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Exports and Firm Productivity The effect of US steel safeguards

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The effect of US steel safeguards¹

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Abstract

This paper investigates possible negative effects of the 2002 US steel safeguards on productivity of Eurozone steel companies. The analysis is based on an extensive literature which predicts that exporting firms not only are bigger and more productive, but also that exporting itself has positive effects, improving efficiency and leading to better utilization of firm resources. The paper investigates a large sample of EU-13 steel producing firms, in the 1998 - 2005 period. Using three methods of Total Factor Productivity (TFP) estimation among which the Olley-Pakes semiparametric estimator, we first calculate the productivity levels of companies, and then check for any unusual fluctuation in this performance variable. We find that in 2002 there has been a significant drop in TFP. The paper is an invitation for further research in this field, given the possible important effects of safeguard measures on exporters.

Keywords: exports, learning-by-exporting, firm heterogeneity, productivity, firm-level data

JEL codes: : D24, F10, F23, L25

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1. Introduction

The WTO and its predecessor the GATT are widely acknowledged for their successful efforts in reducing trade barriers. Over the last rounds of negotiations a significant liberalization of trade negotiations has been achieved, with important reductions in tariffs and the set up of a rule-based trading system. Among these rules there are inevitably also instruments that create import restrictions, albeit when very strict conditions are met. The Safeguard measure is one of them, allowed in case a sudden increase in imports is threatening to cause serious injuries to a national industry (WTO, 2009). Governments are thus allowed to protect their producers by requesting a reduction in the imported products, for example by setting up quotas.

Among the most notable safeguards measures introduced in the last decade is one by the US government. In the beginning of 2002, it imposed trade restricting safeguards on certain steel products, after a well organized lobbying campaign of the corresponding national industry. Despite the protests of US trade partners and the concern of a WTO established panel investigating the legality of the procedure, the safeguards were in place for almost two years, affecting among others a multitude of EU steel producers. So far there has been little research done measuring the negative effects of these safeguards.

In this paper we choose to follow the recent trend in trade related literature, mainly looking at firm productivity levels of exporters. The motivation behind this paper is to broaden the understanding of how exporting can influence one firms' productivity. As suggested by previous research in this area, companies are heterogeneous and only the most productive can enter foreign markets. However, some maintain that not only is there evidence of self selection, but also that firms gain efficiency and improve their performance as a result of exporting. This implies that exporting per se generates beneficial learning effects. If one believes in this learning-by-exporting phenomenon, it is interesting to see what happens to firms if suddenly exports are restricted. Furthermore, this could provide a new argument for restricting the use of safeguards, as they might be detrimental to the existing learning platforms that are beneficial and provide synergy effects for exporting firms.

Keeping in mind the 2002 and 2003 US steel safeguards, we will analyze whether there have been any changes in the productivity of European steel companies. Based on the argument that exporting is beneficial for companies, improving their productivity, this paper tries to explore whether there has been a decrease in the productivity of Eurozone steel producers in the period when these safeguards were in place.

In order to investigate this question, we will first present some EU steel industry characteristics and the impact of safeguards on steel trade flows in Section 2. Section 3 gives an overview of the existing literature on exports and firm productivity. Section 4 describes the methodology used, including data description and results obtained. Section 5 discusses the results and presents some policy implications. Finally, Section 6 concludes.

2. The EU steel industry and US safeguard measures

As it is important to understand the condition under which the safeguards had to be implemented, this section will provide a short description of the European steel industry. Moreover, a short review of the US 2002 trade policy decision will be given, to assess the restrictiveness of safeguards and their impact on EU steel producers.

2.1 Description of EU steel industry

The European steel industry is one of the most competitive and cost-efficient sectors of the EU economy. Established in almost all Member States, it represents roughly 2.5% of the total value of industry production, and an added value of 49 billion Euro in 2005. The sector is also a significant employer, accounting for 1.25% of total employment in EU manufacturing (European Commission, 2009). Moreover, while the industry was the largest steel producer in the world until 2001, it has been overtaken by China and currently produces 16% of world output. The EU steel industry is also the third biggest exporter; at the same time it is the first world importer, since it lacks sufficient primary raw materials, iron ore and cooking coal.

The EU steel sector has enjoyed a leading position until recently due to a significant restructuring process throughout the eighties and nineties. The restructuring not only deregulated and privatized the industry by removing government intervention, but also made significant R&D investments – 2.5 billion Euro subsidies between 1995-1999. This allowed for innovation and development of new technologies which in turn increased productivity and cost efficiency. As suggested by the European Coal and Steel Community (ECSC) “a 20 percent production growth in the last decade was accompanied by a 40 percent reduction in the labour force down to about 270 thousands compared to one million employed in the early seventies” (Vandenbussche & Zarnic, 2006). Moreover, steel producers had to overcome environmental challenges introduced by the EU, aiming at incorporating the Emission Trading Scheme and the REACH chemicals regulation. Thus, remaining competitive is a crucial priority for steel plants, increasing quality and adapting new production processes while reducing production costs and polluting emissions.

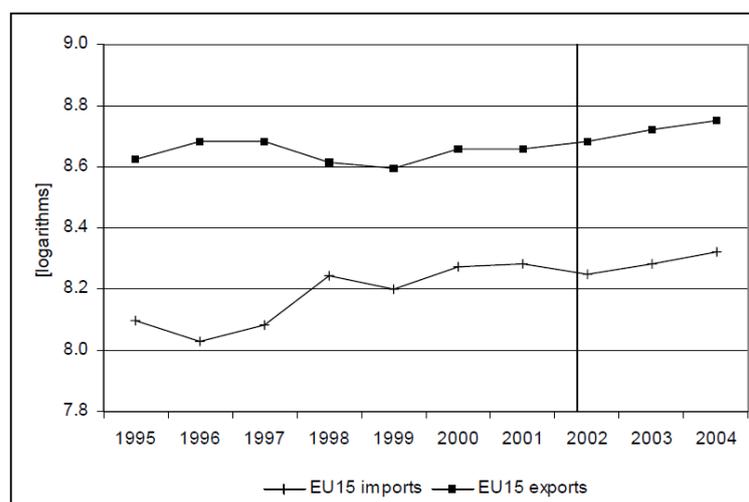
2.2 US policy impact

Amidst a flat world demand and sluggish economic conditions, in March 2002 the US introduced a safeguard protection measures for its steel sector, lasting until the end of 2003. The decision is attributable to the national industry, which petitioned for protection due to its inability to restructure and to achieve cost competitiveness. Moreover, following the GATT/WTO liberalization agreement, the US steel industry experienced a series of bankruptcies and an increase in imports. The safeguards included a quota limit of 5-6 million tonnes and a 15 to 30 percent tariff on 14 categories of steel imported products. The measures were imposed after the US International Trade Commission (ITC) assessed the competitiveness of US steel producers. The ITC concluded that recent growth in imports was damaging the US steel industry, blaming France, Great Britain and Italy for selling their products at dumped prices (Vandenbussche & Zarnic, 2006).

