significantly reduced its import tariffs. In both cases we find no significant differences. The expiration of the Multifiber Agreement in 2005 is beyond the reach of our data.

experiment, the estimated impact of imports from China on price changes rises to -0.057, from -0.035 in the base regression with sectoral fixed effects. This is to say that a 10 per cent increase in the Chinese share of Italian imports reduces price dynamics by 0.6 percentage points, 60 per cent more than what reported in Table 6. Consistently, the same happens to the coefficient of $\Delta IMPEN$ (here not instrumented) that is now equal to -0.009, more than double, in absolute terms, the one estimated in the base regression.

The weighted estimates are presented in columns 3 and 4. Again as expected, the (negative) impact of foreign competition is larger. This holds for both the coefficient of $\Delta CHINA\_IT$ and that of $\Delta IMPEN$. In absolute terms and as compared to Table 6, the former rises by 30 per cent, the latter by 50 per cent.

All in all, our conjecture is confirmed: firms more reliant on domestic revenues are more affected in their pricing strategies by the competition exerted by Chinese products in Italy.

6.2 Heterogeneity across sectors

Is the price effect of China's competitive pressures different across sectors? Providing an answer to this question represents not only a way of testing the predictions of theoretical models but also a further indirect test on the plausibility of the causal relationship we are identifying. Since we focus on price behavior, a dimension we might want to explore is the type of competition prevailing within a given sector. To simplify things, we test the following hypothesis: are competitive pressures from cheap Chinese products stronger in those sectors where the competition game is played more on price than on non-price factors (e.g., product quality, innovative technology)?

To this aim, we need to split sectors according to a criterion that mimics the prevailing type of competition. We follow Romalis (2004) and rank sectors according to skill and R&D intensity. Both measures are computed from 1998 U.S. data to avoid endogeneity problems. The identifying assumption, similar in spirit to Rajan and Zingales (1998), is that the ranking of sectors in terms of skill and R&D intensity is the same in Italy as in the U.S.

The indicator of skill intensity we use is taken from the March 2008 release of the EU KLEMS database and is computed as the number of hours worked by high-skilled persons −defined as those with at least a college degree− as a share of total hours worked. The basic idea we exploit here is that high-skilled workers are those employed in activites like R&D, marketing research, new product development, brand management that overall contribute to raise product quality, at least as perceived by consumers. The R&D intensity indicator is a direct proxy for innovative inputs; measured as R&D expenditure over value added, it is taken from the OECD STAN database.

As shown in Table 11, the distribution of sectors according to R&D intensity is more polarized than the one for skill intensity; however, the two measures are highly correlated (the correlation coefficient is around 0.8). Firms producing “medical, precision and optical instruments”, “radio, television and communication equipment” and “other transportation equipment” spend a relatively higher fraction of their value added on R&D and employ relatively more skilled workers. Traditional sectors (e.g., food, textiles, apparel, leather and wood products) are instead characterized by low values of the two indicators. Importantly, we do not want to claim that product quality does not matter in the traditional sectors (in fact, thinking of the worldwide famous "Made in Italy" apparel and footwear industry, one would easily say the opposite), but that climbing the quality ladder for Chinese competitors is relatively easier in such sectors that in the high R&D and skill intensive ones. We come back on this in section 6.3 when we allow for heterogeneous product quality across firms.

For the empirical analysis, we construct two time-invariant dummy variables: $LOWSK$ is equal to 1 for firms belonging to sectors with skill intensity below the median value of 0.14 and $LOWRD$ is equal to 1 for firms belonging to sectors with R&D intensity below the median value of 0.01. We then include these dummies into equation (3) both as autonomous regressors and interacted with $\Delta CHINA\_IT$ (and with $\Delta CHINA\_WLR$ in the instrument). We expect the coefficient of the interaction term to be negative, that is to say that Chinese price competition puts relatively more pressures on low-skill (low R&D) activities.

Results are reported in Table 12. The first two columns (as usual without and with sector fixed effects) refer to skill intensity; the latter two to R&D intensity. As expected, we find that the stepped-up competition of Chinese provenance is indeed stronger in sectors that are less active in research and development activities. This same intuition is not confirmed when controlling for skill intensity of the labor force at the sector level. In both cases, the use of continuous instead of dummy variables for R&D and skill intensity does not bring any significant evidence.

6.3 Heterogeneity across firms

Reasonably, the ability to compete is also heterogeneous across firms within sectors. Taking stock of different theoretical and empirical contributions, firm size seems to be the crucial variable to be used. Being a structural indicator, its use as interaction with $\Delta CHINA\_IT$ also helps minimize endogeneity problems. Many arguments can be posed in support of the idea that Chinese competitive pressures have a stronger impact on smaller firms.

The possibility that large firms might undertake more R&D is widely accepted (Schumpeter, 1934; Griliches, 1998). Due to fixed cost, many R&D projects are profitable if their outcomes can be used in a sufficiently large production scale. Moreover, R&D itself might be characterized by economies of scale and scope: once innovation is developed, large and diversified firms have better opportunities to exploit it. The same arguments apply to the so-called non-techological innovation related to various commercial activities, like advertising, marketing and distribution (Bugamelli, Schivardi and Zizza, 2008).

Moreover, large firms have presumably a greater capacity to finance innovation thanks to larger internal cash flow and better access to external funding. There is plentiful evidence, for Italy too, that small firms are more likely to be financially constrained (see Hubbard, 1998 for a survey of the literature). Angelini and Generale (2008) provide evidence that Italian small firms are more likely to suffer from financing constraints than large firms. If smaller firms are less able to raise external finance, they are less likely to have the resources to diversify their products, either by investing in R&D and improve product quality, or by investing in advertising and create a recognized brand.

