Trade, Tariffs and Total Factor Productivity: the case of Spanish firms

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Abstract

The aim of this paper is to examine the sensibility of total factor productivity (TFP) to foreign competition in the case of a European country. We use data for Spanish manufacturing firms and measure TFP using Olley and Pakes (1996) method in order to study the impact of EU tariffs, foreign competition and imports at the firm level. We apply system GMM method to show that European tariffs and presence of foreign products have respectively negative and positive impacts on TFP. Moreover, these two effects are complementary. Another important finding is that importing firms benefit from additional productivity improvements. We also find evidence of important asymmetries among firms depending on their involvement with foreign markets.

Keywords Total factor productivity, Spain, trade, tariffs, heterogeneity of firms.

JEL codes: F12

Introduction

The gains that may be obtained from trade in terms of growth crucially depend on the impact of trade on productivity. This relation is challenged by new micro evidence thanks to firm-level data. Tybout and Westbrook (1995) proposed a useful decomposition of the potential productivity improvements at the micro level. They distinguish three possible sources of productivity gains. The first one comes from the exploitation of scale economies (often designed as pro-competitive effect). The second one refers to the market-share effect and describes the reallocation of resources among firms in favour of the most productive ones. The third one is a residual effect referring to the other possible sources of productivity like learning-by-doing and externalities, technical innovation through imports of intermediate goods and managerial effort[1]. Thus, taking into account heterogeneous behaviours of firms may shed new lights on the possible channels between trade liberalisation and productivity gains[2] although country and industry specificities may also be important to explain different impact of the same trade liberalisation process[3].

In recent years, a big work has been made to investigate trade liberalisation channels at the firm level in developing countries under trade liberalisation process[4]. A

[1] These possible effects of foreign exposure on productivity at the industry level have been evidence by different theoretical models. Krugman (1979) and Helpman and Krugman (1985) suggested that openness ensure external and internal externalities; Leibenstein (1966) and Schmidt (1997) focussed on the reduction of X-inefficiency. Grossman and Helpman (1991), Ethier (1982), Markusen (1989) pointed that foreign competition may also affect the incentives to innovate; increase technology transfers or raise intra-firm productivity through an increase in the variety of intermediate inputs or capital goods due to higher quality and/or better technology. Openness can also foster technological spillovers through FDI (Coe and Helpman, 1995).

[2] Unlike most trade models that use a representative firm framework and assume that macroeconomic context affects all firms symmetrically, Melitz (2003), Bernard et al. (2003), Yeaple (2005) and Bernard et al. (2003) include firms' heterogeneity in a trade model to analyse the consequences of a decrease in trade costs. They conclude that a decrease in trade costs will lead to a reallocation of endowments among domestic firms: least efficient domestic firms may exit the market while the most efficient firms start to export or expand their sales, increasing the number of exporters and the volume of exports. As a consequence, market shares of the surviving domestic firms will diminish and productivity at the industry-level will be pulled up. However, these models do not directly contemplate the effect of the decrease in trade costs on intra-firm productivity. Bernard, Jensen and Schott (2006) offer strong support for their main conclusions.

[3] For instance, Vogel (2007) suggests that the quality of institutions may explain the unequal effect of trade liberalisation on growth.

[4] Focussing on trade liberalisation period offers strong advantage but could hide some response of the productive sector that may occur in a medium term since specialisation may be a long dynamic process (Cuñat and Maffezzoli, 2007).

first generation of studies used various measures of efficiency and obtained mixed results[5]. It arises from the previous studies that measures of productivity and openness are crucial to address this issue. More recent studies have tried to overcome the possible endogeneity bias in the estimation of the total factor productivity (TFP) by using the Olley and Pakes (1996) method. This method corrects the simultaneity bias arising from the fact that firms choose their level of input once they know their level of productivity. This is the case of the studies of Pavcnik (2002), Schor (2004), Topalova (2004), Amiti and Konings (2005) and Fernandez (2006) respectively for Chile, Brazil, India, Indonesia and Columbia. These studies also use more precise measures for openness by using explicitly tariffs and find in general a negative relationship between tariffs and TFP. Pavcnik (2002) finds also robust evidence that foreign competition both reduces the market share of import-competing firms and reallocates resources from inefficient to efficient firms. The other studies of Schor (2004), Amiti and Konings (2005) and Fernandes (2007) also investigate the channels through which these effects operate. For Columbia, Fernandes (2007) find that TFP gains are larger for large firms and in less competitive industries. They are also positively linked to imports of inputs. Schor (2004) and Amiti and Konings (2005) take into account tariff on inputs in their study and find a substantial negative effect of this variable on TFP. Depending on their dataset, these studies investigate the effect of some observed characteristics of firms and generally find an important heterogeneity among firms in their response to trade liberalisation.

As pointed by Trefler (2004), there is a lack of evidence for industrialised countries and for countries that engage in bilateral free trade. Studying the Canada-US free trade agreement, he finds that liberalisation leads to large labour productivity gains. Another motivation to focus on industrialised country or transition economies is that the diffusion of technology and knowledge through the acquisition of intermediary goods or exchange of goods is more willing to occur among countries that are very close and have flexible markets (Eaton and Kortum, 1996). Finally, according to the debate about the complementarity or substitutability of regionalism and multilateralism, it is important to

[5] Tybout and Westbrook (1991) find little evidence of intra-firm productivity improvements after the Chilean liberalisation. Harrison (1994) for the Ivory coast finds foreign competition forces down mark-ups among firms. Using the same methodology, Krishna and Mitra (1998) find more weak evidence for India. Using the above mentioned decomposition, Tybout and Westbrook (1995) find that increases in openness are associated with relatively small scale efficiency but significant "residual" gains in Mexico. Driffield and Kambhampati (2003) show that the increase of firm's imports did not raise efficiency in the case of Indian firms.

check the sensibility of members of the trading blocks to the external tariffs. Indeed, if large amount of trade takes place among the partners inside the FTA, the detrimental effect of external tariffs may not be so obvious since the intra-block market is large[6].

This paper aims at contributing to the above empirical literature studying the case of a European country. We focus on the effect of tariffs and foreign competition on TFP of Spanish manufacturing firms[7]. Our dataset covers the period 1991-2002. This period can be considered as a post-liberalisation period for the Spanish economy since the last big part of trade liberalisation occurred during the 1980s and the dismantling of trade barriers in the framework of the adhesion to the European Economic Community (EEC) ended in 1992. A massive reallocation process among industries, labour markets and political reforms and dismantling of capital flows restriction marked the 1980s. After the 1992 crisis of its exchange rate, Spain experienced an exceptional growth of its openness ratio without facing big imbalances all over the period. Its trade with the EU and especially intra-industry trade increased sharply.

