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ABSTRACT

Did US Safeguards Affect Mark-ups of EU Steel Producers?*

This paper empirically investigates the effects of the US safeguard protection on steel imports in 2002 on the mark-ups of EU steel producers. We identify a large panel of EU steel producers between 1995 and 2005 affected by the safeguards. Using the Roeger methodology, our results show that the protection significantly reduced the EU firms' mark-ups. Single-product firms suffered relatively more from the safeguards than multi-product firms. Our evidence further suggests that the US protection resulted in some diverting of the EU steel especially towards China, aggravating the situation on the Chinese steel market and ultimately resulting in the Chinese trade protection of steel imports.

JEL Classification: F13, L13 and L61
Keywords: firm data, price-cost margins, safeguard measures, steel industry and trade diversion

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1 Introduction

In March 2002, the US government obtained safeguard protection for its steel industry, which suffered from a large influx of steel imports choking the industry's adjustment.[1] The European Union (EU) largely opposed this protection, since it feared that world steel exports would divert from the US to the EU. The safeguard protection would artificially raise the competitiveness of the US exporters and distort trade in steel products between the US and the EU. Consequently the European Commission (EC) filed a complaint at the World Trade Organization (WTO), putting forward the potential adverse effects of the US safeguard protection for the EU steel industry.[2] The US safeguard protection was terminated in December 2003.[3]

The primary interest of this paper is to estimate the impact of the US safeguard protection on the markups of European steel firms. To guide our empirical work and to formulate our hypotheses, we use a modification of the existing reciprocal dumping model by Brander (1981) and Brander and Krugman (1983). We mainly focus on the EU price markups over marginal costs as a measure of firm level performance. A model like the Brander and Krugman model would predict a drop in the EU markups resulting from the US safeguard protection.

We estimate the markups using the Roeger (1995) methodology. The main advantage of this method is that it does not suffer from endogeneity issues when estimating markups as shown by Roeger and Warzynski (2004) and Konings and Vandenbussche (2005). Our empirical analysis confirms the theoretical predictions. We find a negative effect of the US safeguards on the markups of European steel producers. Our evidence further suggests that the markups decreased unevenly among firms. We find that single-product firms suffered relatively more from the protection than multi-product firms, which indicates the larger dependency of single-product firms on market re-

[1] In the US, the filing for safeguard protection must meet the serious injury condition and requires the approval of the President, which is higher standard than the material injury condition under the antidumping (AD) legislation, approved by the Department of Commerce. Firms will consider filing for safeguard protection only if the expected value of protection is higher relative to AD protection (Hartigan 2005). Earlier literature suggests that the strictness of injury criteria (Baldwin 1988) or the retaliation threat (Blonigen and Bown 2003) also condition the decision of which measure to be imposed. Unlike antidumping protection, safeguard protection is not based upon the selectivity principles, it covers a large scope of products or industries, and is rarely extended.

[2] In 2002, the European Commission (EC) estimated diversion could be as much as 15 million tons per year or 56 percent of current import level (EC 2006). Producing 193 million tons of crude steel, the EU accounts for 18 percent of the world production. At that time, China was the larger producer with 272 million tons (26 percent of world production), followed by Japan with 113 million tons and the US with 99 million tons. While the EU total imports have risen by 18 percent through 1998-2002, have the US imports of steel fallen by 33 percent in the same period (EC 2006).

[3] The EU after a while negotiated retaliation power and facilitated the termination of the US safeguard protection in December 2003, although it was initially scheduled for the period of four years. The retaliation power is based upon nullification and impairment of expected benefits from the trade agreement.

actions. Controlling for unobserved firm heterogeneity with fixed effects, our results are robust to alternative specifications and are not driven by an EU industry effect common to steel firms.

This paper contributes to the literature on trade protection and firm related aspects. Feenstra (1995) and Gawande and Krishna (2003) are among the few to document the impact of trade remedy measures on the performance of domestic firms. Safeguard measures restrict trade and raise markups of protected firms. Hansen and Prusa (1995) find that the US safeguard measures across different sectors from 1980 to 1988 decreased trade volumes by an average of 34 percent.[4] Konings and Vandenbussche (2005) more recently investigate the relationship between import tariffs and markups in imperfectly competitive domestic industries. In contrast to this literature, our paper is the first to document the effects of one country's administered protection on the markups of firms in another country.

A few economic studies of the US protection have been recently conducted from the perspective of the US steel industry. Liebman (2006) investigates the effect of the US safeguard protection applied on US steel imports on the price of steel in the US. He finds interesting results that improved macroeconomic conditions boosted the recovery of the US steel industry, leaving the price of steel mainly unchanged during the protection. This guides our intuition that the EU steel producers could have partially absorbed the US safeguard tariffs by suppressing their markups. Liebman's findings further suggest that China's increasing demand for steel played an important role in the catching-up of the US steel industry. We find that the US safeguard protection resulted in some rerouting of European steel notably towards China. Bown and Crowley (2006) address the impact of one country's use of an import restricting trade policy on a foreign country's exports to third markets. In conclusion, by investigating the effect of the US safeguard and antidumping measures on Japanese exports of roughly 4,800 products into 37 countries between 1992 and 2001, they show that the US import restrictions both depress Japanese export flows to the US and deflect them to third countries.