Kugler and Verhoogen (2008) model the so-called quality complementarity hypothesis stating that input quality and firm productivity are complementary in generating output quality. Embedding this hypothesis into Melitz (2003) model, they predict a positive correlation between firm size on one side, and input and output quality on the other. The empirical findings, based on output and input price data at the Colombian plant-level, are consistent with the theoretical predictions. In the specific case of Italy, we have some direct evidence of a positive relationship between firm size and output quality. Using self-reported information on product quality collected by SIM in 2004[14], we find that the median firm size is equal to about 160 among firms declaring to produce high quality products, against a lower 130-140 for the others. This difference is also statistically significant as proved by a regression of a dummy variable equal to 1 for high quality products (and 0 otherwise) on the log of employees[15].

The implications of these different literatures for our setup are quite clear: lower quality, less innovative and technologically advanced goods produced by smaller and financially constrained firms are more likely to be crowded out by cheaper Chinese products. In the empirical analysis we do not aim at providing any horse race among these different arguments, but simply focus on firm size. Moreover, we notice that, in theory, firm size might be crucial both in high and low R&D (skill) intensity industries, considering that both groups contains differentiated manufacturing products: this is surely the case for Italian

[14] Sampled firms were asked to assess which of the following categories their products belong to: "price convenient", "fair quality/price ratio", "medium-high quality", "high quality". Due to the very few responses and, admittedly, high chances of collecting upwardly-biased responses, we did not use this data in the econometric analysis.

[15] Similarly, Verhoogen (2008) finds that ISO 9000 certification, an international production standard related to product quality, is more likely among larger Mexican plants.

traditional sectors. It becomes an empirical issue to see whether and in which sectors firm size is indeed relevant.

We construct a dummy variable $SMALL$ that is equal to 1 for firms with less than 80 employees, which is the median firm size in the sample. We include it as an autonomous regressor and interacted with $\Delta CHINA\_IT$, $LOWSK$ ($LOWRD$), and with $\Delta CHINA\_IT * LOWSK$ ($LOWRD$). The results are shown in Table 13[16]. When we focus on skill intensity (columns 1 and 2), we find that the effect of Chinese competition is indeed stronger for smaller firms in low-skill activities. Quantitatively, given a 10 per cent increase in the Chinese share, the average effect on price dynamics equal to 0.30-0.35 percentage points (in absolute value) goes up to 1.15-1.2 for those firms. The result is qualitatively analogous when sectors are split by R&D intensity (columns 3 and 4); quantitatively, the effect on small and low R&D firms is even larger (around 1.7).

One limitation of this exercise is that the two measures of skill and R&D intensity might not appropriately rank sectors according to the degree of price competition. We therefore perform a different exercise and search for heterogeneous effects by firm size only within those sectors where competition is more likely price-based, i.e., textile, apparel, leather goods, and furniture. The results, reported in the last two columns of the Table, fully confirm our intuition: only smaller firms are forced to react to competitive pressures exerted by imports from China by lowering price and markup dynamics. For these firms, a 10 per cent increase in China's import share compresses output price dynamics by 1.2 percentage points. The coefficient of ΔW is now positive and significant. Compared with the base estimation, this result indicates that the effect of wages on prices is significantly different from zero only in labor intensive sectors.

7 Conclusions

Recent advances in the international trade literature have brought forward the idea that firm heterogeneity is a crucial ingredient to understand the functioning of international markets. A large number of empirical papers have therefore put the firm at the center of the analysis and shown that different reactions of firms to trade liberalizations or to increased foreign competition are the trigger to industry-level adjustments in productivity.

In the chain of events that goes from enhanced competition to increases in aggregate productivity a key role is played by prices and markups. Stronger foreign competition indeed forces price and profit reductions, and, as a consequence, "weaker" firms get closer to their break-even until they exit. This provokes a cross-firms reallocation of market shares

[16] We do not report estimation of the models with $\Delta CHINA\_IT$ interacted only with $SMALL$ since they do not give significant results

that eventually leads to sectoral productivity improvements.

In line with these models, we showed that the growing competitive pressures exerted by Chinese products on an advanced economy like Italy has contributed to soften, *ceteris paribus*, output prices and markups. To the best of our knowledge, this paper is the first empirical test, based on firm-level data, of such a prediction. The impact we estimate is non-negligible: a 10 per cent increase in the Chinese share of Italian imports reduces price dynamics by 0.3-0.4 percentage points per year (the average annual inflation rate being equal to 2 per cent). Moreover, the effect of China is significantly larger than that of average import penetration.

When we explicitly exploit sectoral and firm heterogeneity, we confirm other theoretical predictions. Being Chinese competition mostly price-based, we find indeed a stronger effect among low-technology sectors such as textile, apparel, leather goods, furniture. The effect is also more severe for smaller firms, that are presumably less able to escape China's competition by upgrading the quality of their products.

In our view, the estimated negative impact of China's exports to Italy on Italian firms' price dynamics extends to markups, since the empirical specification controls for all the determinants of both unit costs (wage, cost of inputs, TFP) and markups (sector-level demand, sector-level domestic competition, sector-level average foreign competition and, within sector, firm-level market power), except the composition (China vs others) of Italian imports.