As most recent studies, we follow a two-step strategy. First, we use Olley and Pakes (1996) method to estimate a total factor productivity of plants. In a second step, we estimate an equation where TFP is explained by a set of characteristics of the firms and trade policy indicators. Thus, our empirical approach differs from previous studies in two manners. First, unlike most studies except Fernandes (2007), we control for lagged productivity since we believe that TFP determinants are highly persistent. In contrast to Fernandes (2007) who run OLS and fixed effects estimations of this equation accounting for plant fixed effect, we use dynamic panel data techniques. Indeed, our data set allows us to take into account other crucial observable characteristics of the firms that may influence their reaction to trade like import and export intensities. However, these characteristics are not strictly exogenous and fixed-effect estimations may lead to biased and inconsistent estimates. We prefer then the system – GMM method proposed by Blundell and Bond

[6] Frankel et al. (1996), Wei (1996) and Panagariya and Krishna (2002) are some articles that illustrate the debate about regionalism versus multilateralism

[7] For Spain, as far as we know the link between intensification of trade and productivity has not been studied at the firm level. Most studies have focused on the relationship between productivity and exports where productivity are estimated using index method or stochastic frontier method or approximated by value added per worker (Barrios et al., 2004; Barrios and Strobl, 2003; Fariñas and Martin-Marcos, 2007; Campa, 2004; Merino and Salas, 2002;. Salomon and Shaver, 2005; Mañez et al., 2004; Huergo and Jaumandreu, 2004. Delgado, Fariñas and Ruano (2002), Fariñas and Ruano (2004 and 2005) study productivity distributions.

(1998) to deal with this issue. Another possibility is proposed by Fernandes and referred as the direct approach. It consists in introducing trade policy indicators and all characteristics in the first equation of the production function. Thus, since trade policy indicators has an industry dimension, this leads to estimate production function pooling firms across industries and years and assuming that input coefficients are common across industries. Thus, she finally finds that there is no strong difference between the direct and indirect approaches.

We use two different measures for openness for each industry: MFN tariffs of the EU and Spanish import penetration rate (IPR). Another important distinctive feature of our study is that these two measures are not substitutes due to the characteristics of the country under study. The first one is the result of EU negotiations with GATT members. It is a direct component of third country prices while EU countries are granted duty-free access in the EU market. Thus, IPR brings some additional information since it measures the degree of foreign competition in the Spanish market taking into account the growing import flows from third countries but also from the EU.

We address at least three questions. First, do trade policy indicators directly affect productivity of Spanish firms? We find that TFP is negatively impacted by European tariffs and positively benefits from presence of foreign products. Moreover, these two effects are complementary. Secondly, is there evidence of TFP gains via imports of inputs? We find evidence of additional productivity gains for importing firms. Third, are there some asymmetries among firms in the sensibility to these trade openness indicators? We find that the impact of exposure to trade and sensibility to tariffs differ sharply among firms by exploring not only the productivity variation over time but also across firms with different involvements in foreign markets.

The paper is organised as follows. Section 1 presents some important stylized facts concerning Spanish trade liberalisation. Section 2 presents the data and the empirical methodology. Results are displayed and analysed in Section 3, and Section 4 provides some tentative conclusions and possible developments for this analysis.

1 Stylised facts

According to the agreement between Spain and the EEC, the dismantling of trade barriers among members started in 1986. For products for which the difference between Spanish tariff rates and the Common external rate (CET) was inferior to 15%, CET was applied straightforward. For the rest of the products, they follow a progressive dismantling that ended up in 1993. Initial tariffs for manufacturing products (except for the one with agricultural components) are summarised in Table A.1. The Spanish average tariff for non-agricultural products was 12,33% for products from the EEC and 16,44% from third countries. The dismantling of tariff barriers was accompanied by a dismantling of quantitative restrictions, a new VAT tax and suppression of ICGI (tax of internal compensation that consisted in a lower tax on sales for locally produced products). The amount of taxes on imports (effective rate) in 1985 was estimated at 5.44% while the ICGI brought 7.81% of imports' value. The suppression of ICGI had a great dismantling effect (Cañada et al. 1991). Globally, the dismantling effect was estimated to round 35-40%.

Quantitative restrictions with the EEC members were generally eliminated and Spain had to maintain the same barriers as the EEC for third countries. However, there was a large list of exceptions for “sensitive products”. Among others, Spain was allowed to maintain quantitative restrictions during three additional years for cars, metal, naves, TV, textiles, wearing (see Tamames R., 1987).

Although, Spanish tariffs were completely adapted to EEC norms at the end of 1992, the dismantling was just the beginning of Spanish trade taking-off. Concerning the sectors that cover our data, the average of export to output ratio increased from 27% to 39% between 1991 and 2002 and the average import to output ratio from 18% to 32%. Amazingly, the trade deficit has remained stable over the period (5.8% PIB) what can be considered as a successful integration experience. These data confirm that the Spanish case over the period 1991-2002 is a very interesting case to study.

Trade intensification has occurred for electrical products, leather and leather products, vehicles, plastic and rubber products and other transport equipments. The basic metal sector has also intensified his trade but mainly due to imports and the food and tobacco sector mainly due to exports. The chemical sector, wood, paper, textile and textile

products and other manufactured products have increased their exports and their imports but not strongly. For the others, trade has been stable.

To sum-up, Spanish comparative advantage patterns has changed over the period (Table A.2). Agriculture and food products, other non-metallic products and vehicles are clearly the new advantages of Spain. In the case of the first one, the entry into the EU has consisted in an increase of the protection. Textiles and leather products can be considered as old advantages. The traditional disadvantages have increased in energy, mining, machinery and office equipment.

For the period under study 1991-2002, Spanish tariffs were already adapted to the External tariff rate. We use MFN tariff. Due to the application of the different cycles of the GATT (Tokyo Round, Uruguay Round) EU tariff rate slightly diminish all over the period. They are higher in Food products (42%) and range from 4% to 10% in the remaining industries. Tariffs for 1991 and 2002 by industry are displayed in Table 3.

2 Empirical strategy

2.1 Spanish annual survey for manufacturing firms

The Encuesta sobre Estrategias Empresariales (ESEE) is an annual survey of Spanish manufacturing firms carried out by the SEPI Ministry of Industry. The ESEE is representative of the Spanish manufacturing firms classified by industrial sector and size categories[8] and includes exhaustive information at the firm level. The ESEE offers detailed data on balance sheet, sales, inventories and materials, volume of exports and imports among others. For each firm, we know the region it is located in and the sector of the NACE-93 classification. We cleaned the data to correct or eliminate problems due to non-reporting or misreporting. The bigger part of dropped observations corresponding to 1990 (too incomplete) and non-reporting value for fixed assets. The total number of firms in the

[8] Participation rate to the survey is about 70% for firms with more than 200 employees. Firms that employed between 10 to 200 (small firms) were randomly sampled by industry and size strata holding around a 5% of the population.

database attained 3462. At the end of our cleaning process, the sample consists in 3107 firms[9] (20882 observations for the period 1991-2002).

2.2 Productivity measurement

As mentioned above we follow a two-step strategy that became relatively standard in previous studies like Pavcnik (2002), Schor (2004), Topalova (2004), Amiti and Konings (2005) and Fernandez (2006). The first step consists in inferring TFP at the firm level as the difference between the observed output and the output-predicted function. The main point consists in choosing the most accurate estimation of the production function. In general, there are two types of productivity measurement, parametric methods and non-parametric methods. In contrast to the parametric methods, the non-parametric approaches are flexible in the specification of technology but they do not allow for measurement errors in the data. Among all parametric methods, we adopt the one proposed by Olley and Pakes (1996) as many recent articles do. It solved the simultaneity bias assuming that investment is a proxy[10] for the unobserved productivity shocks and it also controls for the selection bias. This is another contribution of our paper since, as far as we know, it hasn't been performed yet for Spain.