The safeguards, although condemned by EU, China, Japan, Korea and eventually by the WTO Appellate Body, had a significant impact on the economic environment of European steel producers. The restriction which initially had the aim of protecting

the US market, created a so called domino effect. According to the European Confederation of Iron and Steel Producers (Eurofer), the US safeguards lead to the “opening or imposition of some 16 safeguard and anti-dumping actions world-wide as a direct reaction to the effective closure of the US market” (Eurofer, 2003). Notorious examples are the safeguards introduced by China and Poland as a response to the US safeguards. Moreover, Eurofer underlines in its annual report that, due to a long-standing stable presence of EU steel producers in the US market, it was those firms in particular that got hit the hardest by these safeguards. Besides the reduction of exports, the EU producers faced an increase in imports since now the market was being invaded by diversion of trade flows from the US. However, the shock was cushioned by a prompt action of the European Commission, which took appropriate measures for stabilizing the market against any significant surge in imports, while maintaining free trade. Nonetheless, as Eurofer signals, “the wave of protectionism set off worldwide by the US measures significantly undermined free trade in steel and highlighted the importance of full compliance with existing WTO rules” (Eurofer, 2003).

Figure 2.1 – Evolution of EU-15 trade flows

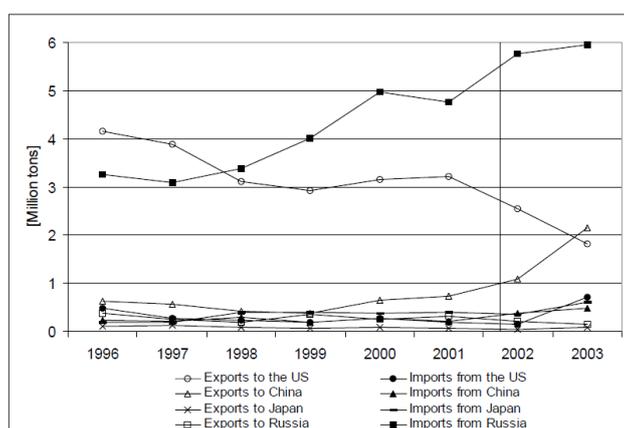


Source: Vandenbussche and Zarnic (2006)

For illustration purposes, we present trade flows of EU-15 indicating the evolution of both imports and exports of steel products. Figure 2.1 shows a slow increase in both the imports and exports of steel products over the 1999-2004 period, with a rather stable trade flow. However, a closer look at the EU’s main trading partners in Figure

2.2 shows clear indication of a decrease in steel exports to the US, which continues throughout 2002 and 2003. As a result of this sharp fall, the EU steel producers had to reroute their exports to countries like China. Moreover, the EU had to face a much higher supply from other steel exporters, such as Russia.

Figure 2.2 – Evolution of EU-15 trade flows (main partners)



Source: Vandenbussche and Zarnic (2006)

Given the evidence of a significant impact of safeguards on EU steel trade flows, Vandenbussche and Zarnic (2005) investigated the existence of possible externalities of US trade protection policies on steel producers' mark-ups. First the authors modify the reciprocal dumping model of Brander (1981) and Brander and Krugman (1983) by introducing the possibility of imposing a safeguard tariff. This theoretical framework suggests two channels through which EU producers might get hurt by the tariff: import penetration and trade costs. Thus the mark-up will be negatively affected both by the level of the tariff and by the market share of EU steel companies. Having set up a theoretical framework, Vandenbussche and Zarnic (2005) empirically measure the adverse effect of US steel safeguards on the mark-ups of EU steel companies. The data consists of annual company accounts of steel producing firms over the 1995-2004 period. The results indicate that EU steel producers experienced a mark-up decrease of 11 percent on average during the imposition of safeguards. To increase robustness of the results, the authors perform a similar empirical analysis on a randomly selected group of firms that were not affected by US safeguards. Results confirm a lack of significant decrease in these mark-ups, thus strengthening their conclusions. Moreover, the authors find that the decrease in mark-ups was stronger

for single-product firms, with less diversified production. This suggest that multi-product firms are affected less by adverse market shocks and are able to adapt easier to changes in trade frameworks. Moreover, the authors conclude that at least partially, EU steel exporters have absorbed the US safeguard tariffs (Vandenbussche & Zarnic, 2006).

Based on the evolution of EU trade flows in the 2002-2003 period, but also on the results of Vandenbussche and Zarnic, we will investigate further the potential externalities caused by the US safeguards. First however let us investigate the existing link between exports and firm productivity.

3. Theory

In this section we will summarize the main findings concerning firm productivity and exports. The review begins with an explanation of the self selection mechanism, which is widely accepted among economists. Moreover, we also review papers looking for possible benefits from exporting in terms of higher productivity. This provides a basis for the assumption that a decrease in exports may generate a drop in TFP.

3.1 Firm heterogeneity and export patterns (self selection mechanism)

The standard trade theories introduced by Ricardo and Heckscher-Ohlin do not consider firms, but merely try to justify the exchange of products and services between two countries. Later models developed using the Dixit-Stiglitz monopolistic competition framework do include firms and aim at explaining large volumes of trade among countries with similar factors of production. In this context, firms were often considered symmetric across an industry as far as technology and productivity is concerned. Against all odds, this meant that anybody could technically export and that trade costs could easily be absorbed no matter what the revenue made abroad was. In the last two decades however, new empirical studies have identified a clear pattern regarding exporters, suggesting that firms are highly asymmetric. The availability of firm level data revealed that only a small percentage of firms within an

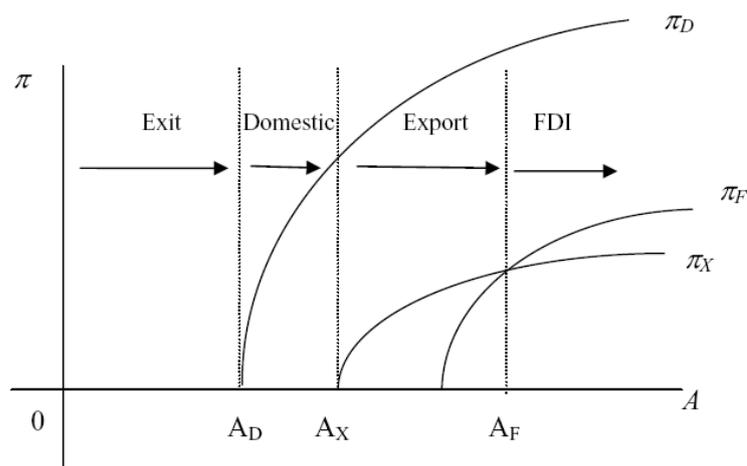
industry export, and they are not just a random sample of the whole population. On the contrary, the exporting firms are larger and more productive than those who serve exclusively national markets. The productivity advantage allows exporting firms to incur sunk costs, such as building new distribution networks, performing market research and modifying the product to better suit new markets.