The remainder of our paper is organized as follows. Section 2 provides an overview of the situation in the EU steel market and motivates further analysis by providing a description of the industry. Section 3 presents a simple theoretical framework to guide the intuition in support of the empirical analysis. Section 4 discusses earlier literature on estimating firm markups and develops

[4] Both antidumping (AD) and safeguard measures (SG) may result in ad valorem tariffs, expressed as a percentage of CIF import price. However, AD and countervailing (CVD) measures are distinguishable from SG measures in their attempt to remedy injury caused by dumping or actionable subsidies. While "red and yellow" subsidies, such as export subsidies, can be countervailed, the "green-light" subsidies, such as construction subsidies, cannot be countervailed.

an empirical model based on the Roeger (1995) approach. It also discusses the results in line with the sensitivity analysis. Section 5 concludes with a brief summary of our empirical results, leading to some interesting implications.

2 The Situation in the EU Market for Steel

Before turning to the theory and empirics, we take a closer look at the statistics on the EU steel firms and trade flows with respect to the US safeguard protection.[5] The US protection against steel imports was implemented in March 2002. The protection was based on the US International Trade Commission's (ITC) investigation. The ITC established serious injury to the US steel industry and decided to protect the US steel industry through safeguard tariffs, described in Table 1.[6] This table shows the type of steel products, the classification of the products within the Harmonized Tariff Schedule (HTS),[7] the tariff levels during the safeguard protection, the average US import market share of the steel products, and the change in the US steel imports during the US safeguard protection.

[Insert Table 1 here]

The US safeguard measures ranged from 8 to 30 percent on 9 categories of steel imports as well as a tariff-rate quota on slabs.[8] The highest tariff levels of 30 and 24 percent were imposed on imports of products that represented the largest share in the total US imports, i.e. slabs, flat steel, and different types of bars and rods. As a whole, the US protection covered about 75 percent of the world's steel exports to the US, as described in the first row of Table 1. A bulk of 16 percent was represented by the EU exports to the US.

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[5] Appendix B describes the information collected from the White House Press on the US Steel Products Proclamation, the company accounts data from Amadeus (Bureau van Dijk 2006), and the trade and tariff data from the US International Trade Commission (2006) from which these statistics are taken for the period 1995-2005.

[6] Certain prerequisites are required for the imposition of safeguard measures: first, the injury determination, and second, the determination of a surge in imports either absolutely, relatively to the market or its consumption, unanticipated, or non-attributed, if low industry performance is associated with the economic downturns. The objective of this protection was to allow the US steel industry to adjust to more liberalized trade in steel. The situation was not bright for the US steel producers in 2001 as they were selling below their production costs and experienced on average a $57 loss per one tonne of steel manufactured. At the same time, the world producers were on average using only 77 percent of their capacities and several US integrated steel manufacturers could not keep pace and went out of business (The International Iron and Steel Institute 2003).

[7] In December 2001, the ITC provided detailed definitions of products under the Harmonized Tariff Schedule of the United States (HTS) in Appendix A to its determination, set out at 66 Fed. Reg. 67304, 67308-67311. By February 2002, the ITC provided additional information in response to a request by the US Trade Representative under section 203(a)(5) of the Trade Act (19 U.S. 2253(a)(5)).

[8] Slabs refer to cold- and hot-rolled carbon steel sheets and plates.

Looking at the breakdown of the US import market shares by products, we see that slabs and flat steel together accounted for about 55 percent of total world exports to the US of which 10 percent came from the EU. The last column of Table 1 reports the change in the US steel imports during the US protection relative to the period 1995-2005. These descriptive statistics point at the loss of the EU market share in the US during the US protection. The EU steel exports to the US declined by a substantial 38 percent during that period. Although the decline in exports from the rest of the world to the US was lower, a 27 percent drop in such exports was nonetheless registered.

The EU steel industry largely opposed the US safeguards. Consequently, the European Commission filed a complaint at the World Trade Organization (WTO), putting forward the argument that additional protection of the US steel market would result in diversion of steel from the rest of the world to the EU. To see what the situation was we first look at the EU imports and exports of steel in Figures 1 and 2. In Figure 1 we show an index of the EU imports of steel, while in Figure 2 we show the EU exports of steel. Figure 1 depicts an increase in the EU steel imports from all countries particularly after 2002, but notably from the US and China. Figure 2 depicts a decline in the EU exports to the US but also an almost simultaneous increase of the EU exports to China. This may reflect the surging demand for steel in China, which may have rerouted some of the EU steel from the US to China during the US safeguard protection.

[Insert Figures 1 and 2 here]

The figures above suggest that the world exports of steel might have diverted from the US to the EU and put pressure upon the EU steel industry. We identify 2,263 EU steel firms directly affected by the US protection. The identification of firms is discussed in greater detail in Appendix B. Table 2 provides some descriptive statistics on these firms over the sample period 1995-2005 by presenting the main indicators of the firm's size in terms of sales and employment, performance in terms of return on total assets and Lerner index, and measured labour productivity in terms of value added per employee.