Let us suppose that the technology of firm *i* is well described by a Cobb-Douglas production function:

$$y_{it} = \beta_0 + \beta_t l_{it} + \beta_m m_{it} + \beta_k k_{it} + \omega_{it} + \eta_{it} \qquad (1)$$

where y_{it} is the logarithm of the firm's output, l_{it} the logarithm of the input labour, m_{it} the logarithm of the intermediary consumptions and k_{it} is the logarithm of the capital. The error as two components, the plant-specific productivity component given as ω_{it}, and η_{it}, an error term that is uncorrelated with input choices. The investment function is given as:

$$i_{it} = i_{it}(\omega_{it}, k_{it}) \qquad (2)$$

The investment function is monotonically increasing in ω_{it} (Pakes, 1994). This permits:

$$\omega_{it} = h_{it}(i_{it}, k_{it}) \qquad (3)$$

[9] Some summary statistics are displayed in Table 1.

[10] Since there are less zero-investment values in our sample than in a sample of firms from developing countries we are able to build a consistent measure of productivity. Moreover, production function estimations without zero-investment values are close to the estimations with zero-investment values.

The higher the productivity is, the higher the investment will be. So, the production function can now be expressed as:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \phi_{it}(i_{it}, k_{it}) + \eta_{it} \qquad (4)$$

Where

$$\phi_{it}(i_{it}, k_{it}) = \beta_0 + \beta_k k_{it} + h_{it}(i_{it}, k_{it}) \qquad (5)$$

Then, we can approximate the unknown function, ϕ_{it}, by a fourth order polynomial in k_{it} and i_{it}. In the first stage, β_l, β_m and ϕ_{it} are estimated and the second stage evaluate the survival probability of the firm, P_{it}. The third stage of the routine identifies the coefficient β_k where productivity is assumed to evolve according to a first-order Markov process: $\xi_{it+1} = \omega_{it+1} - E[\omega_{it+1} | \omega_{it}, X_{it+1} = 1]$, with $\xi_{it+}1$ the innovation in $\omega_{it}+1$. This final stage uses the estimations of β_l, β_m, ϕ_{it} et P_{it} to obtain β_k:

$$y_{it+1} - \hat{\beta}_l l_{it+1} - \hat{\beta}_m m_{it+1} = \beta_k k_{it+1} + \tilde{g}(\hat{P}_{it}, \hat{\phi}_{it} - \beta_k k_{it}) + \xi_{it+1} + \eta_{it+1} \qquad (6)$$

Finally, we use the input coefficients to build a measure of firm productivity as in Olley and Pakes (1996) and Pavcnik (2002). This index is calculated by subtracting the productivity of a reference plant from an individual firm's productivity, measured as the difference between its predicted output and its actual output at time t[11]. The reference firm is constructed with the mean output and the mean input level in the based year. We obtain:

$$TFP_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_k k_{it} - (y_r - \hat{y}_r) \qquad (7)$$

Where y_r is the average of the log output of firms in 1991 ($y_r = \bar{y}_{it}$) and $\hat{y}_r$ is the predicted mean log output in 1991 ($\hat{y}_r = \hat{\beta}_l \bar{l}_{it} + \hat{\beta}_m \bar{m}_{it} + \hat{\beta}_k \bar{k}_{it}$). This index represents the deviation of a firm from the mean industry practice in a base year. Coefficients are reported in Table 2 for 17 industries. Coefficients are significant at the 1-% level in most cases and range in similar intervals as others studies.

[11] This index is transitive and insensitive to the units of measurement.

We also measure the aggregated productivity growth by sector as in Olley and Pakes (1996) and in Pavcnik (2002). Results are reported in terms of growth relative to 1991 (Table 4). They decomposed the aggregate productivity growth as:

$$\Delta TFP_{jt} = \overline{TFP}_{jt} + \sum_i \left(s_{ijt} - \bar{s}_{jt}\right)\left(TFP_{ijt} - \overline{TFP}_{jt}\right) \quad (8)$$

where the bar over a variable denote a mean of the industry *j*, s_{ijt} is the market share of the firm *i* in industry *j* and TFP_{ijt} is the log of the productivity of firm *i* in industry *j* measured as previously and $\Delta TFP_{jt} = TFP_{jt} - TFP_{jt-1991}$. We report aggregate productivity (column 1), unweighted productivity growth (column 2) and covariance (column 3). This enables us to appreciate if the productivity growth is due to the growth of productivity of firms and/or by a reallocation of the resources from the less to more productive plants (positive covariance). The aggregate productivity and the unweighted productivity increase from 1991 to 2002 in all sectors except food and tobacco. Sectors that have increased the most their productivity are the rubber and plastic products sector and the electrical and optical equipments sector. In all the Spanish sectors except food, metal products, office equipment and other manufactures, the reallocation contributes positively to the growth of productivity. In some sectors like wood, paper, plastics and rubber products, non-metallic mineral products and other transport equipment this reallocation explains the main part of the productivity growth. For the majority of sectors the aggregate productivity has increased between 15% to 33%.

This decomposition does not take into account the effect of entry and exit of firms. For this reason we implement the Foster, Haltiwanger and Krizan (1998) decomposition. They measure the total factor productivity of firms as:

$$TFP_{it} = y - \hat{\beta}_l l - \hat{\beta}_m m - \hat{\beta}_k k \quad (9)$$

This decomposition identifies five components of the aggregate productivity (Table 5):

$$\begin{aligned}\Delta TFP_{jt} = &\sum_{i\in C} s_{ijt-1991}\,\Delta TFP_{ijt} + \sum_{i\in C}\left(TFP_{ijt-1991} - TFP_{jt-1991}\right)\Delta s_{ijt} + \sum_{i\in C}\Delta TFP_{ijt}\,\Delta s_{ijt} \\ &+ \sum_{i\in N} s_{ijt}\left(TFP_{ijt} - TFP_{jt-1991}\right) + \sum_{i\in X} s_{ijt-1991}\left(TFP_{ijt-1991} - TFP_{jt-1991}\right)\end{aligned} \quad (10)$$

where *C* represents continuer firms, *N* entering firms and *X* exiting firms. TFP_{jt} is the weighted average TFP of the industry *j* in log with $\Delta TFP_{jt} = TFP_{jt} - TFP_{jt-1991}$.The first component represents the "within effect" calculated as the sum of firm-level productivity changes, weighted by its initial market share. The second component represents the

"between effect" (or the reallocation effect). It measures change in market shares weighted by the deviations of initial firm productivity from the initial overall industry average. The third component is the "compound effect" of the firm's productivity variations and market shares changes. Finally the last two terms represent the contribution of entering and exiting firms to TFP growth. This decomposition of the aggregate productivity in five components sheds new lights on the Spanish TFP growth process that complete the first decomposition proposed above. The "within effect" is always positive except for the leather sector. The average increase in weighted productivity of firms is important for textile, wood, paper, printing products, other non metallical mineral products, basic metals, machinery and equipment and other manufactured products. The higher are the initial market share of the firms that increase their productivity the higher will be this effect. The "between effect" is very often negative (12 sectors on 17) and has a poor contribution on aggregate productivity growth. This indicates that the majority of firms that increases their market share has a lower initial level of productivity than the initial overall industry average and/or the majority of firms with a decreasing market share has an upper level of productivity than the initial overall industry average. The "compound effect" for all the sectors except wood, paper, printing products and other manufactured goods, is positive. In these sectors most part of the firms has increased their productivity and their market share and/or has reduced their productivity and their market share from 1991 to 2002. In chemical products, machinery and equipment, vehicles and other transport equipment it seems to play an important role in the aggregate productivity growth. The effect of exit is very weak and mostly positive. The firms that exit our sample are not necessarily less productive than the average. On the opposite, the entrance of firms is positive and has a big impact on aggregate productivity growth of leather and leather products, wood, paper, rubber and plastics products and electrical and optical equipments. This result is in line with theoretical predictions according to which an increase in competition forces entering firms to have a higher level of productivity.