Among the first empirical researches that proved the relationship between size, productivity and international activity of firms is a series of papers by Bernard and Jensen (1995 and 1999). While their first paper proves that exporters are on average larger and more efficient, it is the second paper that provides richer evidence of self selection. Looking at an unbalanced panel of more than 50,000 US plants in the 1984-1992 period, the authors find that even in a sample of small plants exporters are about 50 to 60 percent larger than non-exporters. Similarly, total employment and total shipments are twice as large for firms that manage to sell abroad than for those that do not. As far as productivity is concerned, labour is 12 to 24 percent more productive, which is only partially explained by the higher capital intensity relative to non-exporting firms. Moreover, the authors spot a difference in labour structure, with more non-production workers for exporting companies, but also a significant higher wage difference which applies to both production and non-production workers. A further look into the causal relationship indicates that exporters are larger, more productive and pay higher wages several years before exporting. Moreover, prior to embracing international markets, they grow at a higher rate than those which will not, confirming that good plants become exporters.

Based on the work of Bernard and Jensen, Melitz (2003) creates a model of monopolistic competition with heterogeneous firms, which is consistent with the assumptions that exporting involves certain sunk costs. This model is further expanded by Helpman, Melitz and Yeaple (2004), to explain the patterns found by the empirical researches as far as export and FDI patterns are concerned. The main findings of the model are that the decision to export or not will depend on several factors, including the firm productivity parameter, the value of sunk cost of exporting and the magnitude of variable cost. Moreover, using their framework one can determine productivity thresholds for producing and serving the national market,

exporting to other non-national markets and even partake in FDI activities. These results are elegantly presented in the graph below, indicating the profit levels in each market as dependent on firm productivity factor. One could also imagine that the higher the sunk cost and variable cost are, the more productive a company ought to be in order to be active in a market.

Figure 3.1 – Profit margins of exporters



Source: Greenaway and Kneller (2004)

Similar models checking for self-selection effects have been tested across a multitude of countries. Most of them have undeniably found that indeed there is a clear impact of productivity on whether a firm starts exporting or not. The most important ones include the work of Aw and Hwang (1995) on Taiwanese firm data, Kimura and Kiyota on Japanese firms, Clerides, Lach and Tybout (1998) on firm data from Mexico, Colombia and Morocco, Bernard and Wagner (1997) on German enterprises, Girma, Greenaway and Kneller (2004) on UK firms and Damijan, Polanec and Prašnikar (2004) on Slovenian data. For a substantial overview of the existing literature on exports and productivity we include a table from Greenaway and Kneller (2005) which summarizes the most notable papers in this area.³

3.2 Learning by exporting

Although the economic literature is positive about the strong causal relationship between firm size and productivity, there are reasons to believe that this relationship could go both ways. While we have seen that bigger firms are better suited to

³ See Table A1 in the Appendix

overcome larger costs linked to exporting, it is not excluded that by exporting some companies actually gain in size and productivity consequently. Several reasons could justify the existence of learning-by-exporting effects. First of all, as Greenaway and Kneller suggest, “interaction with foreign competitors and customers provides information about process and product reducing costs and raising quality” (Greenaway & Kneller, 2005). Thus exporting allows firms to take advantage of the presence of spillovers encountered in more agglomerated regions and is especially relevant in the case of firms exporting to bigger and more significant markets. Secondly, exporting allows firms to profit from economies of scale, thus benefiting from potentially significant cost advantages and a boost in profits. Finally, fiercer competition in the international markets may force the firm to become more efficient and innovative. As Bernard and Jensen point out, “once they begin to sell abroad, firms must improve their performance to remain exporters” (Bernard & Jensen, 1999).

Based on these reasons, a set of empirical and theoretical studies have been undertaken in the last decade, which test for potential correlations between entry in new markets and productivity growth. Bernard and Jensen were among the pioneers of this strand of literature. Their paper on exceptional exporter performance made the step from correlation to causality by testing for both self-selection and learning-by-exporting effects. The authors perform a regression of the change in performance measure on initial export status, controlling for certain initial firm characteristics that might influence productivity. These characteristics include employment level, average wage, the ratio of non-production to total employment and other industry dummies.

The authors find that over annual horizons exporting firms perform better as far as shipments and employment are concerned. However, they do not record any significant productivity growth differences. Labour productivity seems to be growing significantly slower than for non-exporters in the beginning, outperforming national-only firms later on. Wage differences show mixed evidence as well, depending on whether one controls for plant characteristics. With additional variables, wages increase faster for first year exporters. The authors also indicate that wage growth is

explained by an increased share of white-collar workers but also a faster increase in the wage of blue-collar workers. Looking at longer periods, these differences seem to level off, thus any initial significant improvement in performance becomes small and insignificant with time. The benefits from exporting become difficult to identify and are mostly limited to higher employment rates.

The results obtained by Bernard and Jensen do not support learning effects. However, a closer look at firm behaviour after entry explains the above trends. Looking at the degree of switching they realize that the process is relatively dynamic: in the period of one year 10% of firms enter new international markets while 17% exit. As the authors explain, “the large number of plants moving in and out of exporting means that initial export status is poorly correlated with subsequent exporting, especially at longer horizons” (Bernard & Jensen, 1999). Testing for only those who successfully continue exporting during longer periods does indicate significant employment, shipments and production worker wages differences compared to those who exit and re-enter the international markets. However, the authors find no evidence of significant productivity differences, which suggest that the effect of learning-by-exporting is not strong enough. There are however other important gains to be made when successfully exporting which might be due to expanded markets and thus economies of scale. Governments might consider the implications of exports on job creation and job stability in case of a successful performance throughout medium and long intervals of time.

Despite the fact that Bernard and Jensen have strengthened the argument in favour of self-selection, their paper has changed the views of researchers, stimulating a series of investigations into whether a bi-causal relationship exists. Accepting that the new exporters are indeed much more productive than their non-exporting competitors, many researchers began testing whether the difference in productivity led these firms to become exporters, or it was the exporting experience that caused a surge in their productivity. The possibility that the argument runs both ways not only changed the perspective of economists, but also forced them to shift to different econometric models. The new methodology had to control for self-selection, which otherwise would exaggerate the existence of learning-by-exporting. Common methods applied

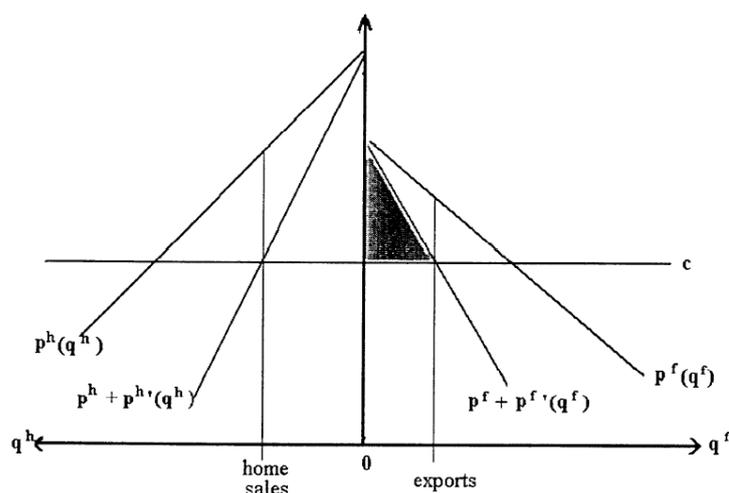
include instrumental variables (IV) by using GMM and matching techniques. While the IV method is relatively easy to implement, it does require having a valid instrument. Matching on the other hand is much more challenging, requiring the researcher to find for each exporter a perfect match among non-exporters. As suggested by Blundell and Costa Dias, this method is an “attempt to mimic the randomised control of the experimental setting but does so with non-experimental data and consequently places reliance on independence and/or exclusion assumptions”(Blundell & Costa Dias, 2002). Once the firms are matched, any difference in their performance can be attributed to learning effects.