[Insert Table 2 here]

Table 2 shows that our dataset consists mostly of single-product firms and only about 25 percent of multi-product firms, given the second column. Multi-product firms are on average larger than single-product firms, in terms of sales and employment, and perform better as they have higher returns on assets at similar levels of measured labour productivity. Most of the multi-product firms

(76 percent) are active in the manufacturing industries, of which 67 percent in the industry of basic and fabricated metals. The statistics reveal another interesting pattern. The statistics at the bottom of Table 2 show that 24 percent of the multi-product firms are active in non-manufacturing sectors, such as financial, marketing and retail sectors. These firms are among the largest, the most capital intensive and have the largest market power, as proxied by the Lerner index.

We plot the Lerner index over time in Figure 3 and distinguish between single and multi-product firms. This figure indicates a drop in the Lerner index for all EU steel firms during the US protection starting from 2002.[9] The decline is most pronounced for the single-product firms, which constitute the majority of our sample. Figure 3 is already suggestive that the single-product firms may have suffered more than multi-product firms from the US safeguard protection.

[Insert Figure 3 here]

The descriptive statistics above motivate our analysis by implying downward pressure of the US protection on the markups of European steel producers due to increased world exports to the EU and decreased EU exports to the US, which can be observed in Figures 1 and 2. In what follows we will look more formally for the causality between the drop in the EU markups and the US safeguard protection.

3 Theoretical Framework

We use a modification of the existing reciprocal dumping model by Brander (1981) and Brander and Krugman (1983) to guide our empirical work and formulate our hypotheses. We consider the two countries to be the EU and the US and introduce a safeguard tariff imposed by the US government on each unit of the EU shipments to the US, denoted by τ. This simple model does not intend to provide an exhaustive alternative to existing theoretical models explaining the effects of protection. On the contrary, our aim is rather to point out that the US safeguard protection mattered for the EU producers. Our model shows that the US safeguard tariff adversely affected the EU firm's markups.

We consider that EU and US firm produce the same steel product at the unit variable cost c.[10] Both firms are located in their home countries, namely the EU and the US. Imperfect competition

[9] Figure 3 reports the annual mean values of the Lerner index calculated by the price-cost margin method (PCM) discussed in Tybout (2003). The observed firm-level Lerner index is defined as sales net of expenditures on labour and materials over sales.

[10] The product is considered homogeneous in line with the "like product" rule. In accordance with this rule, the WTO makes decisions on the basis of appearance, use, and process of production. The first two considerations are

generates trade in this product. While competing in Cournot fashion in shipments of the steel product, the firms face iceberg transport costs, so that the marginal cost of exports is $\frac{c}{g}$, where $0 \leq g \leq 1$. It is essential that the EU and US markets are segmented, so firms set prices independently in each market. The solution of the best reply functions of each firm is the trade equilibrium. Consider that the EU firm's market share in the US market is defined by $\sigma^* = \frac{x^*}{Q^*}$ and the US firm's market share in the EU market is defined by $\sigma = \frac{y}{Q}$, where Q and Q^* denote the total outputs at the output prices P in the EU and P^* in the US. Define the price elasticity of demand as $\varepsilon = -\frac{P}{Q}\frac{\partial Q}{\partial P}$ and similarly for the US denoted by an asterisk. Consider now the US safeguard tariff in place on the EU imports. It can be shown that with the US safeguard tariff the market share of the US firm in the EU will exceed the market share of the EU firm in the US, i.e. $\sigma^* < \sigma$.[11]

The model suggests two channels through which the markup of the EU firm is affected by the US safeguard tariff. We consider a vector of the EU markups, $\widetilde{\mu}$, that consists of the markup associated with the EU market, $\mu = \frac{P}{c}$, and the markup associated with the EU output exported to the US, $\mu^* = \frac{P^*}{\frac{c}{g}+\tau}$. Let us define the equilibrium import penetration ratio as the share of the EU imports over the total EU output, denoted by $m = \frac{y}{x+y}$. Hence, we express the markup of the EU firm as:

$$\widetilde{\mu} = \begin{bmatrix} \mu \\ \mu^* \end{bmatrix} = \begin{bmatrix} [1 - \frac{1-m}{\varepsilon}]^{-1} \\ [1 - \frac{\sigma^*}{\varepsilon^*}]^{-1} \end{bmatrix} \tag{3.1}$$

Intuitively, the EU firm exhibits a lower markup on its exports due to the trade costs, $\frac{c}{g}$ and τ. Equation (3.1) leads to Proposition 1.

Proposition 1 *An introduction of the US safeguard tariff into the reciprocal dumping model affects the EU markup negatively, moreover, the markup of the EU firm:*

1. decreases with the level of the US safeguard tariff, and

2. decreases with the US import penetration to the EU.

Proof.