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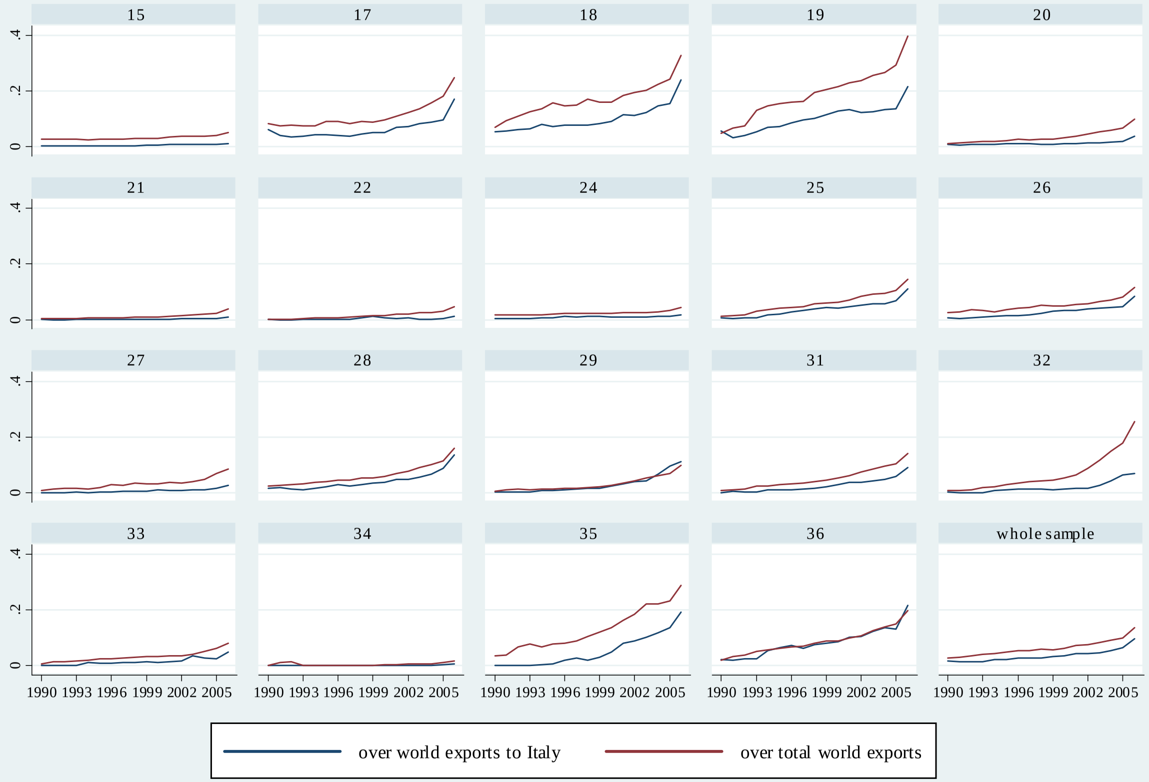
Table 1: Descriptive statistics, sampled firms

	1990	1995	2000	2005
Number of employees	869	654	471	283
Number of employees (median)	206	226	192	131
age	44	43	40	39
sales (million of euros)	105.1	129.1	111.7	79.2
value added per worker (thousands of euros)	41.2	51.4	56.9	60.3
per capita wage (thousands of euros)	27.4	30.1	32.5	36.7
export/sales (percentage, only exporters)	31.1	38.2	39.0	42.1
number of observations	392	434	497	697

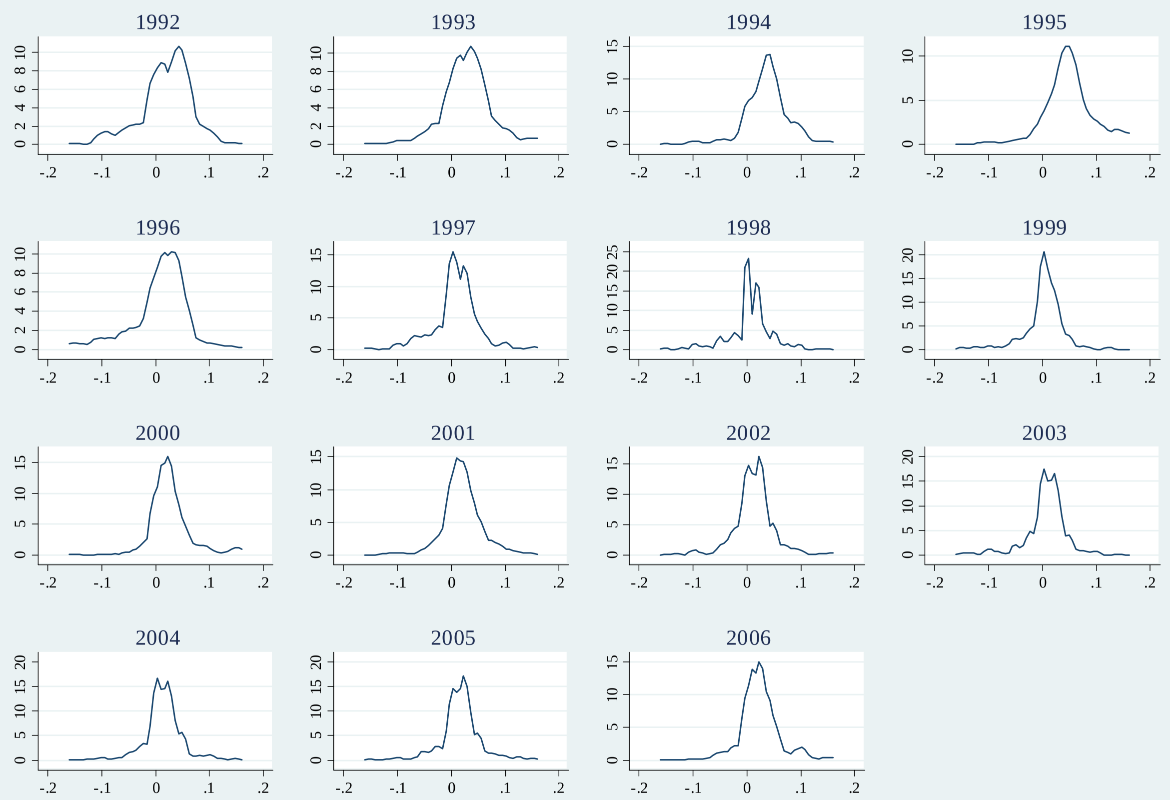
Source: SIM.