The outcomes of these numerous studies have often been inconclusive; however they have proved to be significant for understanding firm export behaviour. Probably the first attempt to analyze entry and exit decision of firms with possible learning-by-exporting implications was the research of Clerides, Lach and Tybout (1998). Inspired by Bernard and Jensen’s paper, Clerides et al. first construct dynamic optimizing models checking for potential effects of learning-by-exporting on firm productivity trajectories and then examine the actual performance of Colombian, Mexican and Moroccan firms. The authors assume a monopolistic market, where companies face a downward sloping demand curve. However, they disregard any strategic interactions, assuming that each firm sees itself as too small to influence the behaviour of its competitors. They also set the marginal cost as constant with respect to output and the market. In this case, the presence of costs associated with exporting (transport and trade barriers) reduces the revenue from exporting, making both the foreign demand and the foreign marginal revenue below domestic levels. The gross profit from exporting is represented by the shaded area in Figure 3.2. The net profit is however even smaller, due to assumed start up costs which one pays to become an exporter. This formulation makes the decision of firms forward looking: the costs incurred must pay off at some point but it does not have to be in the first period of entry, making expectations and potential learning effects extremely important.

The authors find that, given certain assumed exogenous shocks to demand and productivity, both entrants and exporters incur lower costs than the other two groups. Thus, in the presence of sunk costs, firms do have to become more productive

prior to entry. Moreover, before exiting a foreign market firms experience on average an increase in their costs. However, in the presence of learning effects, companies may accept larger expected costs when exporting, the incentives to export being higher. In this case, not only would less efficient firms start exporting, but they would also stay in the foreign markets for longer periods, despite potential losses. This prediction is extremely significant, since it suggests that one cannot evaluate the presence of learning effects from comparing the costs of exporters and non-exporters due to an increase in productivity dispersion among foreign market entrants. Otherwise said, “one has to examine the dynamic trajectory of costs; a single cross-section will not do” (Clerides, Lach, & Tybout, 1998).

Figure 3.2 – Gross operating profits from exporting



Source: Clerides et al. (1998)

Based on the theoretical simulations, Clerides et al. perform an empirical analysis, looking at the actual productivity trajectories of firms from Mexico, Colombia and Morocco. The results obtained can be called at most inconclusive, most of the trajectories obtained being in accordance with ‘no learning effects’ framework. Except for Colombian firms, where labour productivity increases for ongoing exporters, there is little evidence of strong learning-by-exporting effects. In fact, the authors find that negative cost shocks Granger cause higher expected returns from exporting, while exporting does not Granger cause reductions in marginal costs (Clerides et al., 1998).

Despite a general acceptance of self-selection, there are several studies that do find clear indication of learning-by-exporting phenomena. Among these is the paper by Baldwin and Gu (2003) which explores the possible relationship between participation in foreign markets and firm productivity of Canadian manufacturing plants. The authors not only check for the existence of this linkage, but also examine the effect of export intensities on productivity levels. Using survey data for larger plants, which account for 95% of shipments, the model estimates the impact of the capital/labour ratio and export participation on labour productivity. Moreover, the authors use first differencing to remove plant specific effects such as managerial ability, which might potentially be correlated with the decision whether to export or not. Finally, industry dummies and plant size variables are added and the model is rewritten as to account for transition in export markets.

The results obtained for Canadian manufacturing firms are in line with the self selection hypothesis: exporters are found to be around 15% more productive than non-exporters, while those that exit the foreign markets are on average 13% less productive than continuing firms (J. R. Baldwin & Gu, 2003). The authors find impressive differences between labour productivity of companies that export and those that do not, amounting to 5.2 percentage points. Controlling for plant size, the difference is still present, but slightly smaller at 4.9 percentage points. Total factor productivity (TFP) comparison also indicates a higher level for exporters, with a difference of 0.7 percentage points. The conclusion is that exporters are much more capital intensive, the pace of capital accumulation accounting for the difference between labour and total factor productivities.

However, it is the outcome of learning-by-exporting estimation that is worth mentioning. In particular, Baldwin and Gu find that the plants which exit foreign markets do so because they are not able to keep up with the rest of firms. The continuers have on average higher labour productivity (5.6 percentage points) and TFP (0.8 percentage points). Nonetheless, comparing new entrants and continuers, the authors suggest that “entrants are more successful at acquiring or benefit more from new productivity-enhancing information than existing exporters” (J. R. Baldwin

& Gu, 2003). This could be seen as a catching up effect, which new entrants experience once they start exporting.

Furthermore, the authors split their dataset into two periods and investigate the performance of Canadian plants separately in each of these periods. They conclude that the most productive firms from the first period have a higher chance of exporting in the second period. However, as a result of entry, their productivity seems to be accelerating even further. Furthermore, the paper suggests that some firms benefit from participation in foreign markets more than others. Young firms seem to have much more to gain, since they have less technology and innovation channels to begin with. Moreover, it matters whether the firm is domestic or foreign controlled. Those that are domestic-controlled have much more to gain from interaction with foreign markets, than the ones already controlled by foreigners.

Besides the study of Baldwin and Gu, several other papers find evidence that participating in foreign markets does improve productivity.

Girma, Greenaway and Kneller (2004) aim at measuring the effects of exporting on a performance indicator, which is represented by the growth rate of employment, output, labour productivity and TFP. In order to determine this effect, the performance of an exporter has to be compared with its performance had it not started exporting. Since one can never know what could have happened if the firm had not entered a foreign market, the exporters should be compared to a firm that matches best its performance and characteristics prior to new market entry. This is done by using a probit model, which determines the probability of each firm to export, controlling for a set of observables such as TFP, size, ownership and wages. The exporting firm is then matched to a non-exporter with the closest propensity score (probability that it will start exporting). Thus one can be sure that the difference in firm performance is only due to exporting and not other factors. This method is superior to a non-matched (random sample) comparison, since it eliminates potential biases related to comparison between firms with different characteristics (Girma et al., 2004). After firms are matched, the authors apply the Difference-In-Difference method which implies two main steps. First they take the difference in average growth rates of exporters before and after entry into the foreign

market, controlling for past performance, size, age, industry and time characteristics. Since this might not be enough to explain a rise in performance, the second step implies differencing the results obtained at the first step with the difference in the performance of the control group for the same period of time. According to Blundell and Costa Dias, this method removes common macro effects such as shocks or individual effects (Blundell & Costa Dias, 2002).