2.3 Empirical strategy

The second step consists in estimating the effect of trade policy indicators on TFP. Regarding the estimation techniques, fixed effects estimation that takes into account unobservable characteristics of firm may not be valid if explicative variables are not strictly exogenous. This must be a strong assumption concerning TFP since all

characteristics of firms are usually highly persistent and fixed-effect estimations may lead to biased and inconsistent estimates if the lagged level of TFP is correlated with the error term. The idiosyncratic shock, may adopt an autoregressive form, capturing factors such as omitted characteristics that persist or non-instantaneous adjustment. For this reason we use the Generalized Method of Moments (GMM) technique. Blundell and Bond (1998) show that when the dependent variable follows a path close to a random walk, the differenced-GMM (Arellano and Bond, 1991) has poor finite sample properties, and it is downwards biased, especially when T is small. Therefore, Blundell and Bond (1998) propose another estimator (the System- GMM) derived from the estimation of a system of two simultaneous equations, one in levels (with lagged levels as instruments) and the other in first differences (with lagged first differences as instruments). In multivariate dynamic panel models, the System- GMM estimator is shown to perform better than the differenced-GMM when series are persistent and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell and Bond. 2000). This estimation method allows us to assume that firm characteristics, tariffs and the import penetration rate are endogenous variables and use them as instruments. Thus to capture the impact of trade policy changes we use the following framework:

$$\begin{aligned} TFP_{it} &= \alpha_0 + \alpha_1 TFP_{it-1} + \beta' X^{C}_{it/it-1} + \gamma' X^{T}_{jt/jt-1} + \eta_t + (\eta_i + \mu_{it} + \varepsilon_{it}) \\ \mu_{it} &= \rho \mu_{it-1} + e_{it} \end{aligned} \qquad (11)$$

where TFP_{it} is a total factor productivity firm's indicator[12] as measured by equation 7, $X^{C}_{it/it-1}$ is a vector of firm's characteristics, $X^{T}_{jt/jt-1}$ is a vector of trade variables and η_t time specific effects which take into account macroeconomic shocks common to all firms. The error term is composed by an individual-specific effect η_i, a first-order autoregressive shock μ_{it} and an error term ε_{it}.

We check the impact of trade intensification using two trade variables: tariff rates and import penetration rates. For tariffs, we use MFN tariffs[13] of the EU at 2-digit level since Spain already adapted its tariffs to the CET in 1991. We choose to use the simple

[12] Industry indicators are not necessary in our regression analysis because the reference firm included in the total factor productivity measure has exactly the same utility. Integrate industry indicators would absorb the reference firm.

[13] Note that we find same results with the use of the AHS tariffs.

average of these indicators at the industry level since a weighted average (using imports or value added as weights) tends to underestimate tariffs. However, it could be argued that tariffs are endogenously determined but we think that using EU tariffs rate guarantees that there is a sufficient disconnection between the choice of these tariffs and Spanish lobbies. Tariffs are supposed to protect firms and should have a negative impact on TFP. We define Import Penetration Rate at the industry level for year t (IPR_{jt}) as the ratio between imports and imports plus production at the two-digit level. Since the IPR directly depends on the production of the industry, there is also a potential endogeneity bias in this case. Thus, we use the lagged value of tariffs and IPR to upset this issue. We also take into account the Herfindahl index calculated as the sum of the squared market share of firms for an industry. The higher the Herfindahl index, the less competitive is the market. We guess that in non-competitive industry, firms adjust their margins rather than their productivity so we expect a negative sign for this variable. In the same line, market share (as indicated by the firm) is an interesting variable. It gives a subjective view of the performance of the firm that can differ from the observed one mainly due to the fact that entrepreneur refers to a precise market in term of products while we refer to an industry as a whole. For the same reason we expect a negative sign.

An argument in favour of the integration in international markets is the potential additional gains that could be obtained via technology transfers through the access to more specialised capital and intermediary goods. To test this hypothesis we also include the import share of firms to explain firm's TFP and expect a positive impact of this variable. Another important expected result concerning bilateral trade liberalisation is that it allows better access to international market. However, Spanish producers were granted free-access from 1986, the rapid increase of Spanish export all over the 1990s is sufficient to think that the effects of the EU entry were diffused over time. It could be the case that a decrease in trade costs in the EU lowered the minimum of the productivity level of Spanish exporters. Though, there is strong evidence that Spanish exporters has been more productive than the others domestic producers since they had to adjust to an increasing competition in the foreign market. Another link between exports and productivity is more diffused and come from the connection to international market that could favour technical and knowledge diffusion. For all these reason we expect the export intensity to have a positive effect on TFP. Finally, the link between FDI and TFP appears robust in most studies for developing countries. It seems that some kind of joint venture or participation

of foreign companies brings new managerial abilities and techniques that benefit to TFP. We also include the foreign capital share that accounts for this effect.

3 Results

3.1 Average sensibility to protection and competition

Table 6 shows the results of the estimation of equation 11 using the system GMM method respectively for the import penetration rate, tariff and both indicators. To ensure the robustness of our results, we implement the same regressions with OLS and within groups (Table A.3). As expected OLS levels appears to give an upward-biased estimate of the coefficient of the lagged dependent variable whereas within groups give a downward-biased estimate of this coefficient. Estimations with GMM method are based on two-lagged variables as instruments. They were accepted by the results of the Sargan test for overidentifying restrictions[14].

Our results[15] show that IPR and tariff have respectively a positive and a negative impact[16]. These are in harmony with theoretical predictions though it was not so evident that in the case of a European country, the sensibility of TFP to tariff will be significant. More interesting is the fact that foreign competition measured by IPR and tariffs seems to have a complementary effect. Indeed, when we introduce both variables in the regression, there are both significant at the 1-% level, the coefficient of IPR remains the same while the one of tariff is lowered. One may ask if the potential correlation between the two variables bias these coefficients. Let us recall that EU tariff can be considered as exogenous for the Spanish economy and second apply for Spanish imports coming from non-EU countries. So, IPR doesn't have too much correlation with tariffs (30%). IPR

[14] The test of autocorrelation of order 1 and 2 of residuals represents the validity of the estimators and consist in the null hypothesis of no correlation of residuals in order 1 and 2. If the instrumental variable TFP_{it-2} is correlated with the error term, the estimation is biased. As a result, if the test of autocorrelation of order 1 can reject the null hypothesis of absence of autocorrelation, the test of order 2 cannot reject it. Here, the test of autocorrelation of order 2 is not rejected.

[15] Another important issue is the case of the Food sector that is highly protected by the EU. The entry of Spain into the EU consisted in a raise in the protection level toward third country and thus a reorientation of its import, production and export in this sector. Then, it could be the case that external tariff had protected Spanish firms from the international competition in this sector. We run the estimations excluding this sector and obtained similar results (available upon request) which confirms that the negative impact of protection on productivity is an important concern for European countries.

[16] Note that we find the same results when we exclude firms that appear only two or three years.

represents the presence of foreign products in this market and in particular of European products while tariffs are more a measure of government intervention and international prices.