1. $\frac{\partial \mu^*}{\partial \tau} = -\frac{g^2}{c(1+g+\frac{g\tau}{c})^2(1-\frac{g}{1+g+\frac{g\tau}{c}})^2} < 0$, given $c \wedge \tau > 0$, where $0 \leq g \leq 1$;

2. $\frac{\partial \mu}{\partial m} = -\frac{m\varepsilon}{(m+\varepsilon-1)^2} < 0$, given $\varepsilon \wedge m > 0$.

emphasized by the WTO, meaning that if products look the same and are used in the same way, then they are considered to be homogeneous.

[11] See Appendix A for a more detailed description of the theoretical model.

$\blacksquare$

Now that the model has shown that the markup of European firm is negatively affected by the level of the US safeguard tariff and the US import penetration, we take these results to the data. Using a large panel of European steel producers, we expect both the import penetration and the US safeguard tariff to have a negative effect on the markup of the EU firm.[12] Intuitively, each EU firm faces larger costs per unit of output shipped than under free trade, so that the US tariff shifts its best response function inwards in the US market and thus diminishes its market power.

4 Empirical Analysis

4.1 The Model

We use the Roeger (1995) methodology to estimate whether the US safeguard protection had a negative impact on the markups of European steel producers. The advantage of this approach is that it can be used to directly measure the markups of firms, as shown by Roeger and Warzynski (2004) and Konings and Vandenbussche (2005).

Roeger (1995) similar to Hall (1988) decomposes the Solow residual (Solow, 1957) into a markup component and a pure technology component. The Hall approach is less suited for our analysis, because it requires instruments to control for the simultaneity bias coming from the firm's adjustment of factor demands in response to productivity shocks.[13] Roeger (1995) and Olley and Pakes (1996) suggest models that go beyond the Hall approach. Olley and Pakes (1996) overcome a simultaneity problem generated by the relationship between productivity and demand for production factors. Their model circumvents the selection and simultaneity biases by developing a semi-parametric estimator for the production function parameters within the behavioural framework. Because their approach requires longer time spans and can be applied only to firms with positive capital investments, it is also less appropriate for our case.

Roeger (1995), similarly to Hall (1988), decomposes the Solow residual, but argues that the dual Solow residual, consisting of output and production factor prices, nests the same productivity term that will cancel out if the dual Solow residual is deducted from the primal Solow residual (Martins

[12] Empirical literature provides support that markups fall with import competition, since foreign competition increases the price elasticity of demand that domestic firms face. For a more detailed survey of this literature, see Feenstra (1995) and Tybout (2003).

[13] It is hard to find plausible instruments that control for pure demand shocks and they may be correlated with factor stock growth but not with transitory productivity growth, causing spurious correlation with the trade regime as found out by Abbott et al. (1989).

et al. 1996; Konings and Vandenbussche 2005). Hence, the markup is included in the measurement of the total factor productivity growth that is the output growth not accounted for by the growth in inputs.

In agreement with Hall (1988) and Konings and Vandenbussche (2005), we consider a log-linear homogeneous production function $G(K_{it}, L_{it}, M_{it})E_{it}$ for output Q_{it}, where K_{it}, L_{it}, and M_{it} are capital, labour and material inputs, and E_{it} is a shift variable representing changes in productivity efficiency of a firm i at time t. Using the Solow residual (SR_{it}), Hall (1988) measures the productivity growth as the output growth net weighted growth of the production factors, described as:

$$SR_{it} = \triangle q_{it} - (1 - \alpha_{Lit} - \alpha_{Mit}) \triangle k_{it} - \alpha_{Lit} \triangle l_{it} - \alpha_{Mit} \triangle m_{it} \tag{4.1}$$

where small letters refer to the logarithms and the shares of labour and material costs in total sales ($P_{it}Q_{it}$) of a firm i at time t and are denoted by $\alpha_{Lit} = \frac{F_{Lit}L_{it}}{P_{it}Q_{it}}$ and $\alpha_{Mit} = \frac{F_{Mit}M_{it}}{P_{it}Q_{it}}$ with F and P representing input and output prices. Decomposition of the markup and the technology component is a crucial step in the Roeger approach and (4.1) can be expressed in the following form:

$$SR_{it} = \lambda_{it}(\triangle q_{it} - \triangle k_{it}) + (\xi_{it} - \lambda_{it}) \triangle e_{it} \tag{4.2}$$

where $\lambda_{it} = \frac{P_{it} - c_{it}}{P_{it}}$ is the Lerner index for a firm i at time t. The right-hand side is decomposed in the markup and the pure technology component.[14] The price-based or the dual Solow residual (SRP_{it}) is then defined from the relationship between the marginal cost and the output price and it can be expressed in the following form:

$$\begin{aligned} SRP_{it} &= (1 - \alpha_{Lit} - \alpha_{Mit}) \triangle F_{Kit} + \alpha_{Lit} \triangle F_{Lit} + \alpha_{Mit} \triangle F_{Mit} - \triangle p_{it} \\ &= (1 - \lambda_{it}) \triangle e_{it} - \lambda_{it}(\triangle p_{it} - \triangle F_{Kit}) \end{aligned} \tag{4.3}$$

where F_{Kit} denotes the price of capital employed in the production function. The innovation of Roeger (1995) comes from using the dual Solow residual (SRP_{it}) to substitute a change in productivity efficiency of a firm i at time t denoted by $\triangle e_{it}$ in (4.2). Subtracting the dual Solow