The results obtained are in line with the self-selection hypothesis, however, they also suggest evidence of learning-by-exporting. While employment and output growth are significantly higher for exporters than for non-exporters in the entry year, all of the performance variables seem to have grown significantly faster than if the firms had not become exporters one year after entry in the foreign market. Moreover, while TFP growth is similar for both groups prior entry, on the entry year it becomes higher by 1.6 percentage points for exporters, growing even further by an extra percentage point in the second year. These results prove that the matching procedure has been successful in finding proper control firms for each exporter and that indeed exporters have extra benefits to gain by entering into foreign markets. Besides the effects of exporting, the authors check whether export intensity has an effect on productivity growth. They conclude that a 10% increase in the share of exporting capacity raises productivity by 2.1 percentage points, again suggesting important learning effects (Girma et al., 2004).

Another paper drawing on productivity growth through exporting includes the work of Greenaway and Kneller (2004). The empirical methodology used is similar to that in Girma et al. (2004). However, in addition to calculating post entry effects, the authors also try to identify what influences the probability of market entry. Using a probit model, they regress the decision to export (dummy variable) on a set of determinants consistent with the existing theory but also with the assumption that if learning effects exist, they should be less evident in industries that already are open to exports. The model tests for the impact of firm productivity, industry sunk costs (minimum TFP of the new export market entrants), size (log of employment), human capital (log of wage) and R&D intensity on export status. Furthermore, industry agglomeration is added and together with two measures of international trade for

capturing how open the sector is to foreign competition. Starting with a basic model, the authors add trade exposure variables, an FDI measure and a set of industry dummies.

The results of this study are consistent with the self selection effect, the probability of entry being correlated to size, TFP, wage level and the incurred sunk costs. Furthermore, once all the variables are added, the probability of entry is increasing in human capital and size, while TFP seems to be insignificant. As far as the industry variables are concerned, the higher the presence of foreign exporters, the higher the probability of export market entry. The authors suggest that market entry is higher in agglomerated regions due to several factors such as the co-location of support industries, deeper labour markets and intense expertise sharing among market participants. Moreover, the presence of foreign firms has an adverse effect on export activity of domestic firms. As Greenaway and Kneller suggest, "if those [foreign] firms have superior technology it is less likely that domestic firms will be able to compete in the foreign firms' own domestic market and are less likely to have foreign sales of any form" (Greenaway & Kneller, 2004).

This paper also reports learning-by-exporting effects, suggesting that exporters' productivity grows on average 2.9 percent faster than that of non-exporters. Furthermore, employment, output and labour productivity are significantly higher for those engaging in export activities. Using interaction terms, the authors find that TFP growth of exporters is lower in industries with high domestic R&D levels. This suggests that, depending on the industry, the potential learning opportunities by going abroad can vary. Moreover, trade openness also affects one's learning-by-exporting capabilities. If the domestic market is already open to foreign products, exporting might not have a significant impact on a company's productivity.

A final paper investigating whether exporting can boost firm productivity is one by Greenaway, Gullstrand and Kneller (2005). The authors make use of an extensive dataset comprising over 3,500 Swedish manufacturing firms for a period of almost 20 years. The empirical results are even more interesting since Sweden is an extremely open country with trade revenues amounting to 60% of its GDP. Moreover, Swedish

companies are very trade oriented, 85% of them being active in foreign markets. The authors use a similar estimation method as in Girma et al. (2004) and Greenaway and Kneller (2004), mainly matching and DID, since these perform much better than just comparing the exporters with a randomly selected group of non-matched non-exporters.

The results provided show no significant difference between exporters and non-exporters in the period preceding the new market entry. This is again a result of the methodology used, suggesting that the companies have been properly matched. Furthermore, while exporting does increase productivity, it does not improve it in a statistically significant way. The authors also provide matched DID results for other performance indicators. Firm size measured as labour employment and the average wage do show a significant increase when entry occurs. The authors conclude that the high degree of international exposure made Swedish companies competitive enough to squeeze out those firms that normally would only serve the national market. Putting it in the Melitz framework, "Increased export opportunities in that model encourage entry of new firms into the market (through profit opportunities), raising the minimum productivity requirement below which firms exit the industry" (Greenaway, Gullstrand, & Kneller, 2005). To support this evidence, Greenaway et al. (2005) indicate that the majority of non-exporting Swedish firms came from a few industries characterised by high transport costs associated with exporting. Furthermore, the majority of firms that start exporting in the analyzed period are usually young and highly productive, suggesting that they replace the older less productive non-exporting companies.

To conclude, we have discussed a number of papers investigating possible learning effects correlated with exporting activity. While some researches find clear evidence that exporting firms do have a significantly higher productivity growth, others find little evidence of such an effect. More recent empirical studies emphasize that learning-by-exporting is only inherent to certain industries. In particular, Greenaway and Kneller (2004) and Greenaway et al. (2005) suggest that national firms active in industries already exposed to outside competition have little to gain from exporting.

Moreover, R&D intensity of one's national industry has a negative impact on the increase in productivity growth at the level of new exporters.

As suggested by the literature review, exporting may have positive learning effects on productivity. Since the implementation of the US safeguards in 2002, we have seen in section 2 that the EU steel producers have been able to export less goods to the US in 2002 and 2003, instead rerouting their production to developing markets like Russia and China. This has altered the competitive platform in which European firms have been acting, possibly setting them back. Moreover, given that the decrease in EU steel exports to the US caused a significant decrease in mark-ups of steel producers and applying the described literature, we have good reasons to believe that these safeguards had possible negative effects also on the productivity of European companies.

4. Empirical analysis

This section provides a description of the methodology used to calculate both TFP levels and the yearly change in productivity. Moreover, a description of the dataset and the obtained results will be presented.

4.1 Methodology

To evaluate the presence of a potential drop in productivity due to US safeguard measures, it is necessary to compute total factor productivity values. The history of TFP estimation dates back to the seminal paper by Solow (1957). Since output growth includes both growth in factors of production (capital and labour) and the increase in efficiency of utilization of these factors, Solow uses a Cobb-Douglas production function to separate these two. (Solow, 1957) Following Van Beveren (2008), we will replicate the method, adding an additional variable representing material costs. The production function takes the following form:

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m} \quad (4.1)$$

where Y_{it} represents the aggregate output of a firm i in period t , K_{it} , L_{it} and M_{it} are the stock of physical capital and costs of labour and materials. A_{it} is then the Hicks-neutral efficiency level of firm i in period t , which unlike the other variables, is not observed by the researcher (Van Beveren, 2008). A simple logarithmic transformation of (4.1) allows us to rewrite the production function in a more accessible way, so that:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it} \quad (4.2)$$

where small letters represent natural logarithms and productivity level is computed as:

$$\ln(A_{it}) = \beta_0 + \varepsilon_{it} \quad (4.3)$$

In (4.3) β_0 represents the mean efficiency level of firms, while ε_{it} is a firm and time specific productivity. The latter one can be further divided into two components, one of which is observable (ω_{it}), while the other one (u_{it}^q) is considered an i.i.d. process accounting for unexpected deviations from the mean (Van Beveren, 2008). Productivity can thus be computed as the exponential of ω_{it} , where:

$$\omega_{it} = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} \quad (4.4)$$

We use this estimation as the basis for computing firm level TFP, looking for any particular spikes, plunges or any other unusual changes in its values.