These indicators offer complementary views of the competition effect namely the quantitative side of the competition pressure via an increase of the presence of imported products competing with domestic production and the price effect since tariff is a direct component of price. According to the last estimations that take into account both indicators, the sensibility is rather large: a 10% reduction in tariff will lead to an increase of 1.4% of TFP and an increase of IPR of 10% would lead to an increase of 2.2%. These results are very important since they confirm a high sensibility to price component although tariffs' levels are lower than in the eighties.

Concerning the effect of market structure, Herfindahl index calculated at the industry level has usually a negative sign or is not significant when we only consider tariffs. The characteristics of firms we introduced are significant and confirm, as other studies, that the productivity distribution is not a random but an explanatory process. The shares of exports in production and of foreign capital in total capital are included in estimations because exporters and foreign business companies are expected to be more productive than the average in general. The share of foreign capital has a positive and significant impact only at 10% level. The coefficient of the export to output ratio is positive and significant. Sometimes when the import to output is included, the export to output is not significant. The relatively low correlation between the two variables (31%) does not explain this unexpected result. It is possible the level of productivity is better explained by the participation in the export market than by the intensity of exports. Unexpectedly, the market share of the firm as indicated by the respondent of the survey has a positive effect on TFP.

3.2 Additional gains from imported inputs

Our results show that to the connection of firms in the international market influences their productivity level. The effect of tariffs and import penetration rates on productivity is often linked to the idea that competition accounts for the main source of trade liberalisation gains. However, the decrease of tariffs and non-tariff barriers generates a reduction of the price of imported inputs as well. It increases the amounts and the

diversity of the supply of inputs. Domestic firms can access to a wider range of qualities for their intermediate goods at lower prices and/or to unknown technologies. This technology transfer may improve their productivity as well. We investigate this issue by taking into account firm's import share. This variable has a positive and significant impact on TFP and the others coefficients are not affected by this new variable. We can conclude that Spanish manufacturing firms benefited from an additional positive effect of openness via imports. This "technological effect" is complementary to the previous two effects of protection and foreign competition analysed. In fact, IPR and Tariff still have a specific effect on productivity and importers do benefit from additional gains.

3.3 Asymmetries in the sensibility to protection and competition

It is especially interesting to study if trade variables affect the productivity of all firms in a similar way. Our previous results describe accurately the behaviour of the average but data at the firm level allow for a deeper analysis of heterogeneity of firms. In particular, firms may react differently depending on their size, origin of capital, export and import status. In this section, we propose further estimations to investigate this issue. To this aim, we interact trade openness indicators with dummies that distinguish among these types of firms. We consider as: *Large*, firms with more than 50 employees in its first year in the sample; *Foreign,* firms with more than 10% of the capital coming from abroad at least one year in the sample; *Exporters*, firms that export more than 10% of their production at least one year in the sample; *Importers*, firms that imported at least one year over the period. Results are displayed in Table 7.

Concerning size, our results show that presence of foreign products has a similar impact on the productivity of large and small firms. This interesting result suggests that largest firms have no special ability to take benefit from the intensification of trade. Concerning tariffs, differences are more clear-cut. Small firms are largely sensitive to tariffs while it is not significant for the largest firms. When we take into account import status (column 2), the technological effect appears clearer than above. While non-importing firms raise their productivity a 1.2 % if IPR increases a 10 %, importers' productivity raises a 2,4% in the same while. The first ones seem to be affected by a pure competition effect while the others benefit additionally from a technological effect. Firms that do not import are 2 times more sensitive to tariffs than importers. Importers take more

benefit of import competition than the non-importers and are less sensitive to tariffs. We find some similar asymmetries among exporters and non-exporters and among firms with or without foreign participation. Exporters take more advantage of foreign competition than non-exporters and are less sensible to tariffs. Th same result hold for small firms and firms with lower foreign participation whose TFP is more sensitive to tariffs than large and foreign firms (non-significant). More surprisingly, firms with foreign ownership take less benefit from foreign competition than others.

In sum, small firms and those that do not import or export or, firms with mainly domestic ownership react more negatively to tariffs. Tariff rates is a direct component of foreign products prices and the weakest firms (small firms, those who not exports or not imports or with mainly domestic ownership) react strangler to prices than the others. In fact, the robust firms (big firms, exporting and importing firms, firms with foreign participation) are more willing to produce under increasing returns. They face costs of production lower enough to decrease their prices via a reduction of their margin. On the opposite, the import penetration rate takes into account the reduction of non-tariffs barriers of trade and the intensification of trade inside the EU. A higher level of this variable represents more foreign products on the domestic market. When the number of foreign products increases, the range of varieties, available in the market raises. This process improves the quality of products and also can reduce the quantity sold by domestic firms. At this moment even the most competitive firms have to react to the intensification of competition. In other words, when an increase of trade influences foreign prices it does not influence the productivity of the most competitive firms but on the opposite, when there is a strong additional increase in the quantity imported and a quality improvement then, all the firms react strongly. Besides, among all the available inputs, the importers are able to match with their needs or to find inputs with better quality or with technologies still unknown. Therefore, firms that import benefit from additional technological effects on their productivity level.

All these mechanisms should not be contemporaneous to the openness process. Owing to the integration of their country in the EEC, firms could have anticipated the reduction of tariffs. This is a more vital process for the weakest firms since they are aware of their difficulties while the most productive firms do not need to improve so much their productivity to remain competitive. In the same line, the increase in foreign competition should have a dynamic effect: if the importing firms benefit from additional gains due to a

technological effect then these gains must still be perceptible one year after. To confirm the validity of these hypotheses concerning the behaviour of firms, we include the import penetration rate in (t-1) and tariffs in (t+1) in the estimations (Table 8). Only the small firms and firms without foreign capital improve their productivity according to future tariff rates. In the same way, non-exporting firms and importing firms react more strongly on their productivity than the others. Moreover, for the import penetration rate the difference in coefficient between importers and non-importers persist one year after. It exists a persistent link between imports and productivity through a technological effect.

Conclusions

During the last decade, Spain has experienced a rapid growth of external trade and is often viewed as an example for countries under transition process that fears to be unable to manage with large trade imbalances. In these conditions, increasing productivity and by the way, its competitiveness was and is a key issue that was not easy to manage with.

We show that TFP is negatively impacted by European tariffs and positively benefits from presence of foreign products. Moreover, these two effects are complementary. Another important finding is that importing foreign products has an additional positive impact on TFP and can be seen as a proof for a technological effect that allows for additional productivity improvements. However, the reactions are not the same for all type of firms and we were able to confirm this proposition of theoretical models since some firms are more sensitive than other to tariffs and competition in their market. In particular, small firms and firms that are not integrate in foreign market via exports, imports or ownership can be considered as more “sensitive” than others to tariffs reduction. The effect of competition pressure on TFP is similar for firms with different size. In contrast, importers and exporters take more advantage of foreign competition in terms of TFP gains than other firms.

Our paper concludes that, even in a European country like Spain with a relatively low level of protection, there are additional gains to expect to a move towards more liberalised trade. However, large part of the positive effect comes from the presence of foreign products and more indirect effects of openness rather than from tariffs' reduction.