[14] Roeger (1995) shows that the change in the marginal cost ($\triangle c_{it}$) is a weighted average of the changes in input prices ($\triangle F_{it}$) with respect to their relative cost shares in the firm's cost function (ϕ_{it}), accounting for the change in technology (e_{it}), i.e. $\triangle c_{it} = \phi_{Iit} \triangle F_{Iit} - \triangle e_{it}$. Hence, $c_{it} = P_{it}(1 - \lambda_{it}) \Longleftrightarrow \frac{P_{it}}{c_{it}} = \mu_{it} = \frac{1}{1-\lambda_{it}}$.

residual from the primal Solow residual yields the following expression:

$$(\triangle q_{it} + \triangle p_{it}) - (\triangle k_{it} + \triangle F_{Kit}) = \mu_{it}(\phi_{Lit} \triangle \Omega_{Lit} + \phi_{Mit} \triangle \Omega_{Mit}) \tag{4.4}$$

where $\triangle\Omega_{Lit}$ and $\triangle\Omega_{Mit}$ represent the growth rates in labour and material costs per value of capital costs in a firm i at time t.[15] We can directly estimate the price markup term (μ_{it}) in (4.4). Our core model is thus specified as $\triangle Y_{it} = \mu_{it} \triangle X_{it}$, where the left-hand side variable ($\triangle Y_{it}$) represents the growth rate in sales per value of capital for a firm i at time t and the right-hand side explanatory variable ($\triangle X_{it}$) represents a vector of the growth rate in inputs weighted by their shares in total sales.[16]

4.2 Results

We estimate (4.4) in a log-linear fixed-effects model, using annual and country fixed effects to control for any changes in markups that are common across firms.[17] In our basic empirical specification, we estimate whether there is a statistically significant change in the markups in the period of the US safeguard protection with respect to the sample period 1995-2005:

$$\Delta Y_{it} = \alpha_i + \mu_1 \Delta X_{it} + \mu_2[\Delta X_{it} SG] + \mu_3[\Delta X_{it} GDP_{jt}] + \beta_1 GDP_{jt} + \varepsilon_{it} \tag{4.5}$$

Our dependent variable, ΔY_{it}, represents the output growth per value of capital. Our composite explanatory variable, ΔX_{it}, includes the growth of nominal inputs weighted by factor shares in the output for each firm i at year t. The results of estimating (4.5) for each group of the EU steel producers are reported in Table 3. In the first column we report results (1), where we estimate the markups jointly for all EU producers of steel products. The coefficient μ_1 refers to the level of the markups of the EU firms in the absence of the protection. The coefficient is statistically different from 1 and implies that the output price exceeded the marginal cost roughly by 38 percent.[18]

[15] For the sake of brevity we express $\triangle\Omega_{Lit}$ and $\triangle\Omega_{Mit}$ as $\triangle\Omega_{Lit} = (\triangle l_{it} + \triangle F_{Lit}) - (\triangle k_{it} + \triangle F_{Kit})$ and $\triangle\Omega_{Mit} = (\triangle m_{it} + \triangle F_{Mit}) - (\triangle k_{it} + \triangle F_{Kit})$.

[16] Roeger (1995) assumes the constant returns to scale (CRS), implying an estimation bias depending on the actual returns to scale. Relaxing the CRS assumption, the markup could be discounted for the term ξ_{it}, representing the sum of input cost shares in production function, and therefore expressed as $\frac{p_{it}}{c_{it}} = \frac{\mu_{it}}{\xi_{it}}$. The method leads to overestimated markup levels and underestimated markup changes in case of the increasing returns to scale.

[17] Following the results of the Hausman test, we prefer a fixed effects model over a random effects model. The F-test indicated that fixed effects were significant in all model specifications. We control for business cycles with the real GDP growth rates to proxy for country-level shifts of demand as in Konings and Vandenbussche (2005). Appendix B describes the data and variables in more detail.

[18] In Table 3 we show also the results for the fixed-effects regressions, denoted by primes, where standard errors are not adjusted for intra-industry correlation. Table 3 shows that the results are rather robust to alternative specifications.

[Insert Table 3 here]

We interact our composite variable ΔX_{it} with a dummy variable SG denoting safeguard measures, taking values 1 in 2002-2003 and 0 otherwise. The estimated coefficient μ_2 is of particular interest to us as it captures the effect of the US safeguards on the EU markups. We see a statistically significant decrease in the average markup after the imposition of the US safeguards. The point estimate suggests a statistically significant decline of 11 percent in the average markup during the US safeguard protection in 2002-2003. The negative sign on GDP suggests the counter-cyclicality of the markups consistent with Konings and Vandenbussche (2005).[19] In specifications (2) and (3), where we consider multi- and single-product firms, we also find a highly significant decline in their markups due to the US safeguard protection.