Pooled OLS estimation

The first analysis that we perform is regressing (4.2) using pooled OLS. This method basically calculates total factor productivity values by applying (4.4). While pooled OLS is very easy to apply, it also casts doubt on the unbiasedness of obtained coefficients. The existing literature signals that this method of TFP estimation may be violating two important assumptions, mainly endogeneity of input choices (or simultaneity bias) and selection bias.

As far as the simultaneity bias is concerned, OLS requires that production inputs (capital, labour and materials) are chosen in an exogenous way, thus independently from total factor productivity. However, the recent papers on exports and productivity growth, among which Baldwin and Gu (2003), do indicate possible relationship between TFP and the levels of factors of production. Capital intensity is in particular suggested to be influenced by firm characteristics, including productivity. In this case OLS will provide biased coefficients due to serial correlation in ω_{it} , which implies that an increase in productivity will be followed by a surge in production factors (Van Beveren, 2008). According to Levinsohn and Petrin (2003), performing OLS under these conditions will underestimate the effect of capital on TFP, providing biased coefficients. Common solutions for eliminating this bias include using fixed effects or instrumenting the change in inputs with the lagged value of inputs (Wooldridge, 2003).

The selection bias relates to entry and exit decisions of firms in and out of the market, which pooled OLS does not take into account. We have seen in the literature review that an exit is preceded by a drop in productivity, which also might influence the amounts of capital, labour and materials which the firm invests in. Given high entry and exit, especially over longer periods of time, using a balanced panel will lead to biased results. According to Van Beveren (2008), OLS method of estimation will generate in this case a negative correlation between ε_{it} and K_{it} , underestimating the capital coefficient. Olley and Pakes find that “going from a balanced panel to the full sample (entry and exit are allowed) more than doubles the capital coefficient and decreases the labour coefficient by 20%” (Olley & Pakes, 1996). Possible methods of dealing with this bias include using Olley-Pakes estimation, described further on.

Fixed Effects estimation

The fixed-effects method is one of the estimations that provide a solution for the endogeneity of input bias. This methodology assumes that ω_{it} is plant-specific and fixed over time, thus not influencing decision making when it comes to investment in new capital or labour.

Without further changes, equation (4.2) becomes:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_i + u_{it}^q \quad (4.5)$$

Besides overcoming endogeneity of input bias, fixed-effects also eliminates selection bias, provided the entry or exit decisions are determined by the time-invariant plant specific factor ω_i . Thus, using a balanced panel will not result in unbiased coefficients anymore. Nonetheless, many authors dislike this method, suggesting it underestimates the capital coefficient and in general provides biased estimations (Van Beveren, 2008). According to Wooldridge, fixed effects estimation places a “severe restriction on firm behaviour” by assuming that investment decisions are taken independently of firm productivity (Wooldridge, 2003). Better suited models for overcoming these problems have been developed in the recent years.

Olley-Pakes estimation

Probably the first to solve both selection and endogeneity biases when computing TFP is the paper of Olley and Pakes (1996). They develop a semiparametric estimator which deals with the correlation between idiosyncratic firm level productivity ω_{it} and input quantities by using investments as proxy for unobserved productivity shocks. Moreover, by introducing entry and exit rules, Olley-Pakes model corrects the selection bias as well.

For employing the method is it crucial to comply with a set of assumptions. First of all, the model assumes that the only unknown variable is productivity, while other variables such as capital, labour, materials and investment can be observed by the researcher. Second of all the investment proxy should be monotonically increasing in productivity, conditional on the rest of variables. In practice this means that “an increase in investment or intermediate input use, conditional on a given level of capitalization, indicates a positive idiosyncratic shock” (Blalocka & Gertler, 2004). Moreover, this also implies that only positive investment levels can be considered, which should at least apply to a known subset of the sample (Olley & Pakes, 1996).

Starting with the Cobb-Douglas function and given capital levels which are only dependent on current and past firm performance, first investment values are calculated:

$$I_{it} = K_{it-1} - (1 - \delta)K_{it} \quad (4.6)$$

where δ is the depreciation level of capital. We can thus express investment as a function of productivity and capital, so that $i_{it} = i_t(k_{it}, \omega_{it})$. Based on the assumption that investment is positive, lower case letters stand for logarithmic values of variables in capital. Given the fact that investment is increasing in productivity, we can construct its inverse function so that $\omega_{it} = h_t(k_{it}, i_{it})$, where $h_t(x) = i_t^{-1}(x), \forall x \in \mathbb{R}^+$. Thus, the production function becomes:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + h_t(k_{it}, i_{it}) + u_{it}^q \quad (4.7)$$

The method continues following two stages. First (4.7) is used to estimate the coefficients for labour and materials, which will be consistent due to the fact that the error term is not correlated to the inputs anymore. In the second stage non-linear least squares method is used to compute the coefficient of capital, accounting for prior period shocks (Van Beveren, 2008).

The above mentioned methodologies will be used to compute total factor productivity measures.⁴ Once these are computed, we run a simple OLS regression on year dummies using TFP as dependent variable to check for a drop in the steel producers' TFP in the period US safeguards were in place.

4.2 Data description

The estimation of productivity change is based on the Amadeus dataset provided by Bureau van Dijk. The data represents annual accounts of Eurozone companies active in the steel sector over the period 1998-2005. To control for the industry, we use the

⁴ We attempted to also use the Levinsohn-Petrin TFP estimation method, however this was unsuccessful due to lack of appropriate data on materials costs

three digits SIC code 331 corresponding to primary metals, which includes steel works, steel pipes and rolling mills. Moreover, to allow for intertemporal comparison, we inflate the data using CPI deflator from DataStream. The broadest CPI is chosen, to account for increases in prices of energy but also other goods. Unfortunately we are unable to distinguish between exporting firms and non-exporters, since this information is collected only by tax authorities and is not publically available. Thus, when choosing data we only select medium, large and very large steel producers based on their output, as according to the literature the size is correlated to firm activity in foreign markets.

Below we present an overview of the main variables used in the estimations together with their means and standard deviation, sorted by year.

Table 4.1 – Main variables

Year	Turnover		Capital		Materials		Labour		Investment	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev
1998	14.63	94.49	4.25	27.66	8.42	46.82	2.15	17.98		
1999	13.01	75.55	4.33	27.34	7.33	39.14	1.96	16.07	1.07	6.75
2000	16.25	96.20	4.30	26.38	8.84	50.11	2.02	16.30	0.76	4.92
2001	14.12	80.75	3.96	22.18	8.16	45.68	1.98	16.35	0.51	4.91
2002	13.25	74.97	3.45	20.71	7.14	46.39	1.73	13.74	0.50	2.94
2003	13.57	69.84	3.16	19.44	7.28	41.03	1.59	12.24	0.35	2.98
2004	16.32	77.53	3.26	19.98	8.71	44.75	1.55	10.59	0.80	6.54
2005	15.69	75.62	3.16	19.74	8.38	44.54	1.48	10.48	0.42	3.29

Note: All numbers in Million's of Euro's and inflated to 2005 levels.

Physical output of firms is taken from Amadeus in the form of operating revenue. The value of capital is proxied by the book value of tangible fixed assets, while labour and total material costs are directly available from firm annual accounts. We also use investment values, which are calculated from yearly changes in capital levels, given Amadeus depreciation amounts. The data consists of 2,155 firms, from 13 EU Member States⁵, creating an unbalanced panel with over 17 thousand observations.