Figure 1: China's export share by sector



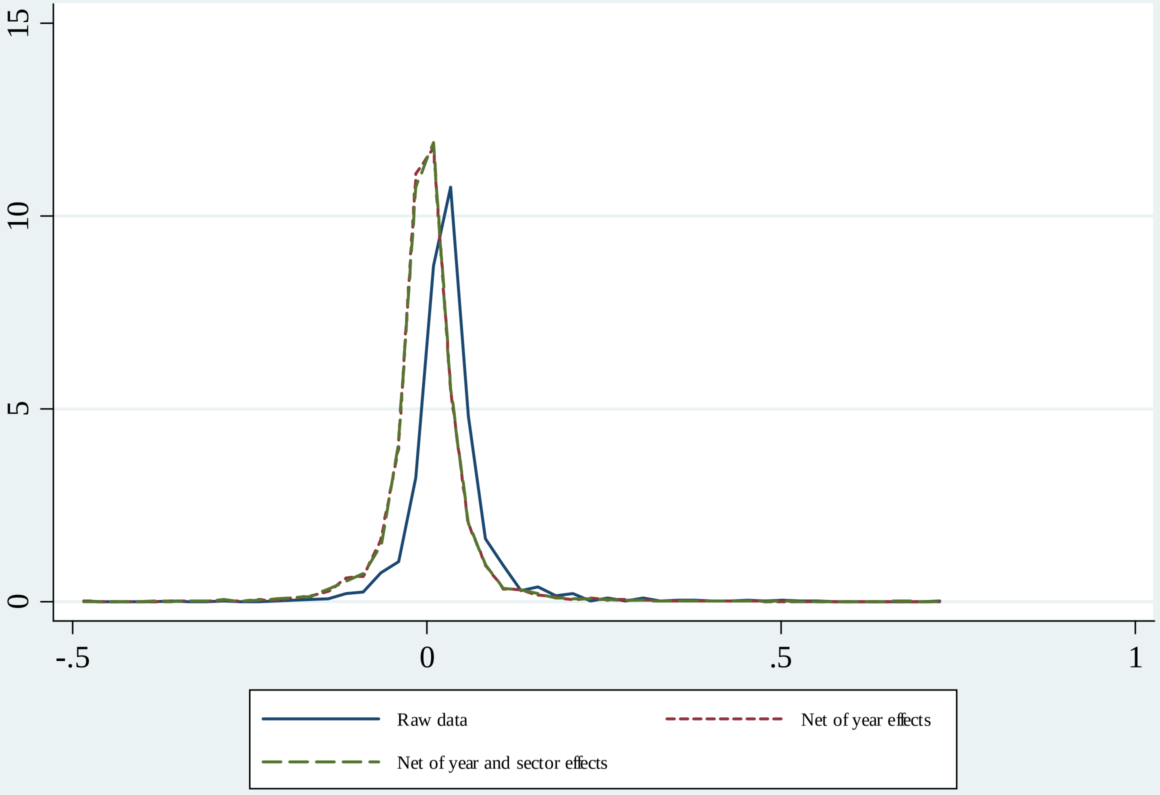
Source: World Trade Analyzer by Canada Trade Statistics - For sector codes see Table 2

Figure 2: Distribution of annual price changes, by year (percentages)



Source: SIM - Price changes are measured at the firm-level and refer to the average across all goods produced by a firm.

Figure 3: Distribution of price changes over all years



Source: SIM - Price changes are measured at the firm-level. Sector fixed effects are computed at 2 digits of the Nace Rev.1 classification.

Figure 4: Average price change, by sector: SIM vs official production prices (percentages)

Source: SIM and Italian National Statistical Institute (ISTAT). SIM price changes are measured at the firm-level. For sector codes see Table 2.