Tables

Table 1 Summary statistics

Variables	Observations	Mean	Stand. Dev.
Production	20882	6 983 382	32 800 000
Number of Employees	20882	263	809
Intermediate consumption	20882	4 007 853	22 800 000
Capital	20882	3 240 820	15 400 000
Export intensity	20807	15.9	24.1
Import Intensity	20692	8.6	13.8
Share of foreign capital	20882	18.4	36.9
Tariffs	20882	9.9	11.9
Herfindahl	20882	7.6	4.6

Table 2: Production estimates with Olley and Pakes (1996) method

Industry	l	k	m	N
1 Food and tobacco	0.280***	0.163***	0.505***	2890
	(0.011)	(0.019)	(0.006)	
2 Textiles and textile products	0.401***	0.043**	0.433***	2232
	(0.012)	(0.018)	(0.006)	
3 Leather and leather products	0.273***	0.136***	0.488***	652
	(0.023)	(0.011)	(0.012)	
4 Wood	0.389***	0.278***	0.360***	526
	(0.029)	(0.022)	(0.017)	
5 Paper	0.292***	0.092***	0.577***	602
	(0.020)	(0.012)	(0.016)	
6 Printing products	0.472***	0.105***	0.500***	1100
	(0.020)	(0.009)	(0.011)	
7 Chemical products	0.334***	0.184***	0.499***	1198
	(0.014)	(0.010)	(0.009)	
8 Rubber and plastic products	0.394***	0.115***	0.469***	1155
	(0.014)	(0.011)	(0.009)	
9 Other non-metallic mineral product	0.415***	0.199***	0.449***	1421
	(0.014)	(0.007)	(0.010)	
10 Basic metals	0.224***	0.092***	0.626***	688
	(0.016)	(0.021)	(0.009)	
11 Fabricated metal products	0.329***	0.096***	0.523***	1900
	(0.013)	(0.018)	(0.007)	
12 Machinery and equipment	0.416***	0.037***	0.513***	1527
	(0.016)	(0.021)	(0.008)	
13 Office equipment and precision	0.416***	0.079***	0.523***	352
	(0.036)	(0.017)	(0.016)	
14 Electrical and optical equipment	0.383***	0.103*	0.565***	1506
	(0.014)	(0.009)	(0.008)	
15 Vehicles motor	0.365***	0.100***	0.532***	957
	(0.017)	(0.004)	(0.009)	
16 Other transport equipment	0.300***	0.119***	0.559***	358
	(0.032)	(0.011)	(0.016)	
17 Other manufactured products	0.393***	0.068***	0.517***	1478
	(0.015)	(0.024)	(0.009)	

*Source: Authors calculation. Standards errors are in parenthesis * significant at 10%, **at 5%; ***at 1%.*

Table 3: MFN tariffs, EU

		1991	1996	2002
1	**Food and tobacco**	42.28	37.77	33.81
2	**Textiles and textile products**	10.81	10.14	9.20
3	**Leather and leather products**	8.34	7.35	6.52
4	**Wood**	5.52	4.25	3.45
5	**Paper**	7.97	5.46	1.50
6	**Printing products**	4.79	3.73	1.47
7	**Chemical products**	7.12	4.85	4.64
8	**Rubber and plastic products**	7.23	6.13	4.87
9	**Other non-metallic mineral product**	5.53	4.32	3.42
10	**Basic metals**	5.18	3.83	5.38
11	**Fabricated metal products**	5.48	4.03	2.89
12	**Machinery and equipment n.e.c**	4.29	2.81	1.85
13	**Office equipment and precision**	5.39	3.58	1.54
14	**Electrical and optical equipment**	6.21	4.78	2.68
15	**Vehicles motor**	8.4	7.08	6.34
16	**Other transport equipment**	4.67	3.23	2.32
17	**Other manufactured products**	5.73	4.02	2.72

Source : TRAINS, UNCTAD

Table 4: Decomposition of productivity growth (1991-2002), Olley and Pakes (1996)

Industry		Aggregated TFP	Unweighted TFP.	Cov.
1	Food and tobacco	**-0.059**	-0.046	-0.012
2	Textiles and textile products	**0.242**	0.166	0.075
3	Leather and leather products	**0.157**	0.044	0.114
4	Wood	**0.308**	0.097	0.211
5	Paper	**0.288**	0.070	0.218
6	Printing products	**0.166**	0.079	0.086
7	Chemical products	**0.276**	0.159	0.118
8	Rubber and plastic products	**0.334**	0.111	0.224
9	Other non-metallic mineral product	**0.243**	0.076	0.167
10	Basic metals	**0.171**	0.138	0.032
11	Fabricated metal products	**0.023**	0.024	-0.001
12	Machinery and equipment n.e.c	**0.223**	0.185	0.037
13	Office equipment and precision	**0.083**	0.277	-0.194
14	Electrical and optical equipment	**0.329**	0.236	0.093
15	Vehicles motor	**0.195**	0.189	0.005
16	Other transport equipment	**0.147**	0.007	0.139
17	Other manufactured products	**0.051**	0.095	-0.044

Source: Authors calculation.

Table 5: Decomposition of productivity growth (1991-2002), Foster, Haltiwanger and Krizan (1998)

Industry	Within effect	Between effect	Compound effect	Entry effect	Exit effect	Total
1	0.024	-0.081	0.067	-0.021	0.049	**-0.059**
2	0.091	0.014	0.092	0.037	-0.009	**0.242**
3	-0.004	-0.031	0.047	0.173	0.027	**0.157**
4	0.242	0.022	-0.054	0.122	0.024	**0.308**
5	0.133	-0.001	-0.032	0.192	0.005	**0.288**
6	0.126	-0.001	-0.046	0.095	0.008	**0.166**
7	0.077	0.044	0.102	0.072	0.019	**0.276**
8	0.084	0.004	0.079	0.173	0.005	**0.334**
9	0.104	0.012	0.085	0.058	0.016	**0.243**
10	0.093	-0.007	0.017	0.084	0.017	**0.171**
11	0.029	-0.003	0.019	0.018	0.040	**0.023**
12	0.098	-0.020	0.101	0.037	-0.007	**0.223**
13	0.016	-0.002	0.020	0.060	0.011	**0.083**
14	0.052	-0.007	0.086	0.209	0.011	**0.329**
15	0.027	-0.036	0.110	0.099	0.006	**0.195**
16	0.020	-0.014	0.107	0.002	-0.031	**0.147**
17	0.160	-0.023	-0.088	-0.014	-0.016	**0.051**

Source: Authors calculation.

Table 6: Average effect of import penetration rate and tariffs on TFP (1991-2002)

	GMM SYS *(t-2)*								
	Dependent variable: ln(TFP_{it})								
Model :	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IPR	0.265***	0.250***	0.240***				0.241***	0.222***	0.217***
	(0.037)	(0.037)	(0.037)				(0.039)	(0.039)	(0.039)
$Tarif_{t-1}$				-0.230***	-0.227***	-0.218***	-0.138***	-0.143***	-0.135***
				(0.021)	(0.020)	(0.021)	(0.023)	(0.023)	(0.023)
Foreign	0.069*	0.079**	0.062*	0.072*	0.083**	0.068*	0.069*	0.076**	0.062*
	(0.036)	(0.035)	(0.035)	(0.039)	(0.037)	(0.037)	(0.036)	(0.035)	(0.035)
$Mratio_{t-1}$		0.160***	0.139***		0.147***	0.135***		0.156***	0.139***
		(0.050)	(0.049)		(0.050)	(0.050)		(0.050)	(0.049)
$Xratio_{t-1}$	0.087**		0.065*	0.067*		0.045	0.072**		0.050
	(0.034)		(0.033)	(0.035)		(0.035)	(0.034)		(0.034)
Herfindahl	-0.141***	-0.134***	-0.147***	-0.050	-0.053	-0.065	-0.116***	-0.111***	-0.123***
	(0.041)	(0.040)	(0.041)	(0.041)	(0.040)	(0.041)	(0.041)	(0.041)	(0.041)
Market Share	0.120**	0.112*	0.117**	0.149**	0.154**	0.154**	0.132**	0.124**	0.128**
	(0.057)	(0.058)	(0.056)	(0.063)	(0.064)	(0.061)	(0.057)	(0.058)	(0.056)
TFP_{t-1}	0.333***	0.334***	0.336***	0.336***	0.337***	0.339***	0.332***	0.332***	0.334***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Constant	-0.066***	-0.066***	-0.067***	0.006	0.001	-0.002	-0.046***	-0.045***	-0.048***
	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)	(0.012)
Year dum.	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	15772	15772	15772	15772	15772	15772	15772	15772	15772
For all the tests the *p*-value are reported:									
m1.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
m2	0.128	0.298	0.299	0.324	0.314	0.308	0.323	0.312	0.308
Sargan	0.311	0.330	0.683	0.130	0.304	0.706	0.159	0.403	0.728