The level of the markups (μ_1) for multi-product firms (2) is on average larger than for single-product firms during 1995-2004. This could be because larger multi-product firms benefit from scale economies as they spread fixed costs over a larger number of units, thus operating on the downward sloping part of the average cost curve. Single-product firms, however, suffer more than multi-product firms as they on average exhibit lower markups during the US protection. The lower markups in more competitive markets leave less room to absorb the cost increase associated with the US tariffs. In Table 2 we saw that a large fraction of multi-product firms (24 percent) is active not only in the affected sector of basic metals. Their presence in other manufacturing and non-manufacturing sectors may allow them to charge their markups according to the product characteristics and thus to maintain higher markups than single-product firms.[20]

4.3 Robustness and Discussion of Results

4.3.1 Safeguard Tariffs, Import Penetration and Trade Diversion

In line with motivating evidence provided by Figures 1 and 2, we extend our model by decomposing the markup change to the part associated with the US safeguard tariffs and the part associated

[19] The real GDP growth rate in our data lies at 2 percent. We prefer to use GDP as a measure of business cycles than the deviations from the industry averages, because of more significant results, even though the direction of signs did not vary.

[20] Multi-product firms use basic steel intermediates further into the fabrication process, allowing for larger markup differentials. Further fabrication of steel increases the degree of product differentiation, where firms are able to charge different markups according to product characteristics and quality differences, unobserved to an econometrician. See Berry et al. (1995) and Verboven (1996) for supporting empirical evidence. Moreover, large multi-product firms are able to operate at lower unit production costs by recycling scrap steel and internalizing the energy and raw material costs.

with the EU trade in steel products. The extended model is specified in a general form as:

$$\begin{aligned}\Delta Y_{it} \quad = \quad & \alpha_i+\gamma_1\Delta X_{it}+\gamma_2[\Delta X_{it}\tau_{kt}]+\gamma_3[\Delta X_{it}SGm_{kt}]+\gamma_4[\Delta X_{it}SGx_{kt}] \\ & +\gamma_5[\Delta X_{it}GDP_{jt}]+\beta_1 m_{kt}+\beta_2 x_{kt}+\beta_3 GDP_{jt}+u_{it} \qquad (4.6)\end{aligned}$$

Hence, γ_2 in (4.6) is the markup change related to the EU exports to the US during 2002-2003 and conditional on the tariff level, τ, imposed on each unit of product k exported to the US in year t. The coefficient γ_3 is the markup change related to the EU imports of a steel product k in year t from the rest of the world during 2002-2003, denoted by m_{kt}. The coefficient γ_4 denotes the markup change associated with the EU exports to the rest of the world, x_{kt}, during the US safeguard protection. These parameters are interacted with the safeguard dummy, taking values 1 during the US protection and 0 otherwise.[21]

A potential problem of our estimation strategy is the reverse causality between the growth in the firm's output on the left-hand side and trade on the right-hand side, arising from the relation between productivity and openness as some high productive EU firms could self-select themselves to export. Similarly, some foreign firms could export to the EU because of the prevailing market structure. To circumvent this problem, we measure the EU imports and exports in terms of the import penetration, m_{kt}, and export intensity, x_{kt}, aggregated at the 4-digit industry level.[22]

The results presented in Table 4 indicate that the average markup of both multi- and single-product firms is negatively associated with the external EU import penetration and export intensity to the US, conditional on the tariff levels. The markups are shown to decrease with the level of the US safeguard tariff, on average by about 6 percent for all firms in the specification (4). Multi-product firms (6) suffered slightly more from the tariffs than single-product firms (8), suggesting that multi-product firms exported to the US a large fraction of flat steel and products hit by the highest levels of tariffs, as described by Table 1. The multi-product firms also saw a considerable decline in their markups due to increased imports into the EU market for steel. Our results suggest

[21] In models with interaction effects we always include the main effects of the variables (referring to β_1, β_2 and β_3) that were used to compute the interaction terms to exclude the possibility that main effects and interaction effects are confounded.

[22] Import penetration is defined as $m_{kt} = \frac{\text{imports}_{kt}}{\text{production}_{kt} + \text{imports}_{kt}}$ and export intensity as $x_{kt} = \frac{\text{exports}_{kt}}{\text{production}_{kt} + \text{imports}_{kt}}$, where k refers to the 4-digit production activity where the steel product subject to the US protection is produced. The industry averages of trade flows in tons are aggregated across all firms reporting their activity in the 4-digit sector, where the 8-digit steel product is produced. On average, the import penetration and export intensity lay around 25 percent over the whole sample period and across all 4-digit industries. The synthetic index of the Economic Freedom of the World or the Warner&Sachs index of openness are not appropriate instruments, since they do not directly measure the impact of the US safeguard measures.

that an increase of EU import penetration by one unit led to a decline in the markups of multi-product firms by 3 percent in (6). This evidence suggests that multi-product firms lost some of their market power in the EU during the protection relative to the period 1995-2005, while the effect was not significant for the single-product firms.