Table 2: Distribution of firms in terms of value added and employment, by sector

	Value added				Employment			
	1992	1995	2000	2005	1992	1995	2000	2005
Food products and beverages (15)	3.6	5.3	12.7	10.1	2.0	3.8	10.5	9.0
Textiles (17)	5.6	5.8	6.4	3.5	6.5	6.9	8.0	5.5
Wearing apparel, dressing (18)	3.1	4.6	3.3	2.8	3.3	5.0	4.1	4.0
Leather, leather products and footwear (19)	0.5	1.0	1.3	1.5	0.6	1.9	2.6	2.5
Wood and products of wood and cork (20)	0.2	0.5	0.7	0.9	0.3	0.6	1.1	1.1
Pulp, paper and paper products (21)	3.4	5.3	3.7	3.0	3.1	3.4	3.0	2.7
Printing, publishing and reproduction (22)	1.4	1.2	5.0	2.8	1.1	1.2	4.7	1.8
Chemicals and chemical products (24)	12.3	7.9	11.3	6.9	8.4	5.4	7.5	4.7
Rubber and plastics products (25)	7.6	7.8	7.6	4.0	6.6	6.5	8.5	4.6
Other non-metallic mineral products (26)	7.7	4.5	9.9	8.7	5.4	3.4	7.5	7.2
Basic metals (27)	3.0	5.1	12.4	9.3	2.2	3.0	13.7	7.3
Fabricated metal products (28)	2.3	2.2	2.3	4.9	2.2	2.3	2.7	5.8
Machinery, n.e.c. (29)	11.9	13.8	9.0	20.7	11.3	12.2	9.8	21.0
Electrical machinery (31)	5.1	3.9	2.2	3.2	3.8	3.6	2.3	2.9
Radio, television and communication equipment (32)	4.9	2.4	1.5	0.8	6.3	5.4	1.3	1.0
Medical, precision and optical instruments (33)	1.0	1.4	3.0	4.2	1.1	1.7	3.8	3.8
Motor vehicles, trailers and semi-trailers (34)	22.5	21.8	2.5	7.2	32.0	28.0	2.3	7.4
Other transport equipment (35)	3.1	4.5	2.2	1.8	2.9	4.9	3.5	2.3
Manufacturing n.e.c., including furniture (36)	0.6	1.0	3.1	2.3	0.8	0.9	3.3	5.4

Source: SIM

Table 3: China's share over total exports to Italy and to the world, by sector

Sector (NACE -Rev.1 code in parenthesis)	exports to Italy				world exports			
	1992	1995	2000	2005	1992	1995	2000	2005
Food products and beverages (15)	0.3	0.4	0.6	0.8	2.6	2.8	3.1	4.0
Textiles (17)	3.6	4.3	5.1	9.8	7.7	9.0	9.6	18.3
Wearing apparel, dressing (18)	6.2	7.4	9.1	15.5	11.0	15.7	16.0	24.2
Leather, leather products and footwear (19)	4.2	7.2	12.8	13.6	7.5	15.6	21.6	29.4
Wood and products of wood and cork (20)	0.8	1.0	1.1	1.9	1.7	2.1	3.2	6.8
Pulp, paper and paper products (21)	0.0	0.0	0.2	0.4	0.4	0.7	0.9	2.3
Printing, publishing and reproduction (22)	0.0	0.2	0.7	0.4	0.3	0.6	1.6	3.2
Chemicals and chemical products (24)	0.4	0.7	1.0	1.2	1.7	2.0	2.3	3.2
Rubber and plastics products (25)	0.6	2.0	4.1	6.9	1.7	4.2	6.2	10.5
Other non-metallic mineral products (26)	0.8	1.6	3.4	4.6	3.7	3.7	5.0	8.1
Basic metals (27)	0.1	0.2	1.0	1.7	1.5	1.9	3.1	6.9
Fabricated metal products (28)	1.2	2.1	3.7	8.7	2.8	4.0	5.8	11.4
Machinery, n.e.c. (29)	0.2	0.8	2.4	9.6	1.4	1.3	2.6	6.9
Electrical machinery (31)	0.1	1.0	2.9	5.7	1.2	2.9	5.4	10.4
Radio, television and communication equipment (32)	0.0	1.0	1.2	6.4	1.0	3.0	5.3	17.9
Medical, precision and optical instruments (33)	0.1	0.8	1.3	2.5	1.5	2.3	3.2	6.1
Motor vehicles, trailers and semi-trailers (34)	0.0	0.0	0.1	0.3	1.4	0.1	0.2	1.0
Other transport equipment (35)	0.0	0.5	5.0	13.7	6.7	7.8	13.8	23.3
Manufacturing n.e.c., including furniture (36)	2.5	6.5	8.6	13.2	3.7	6.3	8.9	14.9

Source: World Trade Analyzer, Statistics Canada

Table 4: Import penetration in Italy and US, by sector

Sector (NACE -Rev.1 code in parenthesis)	Italy				US			
	1992	1995	2000	2005	1992	1995	2000	2005
Food products and beverages (15)	14.7	16.7	16.8	17.6	5.4	5.6	7.1	8.5
Textiles (17)	16.4	19.2	22.8	27.6	15.1	16.7	28.5	39.5
Wearing apparel, dressing (18)	12.0	15.7	20.8	27.0	33.3	37.9	51.9	71.6
Leather, leather products and footwear (19)	15.0	20.2	27.8	31.1	65.0	71.6	79.5	92.1
Wood and products of wood and cork (20)	14.8	16.9	17.3	17.6	11.5	12.8	15.8	19.6
Pulp, paper and paper products (21)	23.0	28.8	28.9	28.5	8.3	9.9	11.4	12.9
Printing, publishing and reproduction (22)	2.9	5.0	7.0	6.9	1.4	1.7	1.7	2.0
Chemicals and chemical products (24)	32.0	37.9	43.1	49.1	10.1	12.5	17.7	21.8
Rubber and plastics products (25)	15.6	15.9	17.9	19.7	9.2	10.2	12.9	17.5
Other non-metallic mineral products (26)	7.7	10.0	9.7	8.9	9.8	11.4	14.2	16.3
Basic metals (27)	35.5	38.4	45.7	47.5	16.4	18.9	25.4	27.4
Fabricated metal products (28)	5.2	5.3	6.1	6.0	5.7	6.5	8.5	11.5
Machinery, n.e.c. (29)	22.7	28.2	31.4	31.5	23.1	26.0	29.8	38.6
Electrical machinery (31)	18.8	23.5	26.4	25.2	23.4	28.4	38.4	47.7
Radio, television and communication equipment (32)	33.9	44.8	58.6	59.8	32.1	37.2	40.0	54.9
Medical, precision and optical instruments (33)	42.8	46.5	52.0	51.3	21.4	27.2	42.8	46.7
Motor vehicles, trailers and semi-trailers (34)	52.9	54.3	57.4	66.5	25.9	25.3	30.4	34.1
Other transport equipment (35)	30.4	24.2	45.9	35.9	13.1	14.5	25.8	23.0
Manufacturing n.e.c., including furniture (36)	10.9	12.3	15.5	15.8	19.8	21.8	28.0	31.6