*Source : Authors' calculation. Standards errors are in parenthesis * significant at 10%, **at 5%; ***at 1%.*

Table 7: Interaction of import penetration rate and tariff with firm's characteristics

	GMM SYS (t-2)			
	Dependent variable: $\ln(TFP_{it})$			
Model :	(1)	(2)	(3)	(4)
IPR*Large	0.238***			
	(0.045)			
IPR*Small	0.206***			
	(0.042)			
$Tarif_{t-1}$*Large	-0.017			
	(0.031)			
$Tarif_{t-1}$*Small	-0.237***			
	(0.029)			
IPR*M		0.243***		
		(0.040)		
IPR*(1-M)		0.117**		
		(0.047)		
$Tarif_{t-1}$*M		-0.072**		
		(0.031)		
$Tarif_{t-1}$*(1-M)		-0.205***		
		(0.037)		
IPR*X			0.231***	
			(0.043)	
IPR*(1-X)			0.180***	
			(0.042)	
$Tarif_{t-1}$*X			-0.088***	
			(0.033)	
$Tarif_{t-1}$*(1-X)			-0.145***	
			(0.027)	
IPR*FDI				0.168***
				(0.060)
IPR*(1-FDI)				0.235***
				(0.041)
$Tarif_{t-1}$*FDI				0.057
				(0.051)
$Tarif_{t-1}$*(1-FDI)				-0.185***
				(0.025)
Foreign	0.047	0.050	0.037	0.082**
	(0.035)	(0.034)	(0.034)	(0.037)
$Mratio_{t-1}$	0.131***	0.137***	0.141***	0.132***
	(0.049)	(0.049)	(0.049)	(0.048)
$Xratio_{t-1}$	0.047	0.044	0.059	0.052
	(0.034)	(0.034)	(0.037)	(0.033)
Herfindahl	-0.144***	-0.136***	-0.134***	-0.126***
	(0.040)	(0.041)	(0.040)	(0.040)
Market Share	0.144***	0.136**	0.127**	0.129**
	(0.055)	(0.055)	(0.054)	(0.054)
TFP_{t-1}	0.341***	0.337***	0.342***	0.340***
	(0.016)	(0.016)	(0.016)	(0.016)
Constant	-0.047***	-0.051***	-0.045***	-0.051***
	(0.012)	(0.012)	(0.012)	(0.012)
Year dummies	yes	yes	yes	yes
Observations	15772	15772	15772	15772
For all the tests the *p*-value are reported:				
m1	0.000	0.000	0.000	0.000
m2	0.287	0.298	0.280	0.285
Sargan	0.697	0.711	0.604	0.924

*Source : Authors' calculation. Standards errors are in parenthesis * significant at 10%, **at 5%; ***at 1%.*

Table 8: Different impact on firm's productivity

	GMM SYS *(t-2)*			
	Dependent variable: ln(TFP_{it})			
Model :	(1)	(2)	(3)	(4)
IPR_{t-1}*Large	0.227***			
	(0.043)			
IPR_{t-1}*Small	0.186***			
	(0.038)			
$Tarif_{t+1}$*Large	-0.005			
	(0.032)			
$Tarif_{t+1}$*Small	-0.217***			
	(0.030)			
IPR_{t-1}*M		0.219***		
		(0.037)		
IPR_{t-1}*(1-M)		0.116***		
		(0.045)		
$Tarif_{t+1}$*M		-0.076**		
		(0.034)		
$Tarif_{t+1}$*(1-M)		-0.206***		
		(0.041)		
IPR_{t-1}*X			0.222***	
			(0.040)	
IPR_{t-1}*(1-X)			0.160***	
			(0.040)	
Tari f_{t+1}*X			-0.080**	
			(0.034)	
$Tarif_{t+1}$*(1-X)			-0.133***	
			(0.028)	
IPR_{t-1}*K				0.139**
				(0.060)
IPR_{t-1}*(1-K)				0.226***
				(0.038)
$Tarif_{t+1}$*K				0.070
				(0.054)
$Tarif_{t+1}$*(1-K)				-0.170***
				(0.026)
Foreign	0.028	0.038	0.019	0.073*
	(0.036)	(0.036)	(0.035)	(0.038)
$Mratio_{t-1}$	0.102**	0.112**	0.119**	0.118**
	(0.052)	(0.052)	(0.052)	(0.051)
$Xratio_{t-1}$	0.065*	0.059*	0.057	0.065*
	(0.034)	(0.035)	(0.037)	(0.034)
Herfindahl	-0.162***	-0.157***	-0.152***	-0.148***
	(0.041)	(0.042)	(0.041)	(0.042)
Market Share	0.157***	0.182***	0.165***	0.174***
	(0.056)	(0.057)	(0.056)	(0.055)
TFP_{t-1}	0.362***	0.359***	0.362***	0.362***
	(0.018)	(0.018)	(0.018)	(0.018)
Constant	-0.019*	-0.026**	-0.019*	-0.028**
	(0.012)	(0.011)	(0.011)	(0.012)
Year dummies	yes	yes	yes	yes
Observations	15772	15772	15772	15772
For all the tests the *p*-value are reported:				
m1	0.000	0.000	0.000	0.000
m2	0.085	0.096	0.089	0.090
Sargan	0.547	0.580	0.596	0.805

*Source : Authors' calculation. Standards errors are in parenthesis * significant at 10%, **at 5%; ***at 1%.*

Appendix

Cleaning process and data

For the cleaning process, we choose to use interpolation to fill the gaps for a particular variable if a firm reported no value in a given year, while values were reported in the year prior and the year after the missing one. In particular, we did so, for all the components of the value added, labour and investment, in order to obtain better estimates for the TFP. This only applies for 114 observations of 24241. We dropped from the sample all the observations corresponding to firms that did not answered this year except if data were interpolated using the criterion explained above. The capital stock is measured using the inventory perpetual method with a depreciation rate of 9% base on the average depreciation rate as used in FBBA (2005). After eliminating the firm for which we do not have fixed asset in any year we have 3167 observations per year. We finally dropped observations with unrealistic large spikes in the data (e.g. value-added negative, growth in value added of more than 300% with a reduction of employment).