⁵ A more extensive overview of the firm-country statistics is available in the Appendix, Table 2.

4.3 Results

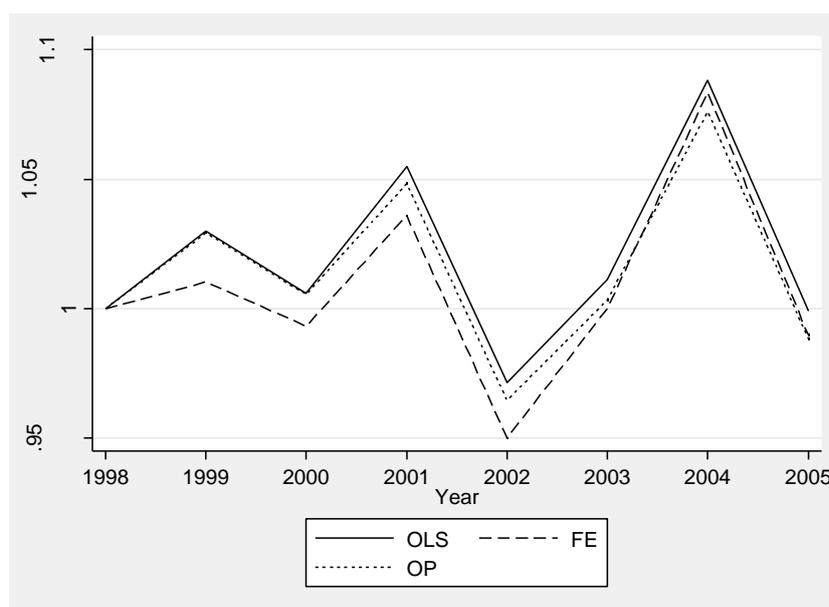
The main results obtained from pooled OLS, fixed effects and Olley-Pakes estimation methods are reported in Table 4.2. We report coefficients of all input factors for each individual estimation method. As the results clearly indicate, these coefficients vary depending on the method used. Moreover, as suggested by the existing literature, the simultaneity bias present in pooled OLS overestimates the labour coefficient at the expense of capital. The fixed effects method shows a significant but dangerously low impact of capital on output. This might be due to the fact that the assumption of no correlation between TFP and input choices is violated. Olley-Pakes however performs best as far as the impact of capital is concerned and according to previous researches provides consistent coefficients.

Table 4.2 – Estimated coefficients

Coefficients	OLS	Fixed Effects	Olley – Pakes
Capital	0.0410*** (0.0026)	0.0066* (0.0035)	0.0629*** (0.0212)
Labour	0.3538*** (0.0033)	0.3689*** (0.0067)	0.3317*** (0.0107)
Materials	0.5902*** (0.0030)	0.5509*** (0.0046)	0.5925*** (0.0128)

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

After computing TFP values, we look at how productivity has evolved over the 1998-2005 timespan. First, we generate a weighted productivity index to better visualize the behaviour of total factor productivity (See Graph 4.1). The index is formed by dividing each productivity value by the initial 1998 value. The graph shows generous year-to-year fluctuations. However, by eyeballing the weighted productivity index, we can see particularly high fluctuation especially in 2002 and 2005, when the TFP levels seem to drop to unusually low levels. Thus, we can only observe a decrease in the first year the safeguards were in place, with TFP starting to grow again in 2003. To confirm the suspicion of a significant decrease in productivity from 2001 to 2002, we test whether this decrease was significantly different from zero.

Graph 4.1 – Weighted productivity index

Below we present the changes in average productivity levels together with their standard errors. As indicated by Table 4.3, a productivity decrease was recorded in three of the analyzed years, namely in 2000, 2002 and 2005. If there was a negative impact of the decrease in exports, it seems to have disappeared in 2003, the second of the two years the safeguards were in place. Using a t-test, we see that only the 2002 drop is significant across all methodologies.

Table 4.3 – Estimated productivity levels

Change in average TFP	OLS	Fixed Effects	Olley – Pakes
1998 – 1999	0.1238 (0.2184)	0.0820 (0.3603)	0.1178 (0.2176)
1999 – 2000	-0.0988 (0.2130)	-0.1355 (0.3241)	-0.0958 (0.2168)
2000 – 2001	0.2018 (0.2102)	0.3392 (0.3080)	0.1725 (0.2110)
2001 – 2002	-0.3452* (0.1958)	-0.6807** (0.2940)	-0.3367* (0.1923)
2002 – 2003	0.1645 (0.2025)	0.3959 (0.3996)	0.1560 (0.1951)
2003 – 2004	0.3183 (0.3576)	0.6602 (0.7144)	0.2926 (0.3406)
2004 – 2005	-0.3678 (0.3075)	-0.7407 (0.6143)	-0.3526 (0.2922)

*** p<0.01, ** p<0.05, * p<0.1

Where standard errors in parentheses are calculated as: $\sigma_{t-(t-1)} = \sqrt{\frac{\sigma_{t-1}^2}{N_{t-1}} + \frac{\sigma_t^2}{N_t}}$

Given the obtained values, the next section elaborates on these results. Furthermore, some implications of safeguards are considered.

5. Discussion and policy implications

As seen in the previous section, the results suggest that productivity of EU-15 firms included in the dataset decreased significantly in 2002. Both the Graph 4.1 and Table 4.3 indicate a decrease in the total factor productivity of these companies. However, to answer the question whether it was precisely the US safeguards that determined this decrease, it is necessary to perform further calculations. One could think of extending the methodology by checking for differences between exporters and non-exporters, or setting up a control group that has not been influenced by 2002 US safeguards.

Unfortunately, the dataset does not allow for such extensions, due to the fact that Amadeus does not contain information on which firms are exporting and which are only active on national markets. Despite the fact that this constitutes a weakness of the research, the scope of the paper was an attempt merely to calculate productivity levels and investigate the presence of a potential decrease in this performance measure. This paper is thus an invitation towards further research into the effects of protectionist trade policies on foreign exporting firms.

Nevertheless, this paper raises an important question, mainly do foreign safeguards blunt the best EU companies, considering that it is the biggest and most productive firms that engage in exporting? Despite the fact that this research has not been able to give a definitive answer, the question remains valid. Given that there are potentially significant policy implications and based on the results obtained by Vandebussche and Zarnic (2006), it is necessary to consider the effects of such protectionist measures.

First of all, while the country imposing the safeguards aims at protecting its own industry, it ends up hurting the foreign exporters. Vandebussche and Zarnic (2006) have found an 11 percent decrease in mark-up of steel producers during the period in which safeguards were in place. However, as suggested by the authors, this policy was somewhat expected in 2001, giving the producers more time to prepare for a potential decrease in their exports. Moreover, the EU has taken the matter seriously by signing special agreements with Russia and Ukraine in order to offset the negative impact of these safeguards. Without such expectations and swift intervention from

European authorities, the effect of safeguards on mark-ups might have been much more drastic.