Source: our elaborations on OECD data

Table 5: Univariate regression

	(1)	(2)	(3)	(4)
ΔCHINA_IT	-0.001	-0.005***	-0.000	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.021***	0.021***	0.018***	0.017***
	(0.001)	(0.003)	(0.002)	(0.003)
Year FE	no	yes	no	yes
Sector FE	no	no	yes	yes
Observations	6345	6345	6345	6345
R^2	0.000	0.091	0.010	0.101
P-value test F(all year FE = 0)		0.000		0.000
P-value test F(all sector FE = 0)			0.000	0.000

Notes: OLS estimates. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 6: Base Regression

	OLS		IV			First stage IV	
	(1)	(2)	(3)	(4)		(5)	(6)
ΔCHINA_IT	-0.005*	-0.004	-0.030***	-0.035***	ΔCHINA_WRL	1.00***	0.761***
	(0.002)	(0.002)	(0.009)	(0.012)		(0.190)	(0.191)
ΔIMPEN	-0.004*	-0.005***	-0.004	-0.006**		-0.060	-0.053
	(0.002)	(0.002)	(0.003)	(0.003)		(0.053)	(0.041)
ΔCONC	-0.001	-0.000	-0.001	-0.000		0.018	0.011
	(0.005)	(0.006)	(0.006)	(0.006)		(0.051)	(0.057)
ΔDEM	0.002	0.003	0.002	0.003		-0.002	0.013
	(0.008)	(0.008)	(0.008)	(0.008)		(0.034)	(0.028)
ΔSIZE	0.180**	0.188**	0.183***	0.180***		-0.097	-0.348
	(0.072)	(0.073)	(0.068)	(0.070)		(0.441)	(0.362)
ΔIC	0.023***	0.023***	0.023***	0.021***		-.015	-.054
	(0.006)	(0.006)	(0.006)	(0.005)		(0.069)	(0.073)
ΔW	0.002	0.004	0.006	0.009		0.135	0.157
	(0.010)	(0.011)	(0.011)	(0.012)		(0.103)	(0.111)
ΔTFP	0.004	0.004	0.002	0.002		-0.099	-0.077
	(0.005)	(0.005)	(0.005)	(0.005)		(0.063)	(0.049)
Constant	0.021***	-0.006	0.031***	0.035***		0.244	0.869***
	(0.003)	(0.004)	(0.005)	(0.005)		(0.206)	(0.189)
Sector FE	no	yes	no	yes		no	yes
F- stat	-	-				27.82	15.94
R^2	0.099	0.147					
Observations	6345	6345	6345	6345		6345	6345

Notes: In columns 1 and 2 OLS estimates of equation 3; in columns 3 and 4 IV estimates of equation 3 where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$; in columns 5 and 6 first stage IV regressions. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In column 2 and 4 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. F-stat refers to the F-statistics of excluded instruments from the first stage estimation of $\Delta CHINA\_IT$ on $\Delta CHINA\_WRL$ and all the explanatory variables included in the second stage.

*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 7: Instrumenting import penetration

	(1)	(2)
ΔCHINA_IT	-0.029***	-0.035***
	(0.009)	(0.012)
ΔIMPEN	-0.009**	-0.009**
	(0.004)	(0.005)
ΔCONC	-0.000	0.000
	(0.006)	(0.006)
ΔDEM	0.002	0.003
	(0.008)	(0.008)
ΔSIZE	0.183***	0.180***
	(0.068)	(0.070)
ΔIC	0.023***	0.021***
	(0.006)	(0.005)
ΔW	0.006	0.009
	(0.011)	(0.012)
ΔTFP	0.002	0.002
	(0.005)	(0.005)
Constant	0.031***	0.035***
	(0.005)	(0.005)
Sector FE	no	yes
Observations	6345	6345