[Insert Table 4 here]

Previously presented Figures 1 and 2 are suggestive that on the one hand some EU firms might have suffered particularly from the imports from Russia. On the other hand, some EU firms might have diverted their exports from the US to China. In the alternative specification, we include the EU imports from Russia and exports to China in (4.6), measured in the same manner as the external EU trade flows denoted by m_{kt} and x_{kt}. The estimation results (7) in Table 4 suggest that multi-product firms suffered especially from the Russian exports during the US protection, but on the other hand countervailed some of their losses by increasing their markups associated with the exports to China. By contrast, single-product firms (9) lost less of their market power because of the Russian exports to the EU. However, the results (9) suggest that single-product firms exporting to China saw their markups decline as competition became fiercer in China's market for steel. The evidence above shows that multi-product firms appear to be less dependent on individual international markets and seem to adjust their markups to the high-variance trade shocks in the global trade arena.

4.3.2 Exit and Entry of Firms

We consider that exit and entry could determine the pattern of the average firm's markup response to the US protection. According to recent literature on intra-industry heterogeneity (Melitz 2003), the increased competition forces less productive firms, with relatively low markups to exit, while more productive firms, with higher markups, gain market shares. Consequently, we would expect the average markup to increase when controlling for the exit of firms, if less efficient firms exit during the US protection.

[Insert Table 5 here]

In Table 5 we report estimates for two sub-samples of the EU steel firms. First, we estimate the average markup and its change during the US protection for a balanced panel of firms, where we control for any entry or exit of firms. Second, we control for the possibility that some EU steel firms might have exited during the US protection. Our results are in line with the intuition above and vary by rough 2 percentage points relative to the estimates presented in Table 3.[23] The estimated markup change is lower by 2 percentage points and the level of markup is on average 3 percentage points higher compared to the results in Table 3. We find no conclusive evidence for the multi-product firms. Controlling for the exit of firms during the US safeguard protection, we do not find that the results in Table 3 are associated with the exit of firms during the US protection.

4.3.3 Counterfactuals

We use the exact matching method following closely the work of Rosenbaum and Rubin (1984) and Angrist (1998) to verify that the markups of the EU steel producers declined due to the US safeguard protection and not due to some common phenomenon in the EU manufacturing sectors. This method reduces the selection bias in the choice of the counterfactual group. We find it appropriate, because it enables us to choose from a large pool of firms across manufacturing industries that are similar to steel firms.

The parameter of interest is the markup change during the US protection relative to the period 1995-2005. For any non-steel firm observed during the US protection we define random variables representing how the firm's markup would have changed, had the firm's production been subject to the US protection. Denote these potential outcomes by S_1, if a firm is exposed to the treatment and S_0, if a firm is not exposed to the treatment. The treatment status is denoted by a dummy variable D taking value 1 during the US protection in 2002-2003 and 0 otherwise. The effect of treatment on treated steel firms could be estimated by the parameter following Rosenbaum and Rubin (1984) as:

$$E[S_1 - S_0|D = 1] = E[S_1|D = 1] - E[S_0|D = 1] \tag{4.7}$$

which tells us if a treated firm on average experienced a change in its markup due to the US protection. Simple comparisons can be used to construct a counterfactual in (4.7) but these comparisons would not control for the firm-specific criteria. Therefore we decompose the comparisons by firm characteristics that can be observed in our company-accounts data and we express them in logarithmic terms. These predetermined covariates, denoted by V, include the firm's size in terms of employment, factor intensity in terms of total fixed assets per worker, and measured labour productivity in terms of value added per worker. We cluster steel firms into three cohorts according to

[23] We exclude about one fifth of firms from our sample. However, in this reduced sample we do not find significant changes in the markups of the multi-product firms during the US protection.

the mass distribution of values in each of the three criteria. If the firm's response in the markup were independent of its own characteristics, then the effect of treatment on the treated would be also the average treatment effect on the population and could be estimated by simple comparisons. Table 6 suggests this is not the case.

[Insert Table 6 here]

Firms exhibit different markup levels and changes depending on their characteristics. In Table 6, we observe that markups are positively related to the measured labour productivity of firms, which is in line with the recent literature on intra-industry firm heterogeneity coming from differences in technical efficiency (Bernard et al. 2003). More productive firms exhibit a larger markup of 1.613 compared to less productive firms with a markup of 1.273. High-productivity firms also respond sharper than low-productivity firms to the US protection, with a difference of about 5 percentage points. A closer look at the steel firms reveals that even within the cohort of high-productivity firms, the multi-product firms have higher markups than the single-product firms, i.e. 2.041 and 1.550 respectively. Table 6 further shows that size and capital intensity also clearly determine the level of markups and their response to the US protection. Larger and more capital-intensive multi-product firms have larger markups and seem more flexible to adjust to the US protection.[24]