Second of all, the safeguards might not only generate adverse externalities for the foreign producers, but also can change the dynamics of global trade patterns in a radical way. As suggested by Vandenbussche and Zarnic (2006), the US safeguards triggered domino effects. This concept was first introduced by Baldwin (1993) in the context of multilateral trade agreements, under which a change in the trade policy of one country can set off trade actions of other countries (R. E. Baldwin, 1993). In this case US safeguards forced EU steel companies to reroute their production to other countries, among which China. However, that triggered further safeguards from the Chinese government reacting to a significant increase in steel imports. Thus, trade protectionist policies may affect not only the group aimed at, but also set free a series of unpredictable forces which could hurt a much larger group of producers.

Finally, one has to be aware that the negative impact of safeguards may affect different producers in different ways. As suggested by Vandenbussche and Zarnic (2006), based on the findings of Girma et al. (2004), the more a company exports to one country, the more it will be hit in case of a trade restriction with that country. Therefore, diversifying is an important strategy for companies trying to decrease dependency on certain markets. Moreover, it also seems that well diversified firms are able to adjust their mark-ups and also productivity to unexpected shocks in the international trade environment (Vandenbussche & Zarnic, 2006).

The policy implications which can arise given the mentioned patterns and relations between safeguards, producers' mark-ups and possible also productivity are significant. Trade protection has been seen for a long time as a means of shielding one's industry and offering it a somewhat unfair advantage. However, in this context, protectionist policies can not only be seen as a shield for local firms but also as a tool for hurting the foreign companies. As suggested by Vandenbussche and Zarnic (2006), "one country's safeguard protection generates adverse externalities for its trading partners". Thus, on the one hand, countries should be extremely careful when using such radical tools and consider the potential negative effects that might arise.

On the other hand however, diversified exporting should be encouraged, since it can generate positive externalities and promote beneficial learning effects.

6. Conclusion

Safeguards and anti-dumping measures are becoming popular instruments for restricting imports, with US 2002 steel safeguards as a notorious example. These measures are often viewed as a means for protecting one's industry, especially in extremely competitive environments. However, recent research including the paper of Vandebussche and Zarnic (2006) suggests that not only are safeguards a way of ensuring an easier life for national producers, but also a potential tool for hurting foreign exporters. Our paper further investigates possible negative externalities of protectionist trade policies, taking a closer look at the behaviour of total factor productivity values of Eurozone steel producers between 1998 and 2005.

The analysis is based on a comprehensive literature review, which explores possible correlations between firm heterogeneity and participation in foreign markets. Although there is extensive evidence that exporting firms are bigger and more productive than their non-exporting counterparts, some argue the relationship may run both ways. This implies that not only do firms need to be more efficient to enter new markets, they also may be gaining in productivity while exporting, thus pointing to the presence of learning effects. Recent papers investigating the causality of this relation are sometimes inconclusive or contradictory. While some do not register any TFP growth of firms while exporting, others find clear improvements in performance of exporters after entry. A third strand in the literature including Greenwood and Kneller affirms that the existence of learning effects depends on certain characteristics of an industry, being more pronounced where exporters have more to learn abroad than at home.

Given potential serious implications of exporting on firm TFP growth, the paper investigates whether in the period in which US steel safeguards were in place there was a reduction in the performance of Eurozone steel producing companies. We approach this research question by calculating total factor productivity values using three widely known methodologies, mainly pooled OLS, fixed effects and a more recent semiparametric estimator approach by Olley and Pakes. Furthermore, we check for the significance of changes in firms' TFP from year to year.

The results suggest that indeed, as suspected, productivity of Eurozone steel producing firm significantly decreases from 2001 to 2002.

Given these results, it cannot be concluded that it was the safeguards that generated such adverse effects on firm TFP, which is a limitation of the paper. However, based on the previous research of Vandebussche and Zarnic (2006) and the literature suggesting that exports improve productivity, it is not far-fetched to consider that a trade restriction may have negatively affected exporters. This paper is thus an invitation to further research the area, indicating promising results.

As suggestions for future analysis of negative externalities of 2002 US safeguards, one should consider robustness checks. Possible examples include performing the same research while taking into account a control group or performing the analysis on exporters vs. non-exporters when the necessary data is available.

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Appendix

Table A.1 – Studies on exports and firm productivity

Study	Country	Sample	Methodology	Results
Bernard and Jensen (1999)	US	50–60,000 plants; 1984–92	Linear probability with fixed effects	Self-selection of exporters; absence of learning from exporting; higher productivity of exporters
Delgado et al. (2001)	Spain	1,766 firms; 1991–96	Non-parametric analysis of productivity distributions	Higher productivity of exporters; self selection of exporting firms; inconclusive evidence on learning
Aw and Hwang (1995)	Taiwan	2,832 firms; 1986	Translog production function; cross-section	Higher productivity of exporters; self-selection; absence of learning from exporting
Castellani (2002)	Italy	2,898 firms; 1989–94	Cross-section	Higher productivity of exporters; learning associated with export intensity
Kraay (1999)	China	2,105 firms; 1988–92	Dynamic panel	Higher productivity of exporters; learning from exporting
Clerides et al. (1998)	Colombia, Mexico, Morocco	All plants; 2,800 firms; All firms; 1981–91; 1986–90; 1984–91	FIML of cost functions; panel data	Exporting firms more efficient than non-exporting firms; quitters less productive; no learning from exporting in Colombia and Mexico; some learning from exporting in Morocco; spillovers from exporters to non-exporters
Bernard and Wagner (1997)	Germany	7,624 firms; 1978–92	Panel data	Higher productivity of exporting firms; self-selection of exporters
Wagner (2002)	Germany	353 firms; 1978–89	Panel data; matching	Higher productivity of exporting firms; absence of learning from exporting
Alvarez and Lopez (2004)	Chile	5,000 plants; 1990–96	Ordered probit; panel data	Higher productivity of exporting; self-selection of exporters; absence of learning from exporting
Van Biesebroeck (2003)	Six sub-Saharan African countries	1,916 firms; 1992–96	GMM panel estimation	Learning from exporting
Girma et al. (2003)	UK	658 firms; 1988–99	Panel data; matching; difference-in-differences	Lower productivity of quitters
Hansson and Lundin (2004)	Sweden	3,275 firms; 1990–99	Difference-in-differences; matching	No difference in TFP growth for entrants; increase in TFP level relative to non-export firms
Girma et al. (2004)	UK	8,992 firms; 1988–99	Panel data; matching; difference-in-differences	Higher productivity of exporting firms; self selection of exports; learning from exporting
Baldwin and Gu (2004)	Canada	19,142 plants; 1984–90, 1990–96	Difference regressions; survey data	Learning from exporting; identifies a number of channels such as scale economies, technology transfer, human capital improvements
Blalock and Gertler (2004)	Indonesia	20,018 firms; 1990–96	Panel production function	Learning from exporting

Source: Greenaway et al. (2005)

Table A.2 – Firm-country statistic

Country	Number of Firms
Austria	45
Belgium	150
Finland	28
France	207
Germany	438
Greece	49
Ireland	62
Italy	682
Luxembourg	9
Portugal	38
Slovenia	10
Spain	373
The Netherlands	64

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