Notes: IV estimates of equation 3 where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$ and $\Delta IMPEN$ by $\Delta IMPEN\_US$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In column 2 the regression includes sectoral fixed effects. The explanatory variables are described in sections 3 and 4
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 8: Firms' exit

	liquidation or bankruptcy		liquidation, bankruptcy or acquisition	
	(1)	(2)	(3)	(4)
ΔCHINA_IT	-0.030***	-0.035***	-0.030***	-0.035***
	(0.009)	(0.012)	(0.009)	(0.013)
ΔIMPEN	-0.004	-0.006**	-0.004	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
ΔCONC	-0.001	-0.000	-0.001	-0.000
	(0.006)	(0.006)	(0.005)	(0.006)
ΔDEM	0.002	0.003	0.002	0.003
	(0.008)	(0.008)	(0.008)	(0.008)
ΔSIZE	0.180***	0.178**	0.184***	0.183***
	(0.069)	(0.070)	(0.067)	(0.068)
ΔIC	0.023***	0.021***	0.023***	0.021***
	(0.006)	(0.005)	(0.006)	(0.005)
ΔW	0.006	0.009	0.006	0.009
	(0.011)	(0.012)	(0.011)	(0.012)
ΔTFP	0.002	0.002	0.002	0.002
	(0.005)	(0.005)	(0.005)	(0.005)
EXIT	-0.003	-0.002	0.000	0.001
	(0.003)	(0.003)	(0.002)	(0.002)
Constant	0.032***	0.036***	0.031***	0.035***
	(0.005)	(0.005)	(0.005)	(0.005)
Sector FE	no	yes	no	yes
Observations	6345	6345	6345	6345

Notes: IV estimates of equation 3 where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In column 2 and 4 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. In columns 1 and 2 the dummy EXIT is equal to 1 if the firm is liquidated or go bankrupt after exiting the sample and 0 otherwise; in columns 3 and 4 it is equal to 1 also for firms that is subsequently acquired by another firm.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 9: Outliers

	>20 firms		1996-2006	
	(1)	(2)	(3)	(4)
ΔCHINA_IT	-0.030***	-0.034***	-0.044**	-0.053*
	(0.010)	(0.012)	(0.018)	(0.030)
ΔIMPEN	-0.003	-0.005**	-0.003	-0.004***
	(0.002)	(0.002)	(0.002)	(0.002)
ΔCONC	-0.001	-0.000	-0.005	-0.004
	(0.005)	(0.006)	(0.003)	(0.004)
ΔDEM	0.002	0.003	-0.002	-0.000
	(0.009)	(0.009)	(0.009)	(0.008)
ΔSIZE	0.183***	0.182**	0.237***	0.234***
	(0.069)	(0.071)	(0.070)	(0.076)
ΔIC	0.023***	0.022***	0.014**	0.012**
	(0.006)	(0.005)	(0.006)	(0.006)
ΔW	0.004	0.007	0.026**	0.031**
	(0.011)	(0.012)	(0.012)	(0.013)
ΔTFP	0.004	0.004	-0.002	-0.002
	(0.005)	(0.005)	(0.003)	(0.003)
Constant	0.030***	0.034***	0.057***	0.063***
	(0.005)	(0.004)	(0.015)	(0.017)
Sector FE	no	yes	no	yes
Observations	6145	6145	5076	5076

Notes: IV estimates of equation 3 where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In column 2 and 4 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. In columns 1 and 2 we exclude sector-year cells with less than 20 firms; in columns 3 and 4 the equation is estimated on the subperiod 1996-2006.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 10: Domestic vs exporting firms

	exports<30%		weighted regression	
	(1)	(2)	(3)	(4)
ΔCHINA_IT	-0.042***	-0.057***	-0.036***	-0.045***
	(0.012)	(0.016)	(0.011)	(0.014)
ΔIMPEN	-0.009**	-0.009**	-0.006**	-0.008**
	(0.004)	(0.004)	(0.003)	(0.003)
ΔCONC	-0.001	-0.003	0.000	0.000
	(0.005)	(0.006)	(0.005)	(0.005)
ΔDEM	0.010	0.013	0.005	0.006
	(0.014)	(0.015)	(0.011)	(0.011)
ΔSIZE	0.070	0.099	0.162**	0.167**
	(0.090)	(0.095)	(0.075)	(0.079)
ΔIC	0.027***	0.024***	0.026***	0.024***
	(0.009)	(0.009)	(0.007)	(0.007)
ΔW	0.022	0.032	0.014	0.020
	(0.019)	(0.022)	(0.014)	(0.015)
ΔTFP	-0.006	-0.004	-0.000	0.000
	(0.006)	(0.006)	(0.005)	(0.005)
Constant	0.058***	0.073***	0.053***	0.061***
	(0.013)	(0.013)	(0.012)	(0.011)
Sector FE	no	yes	no	yes
Observations	2905	2905	6045	6045

Notes: IV estimates of equation 3 where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In columns 2 and 4 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. In columns 1 and 2 we exclude firms that at (t-1) have exported more than 30 per cent of their total sales; in columns 3 and 4 the equation is estimated weighting observations by the share of domestic out of total sales.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 11: RD and skill intensity, US 1998

Sector (NACE -Rev.1 code in parenthesis)	R&D intensity	Skill intensity
Food products and beverages (15)	0.01	0.16
Textiles (17)	0.01	0.10
Wearing apparel, dressing (18)	0.01	0.14
Leather, leather products and footwear (19)	0.01	0.09
Wood and products of wood and cork (20)	0.01	0.08
Pulp, paper and paper products (21)	0.02	0.17
Printing, publishing and reproduction (22)	0.02	0.34
Chemicals and chemical products (24)	0.14	0.41
Rubber and plastics products (25)	0.03	0.15
Other non-metallic mineral products (26)	0.02	0.14
Basic metals (27)	0.02	0.14
Fabricated metal products (28)	0.02	0.12
Machinery, n.e.c. (29)	0.06	0.16
Electrical machinery (31)	0.12	0.21
Radio, television and communication equipment (32)	0.22	0.36
Medical, precision and optical instruments (33)	0.36	0.38
Motor vehicles, trailers and semi-trailers (34)	0.13	0.20
Other transport equipment (35)	0.24	0.33
Manufacturing n.e.c., including furniture (36)	-	0.16