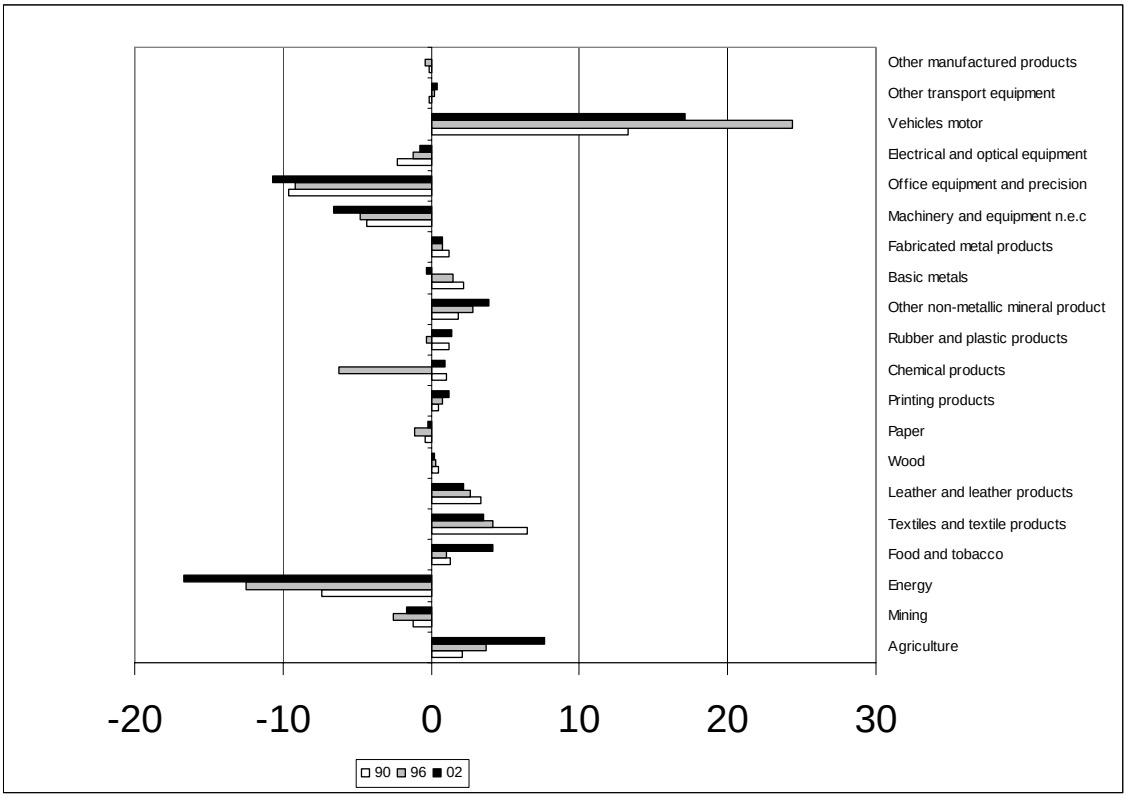
We use production price index at 3-digit industry level to express in constant terms the production and the intermediary consumption. To deflate the capital, we deflate the investment by the investment price index at 3-digit level. The other variables do not need to be deflated because they are expressed in numbers or in ratios. Deflators come from *Instituto Nacional de Estadística*.

Table A.1: Tariffs for Spain and the CEE in 1985 for manufacturing products

	Industry	Spanish Tariff on CE products	Spanish tariff on Third Countries	CE tariffs on Third Countries	CE tariffs on Spanish products
1	**Food and tobacco**	-	-	-	-
2	**Textiles and textile products**	14,67	20,49	6,81	2,73
3	**Leather and leather products**	14,67	20,49	6,81	2,73
4	**Wood**	-	-	-	-
5	**Paper**	8,19	9,3	4,32	1,73
6	**Printing products**	7,38	9,62	2,69	1,08
7	**Chemical products**	11,52	14,74	6,07	2,65
8	**Rubber and plastic products**	12,56	17,29	5,87	2,35
9	**Other non-metallic mineral product**	2,22	3,37	0,83	0,33
10	**Basic metals**	0,26	0,3	0	0
11	**Fabricated metal products**	11,7	12,8	4,92	4,87
12	**Machinery and equipment n.e.c**	11,92	14,95	3,96	1,58
13	**Office equipment and precision**	11,92	14,95	3,96	1,58
14	**Electrical and optical equipment**	16,93	19,46	5,06	2,02
15	**Vehicles motor**	20,2	26,64	8,6	3,44
16	**Other transport equipment**	20,2	26,64	8,6	3,44
17	**Other manufactured products**	16,81	22,59	5,04	2,02

Source: Authors calculation based on Cañada A. Carmena A (1991) p 13

Table A.2: Comparative advantage of Spain by industry



Source: Authors calculation based on CHELEM, CEPII

Table A.3: Comparison (1991-2002)

	Dependent variable: $\ln(TFP_{it})$								
	OLS levels			**WITHIN groups**			**GMM SYS (t-2)**		
Model :	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IPR	0.086***		0.069***	0.046		0.047	0.240***		0.217***
	(0.012)		(0.012)	(0.030)		(0.030)	(0.037)		(0.039)
$Tarif_{t-1}$		-0.097***	-0.074***		0.197***	0.198***		-0.218***	-0.135***
		0.034***	0.031***		(0.060)	(0.060)		(0.021)	(0.023)
Foreign	0.030***	(0.006)	(0.006)	0.039***	0.039***	0.039***	0.062*	0.068*	0.062*
	(0.006)	0.108***	0.097***	(0.014)	(0.014)	(0.014)	(0.035)	(0.037)	(0.035)
$Mratio_{t-1}$	0.099***	(0.014)	(0.014)	0.089***	0.089***	0.088***	0.139***	0.135***	0.139***
	(0.014)	0.021***	0.019**	(0.023)	(0.023)	(0.023)	(0.049)	(0.050)	(0.049)
$Xratio_{t-1}$	0.022***	(0.008)	(0.008)	0.042**	0.042**	0.042**	0.065*	0.045	0.050
	(0.008)	-0.080***	-0.096***	(0.017)	(0.017)	(0.017)	(0.033)	(0.035)	(0.034)
Herfindahl	-0.108***	(0.031)	(0.031)	-0.029	-0.067	-0.071	-0.147***	-0.065	-0.123***
	(0.031)	0.056***	0.057***	(0.056)	(0.057)	(0.057)	(0.041)	(0.041)	(0.041)
Market Share	0.054***	(0.009)	(0.009)	0.024*	0.024*	0.024*	0.117**	0.154**	0.128**
	(0.009)	0.767***	0.765***	(0.013)	(0.013)	(0.013)	(0.056)	(0.061)	(0.056)
TFP_{t-1}	0.767***	(0.005)	(0.005)	0.218***	0.217***	0.217***	0.336***	0.339***	0.334***
	(0.005)	-0.004	-0.018***	(0.007)	(0.007)	(0.007)	(0.017)	(0.017)	(0.017)
Constant	-0.027***	(0.005)	(0.006)	-0.030***	-0.038***	-0.048***	-0.067***	-0.002	-0.048***
	(0.005)		0.069***	(0.009)	(0.008)	(0.010)	(0.011)	(0.010)	(0.012)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15772	15772	15772	15772	15772	15772	15772	15772	15772
R^2 adj.	0.67	0.67	0.67	0.79	0.79	0.79			
For all the tests the *p*-value are reported:									
m1.							0.000	0.000	0.000
m2							0.299	0.308	0.308
Sargan							0.683	0.706	0.728

*Source : Authors' calculation. Standards errors are in parenthesis * significant at 10%, **at 5%; ***at 1%.*

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