Source: EU KLEMS, OECD STAN, Year 1998. RD and skill intensity are defined in sections 6.2

Table 12: Sector heterogeneity

	LOWSK (1)	*LOWSK* (2)	*LOWRD* (3)	*LOWRD* (4)
ΔCHINA_IT	-0.031***	-0.036***	-0.032***	-0.033***
	(0.010)	(0.013)	(0.010)	(0.011)
ΔCHINA_IT*SECT	0.012	0.012	-0.035*	-0.040*
	(0.015)	(0.016)	(0.020)	(0.021)
SECT	0.005	0.005	0.001	0.029***
	(0.003)	(0.003)	(0.003)	(0.010)
ΔIMPEN	-0.004	-0.006**	-0.004	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
ΔCONC	-0.001	-0.000	-0.002	-0.001
	(0.006)	(0.006)	(0.006)	(0.006)
ΔDEM	0.002	0.003	-0.000	0.002
	(0.008)	(0.008)	(0.009)	(0.009)
ΔSIZE	0.179***	0.181***	0.187***	0.189***
	(0.067)	(0.070)	(0.070)	(0.071)
ΔIC	0.023***	0.021***	0.022***	0.021***
	(0.006)	(0.005)	(0.005)	(0.005)
ΔW	0.005	0.009	0.007	0.010
	(0.011)	(0.012)	(0.012)	(0.012)
ΔTFP	0.001	0.002	0.002	0.003
	(0.005)	(0.005)	(0.006)	(0.005)
Constant	0.028***	0.032***	0.031***	0.028***
	(0.004)	(0.006)	(0.006)	(0.006)
Sector FE	no	yes	no	yes
Observations	6345	6345	6089	6089

Notes: IV estimates where $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In columns 2 and 4 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. The variable SECT is equal to LOWSK in columns 1 and 2 and to LOWRD in columns 3 and 4. LOWSK is a time-invariant dummy variable equal to 1 for firms belonging to sectors with skill intensity below the median value of 0.14; LOWRD is a time-invariant dummy variable equal to 1 for firms belonging to sectors with R&D intensity below the median value of 0.04. More details on skill and R&D intensity are provided in section 6.2.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

Table 13: Firm and sector heterogeneity

	LOWSK		*LOWRD*		restricted sample	
	(1)	(2)	(3)	(4)	(5)	(6)
ΔCHINA_IT	-0.031***	-0.034**	-0.032***	-0.033**	0.004	-0.000
	(0.011)	(0.016)	(0.011)	(0.014)	(0.044)	(0.044)
ΔCHINA_IT*SECT	0.005	0.004	-0.022	-0.027		
	(0.021)	(0.026)	(0.059)	(0.058)		
ΔCHINA_IT*SMALL	0.013	0.007	0.040	0.038	-0.116**	-0.118**
	(0.032)	(0.035)	(0.042)	(0.042)	(0.048)	(0.047)
ΔCHINA_IT*SECT*SMALL	-0.090**	-0.079*	-0.139**	-0.137**		
	(0.043)	(0.046)	(0.060)	(0.059)		
SECT	0.003	0.003	0.002	0.038**		
	(0.003)	(0.004)	(0.006)	(0.016)		
SMALL	-0.002	-0.001	-0.012	-0.010	0.006	0.006
	(0.006)	(0.007)	(0.009)	(0.009)	(0.007)	(0.007)
SMALL*SECT	0.004	0.001	0.017*	0.016		
	(0.007)	(0.008)	(0.010)	(0.010)		
ΔIMPEN	-0.003	-0.005	-0.003	-0.005	0.038	0.026
	(0.003)	(0.004)	(0.003)	(0.004)	(0.024)	(0.021)
ΔCONC	0.002	0.002	0.002	0.001	-0.017**	-0.016**
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
ΔDEM	0.003	0.004	0.002	0.003	0.009	0.010
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
ΔSIZE	0.193***	0.196***	0.206***	0.208***	0.299***	0.268**
	(0.071)	(0.073)	(0.075)	(0.077)	(0.102)	(0.114)
ΔIC	0.023***	0.022***	0.022***	0.021***	0.012***	0.012***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)
ΔW	-0.001	0.002	-0.001	0.001	0.040***	0.037***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)	(0.012)
ΔTFP	0.003	0.003	0.004	0.004	0.005	0.005
	(0.006)	(0.006)	(0.007)	(0.007)	(0.011)	(0.011)
Constant	0.030***	0.033***	0.031***	0.025***	0.024***	0.028***
	(0.004)	(0.005)	(0.007)	(0.006)	(0.004)	(0.005)
Observations	6345	6345	6089	6089	1382	1382

Notes: IV estimates. $\Delta CHINA\_IT$ is instrumented by $\Delta CHINA\_WRL$. Robust standard errors clustered at the sectoral level (2 digits of the Nace Rev.1 classification) are reported in brackets below the coefficients. In columns 2, 4 and 6 the regressions include sectoral fixed effects. The explanatory variables are described in sections 3 and 4. SMALL is a dummy variable equal to 1 for firms with less than 80 employees at (t-1). For the variable SECT see the note to Table 12.The restricted sample includes textile, apparel, leather products, other manufacturing.
*** identifies significance of the coefficient at 1 per cent; ** identifies significance at 5 per cent, * identifies significance at 10 per cent.

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