Table 6 suggests we have to consider that the effect of the US protection on the markups is conditional on a set of observed covariates included in V using conditional independence, expressed as $E[S_0|D, V] = E[S_0, V]$. The effect of treatment on the treated can therefore be estimated using the expression (Angrist 1998):

$$E[S_1 - S_0|D = 1] = \int \{E[S_1|V, D = 1] - E[S_0|V, D = 0]\} df(V|D = 1) \tag{4.8}$$

where $df(V|D = 1)$ is the density function for V during the US protection. $E[S_1 - S_0|D = 1]$ is obtained as a weighted average of firm characteristics between treated steel and counterfactual firms at each value of V in 27 cohorts.[25] The sample of counterfactuals is drawn conditional to V

[24] The higher the amount of capital involved within an industry the more difficult it is to enter. When the threat of potential entry is low it allows incumbents to charge higher markups, consistent with the estimates for the multi-product firms. However, Table 5 suggests there has been an upward switch between capital intensity and measured labour productivity for low- and medium-productivity single-product firms, while very productivity firms have hardly made any change in their markups. A similar result is obtained by Roeger and Warzynski (2004), suggesting that firms with average or low productivity have adopted more flexible production structures to employ capital more efficiently.

[25] Cohorts refer to all possible combinations of the chosen three criteria, i.e. 3^3 combinations as firms are assigned to three cohorts according to size, factor intensity and measured labour productivity. We refrain from constituting a larger number of cohorts, because we want to maintain about 400 observations in each cohort to ensure validity of our estimates.

to avoid the problem, where values of V appear only for treated observations. Thus V is discrete as it takes values within one out of 27 cohorts, i.e. $V = \{v_{1,}v_2, ..., v_{27}\}$. There are N_{1h} observations in the population of counterfactual firms and N_{0h} observations in the population of steel firms. The corresponding sample sizes are denoted by n_{1h} for counterfactual and n_{0h} for steel firms. The sample size design is denoted by $\delta_h = 1[n_{1h} > n_{0h} > 0]$, since the population pool of counterfactual firms is about four times larger than the population pool of steel firms in our data set. Let $\overline{s}_{1h}$ denote the markup change of counterfactual firms and $\overline{s}_{0h}$ the markup change of treated steel firms. Angrist (1998) shows the estimator is consistent for the population parameter

$$\kappa = \{E[S_1 - S_0|D = 1, P(D = 1|V) < 1\} \tag{4.9}$$

when it holds that $\widehat{\kappa} \equiv \sum_h \delta_h N_{1k}[\overline{s}_{1h} - \overline{s}_{0h}] / \sum_h \delta_h N_{1k}$. The weighting function in (4.8) and (4.9) is the population distribution function of V among steel firms at values where $[\overline{s}_{1h} - \overline{s}_{0h}]$ is defined. The restriction $P(D = 1|V) < 1$ ensures that there are observations for all values of V.[26]

[Insert Tables 7 and 8 here]

Summary statistics on the treated and counterfactual firms are presented in Table 7. The matching between steel and counterfactual firms is rather successful as counterfactual firms on average do not differ by more than 5 percent from steel firms according to predetermined covariates captured by V. Table 8 reports the estimated levels of markups and markup changes for the treated steel firms and counterfactual firms from different manufacturing industries. The decline in markups of the EU steel firms was systematically lower than for counterfactual firms by about 4 percentage points during the US protection. Therefore we can conclude that a decline in the markups of the EU steel firms was associated with the US protection despite a clear downward trend in markups across the EU manufacturing industries.

[26]Values of V for which there are no observations, i.e. for which the probability $P(D = 1|V) = 0$, are given zero weight. In practice this implies that we use population cell sizes, referring to the number of observations for treated steel firms in each of the 27 cohorts, excluding missing values. Consequently we end up with 7,517 observations across all 27 cohorts. The estimator $\widehat{\kappa}$ is unbiased and consistent, since the sampling conditions on V of the treated steel firms. An alternative approach would be a propensity-score matching method, which is less appropriate when a large population pool of counterfactual firms is available as in our data. The approach developed by Angrist (1998) is more suited to our data and gives better matching scores than the propensity score matching method.

5 Conclusion

Safeguard measures, together with antidumping measures, have become the prevalent instruments for imposing import restrictions. While previous micro-econometric research focuses on domestic producers, it largely neglects the effects of safeguards on foreign firms. In this paper we provide evidence that the US safeguard protection on steel in 2002 adversely affected the markups of European steel producers. We find that the markups of European steel producers on average declined by 11 percent during the US safeguard protection. Single-product firms saw their markups decline by more than multi-product firms. Our results also suggest that European steel exporters partially absorbed the US safeguard tariffs. We show that higher levels of the US safeguard tariffs were associated with larger declines in the markups of the EU steel producers.

Our results have interesting implications. First, the safeguard measures designed to protect the US firms induce adverse externalities for European firms. Our evidence is suggestive that the US safeguard protection triggered domino effects.[27] We find that the US safeguard protection resulted in some rerouting of European steel notably towards China. This resulted in a call for import protection by China's steel producers. In 2003, China itself imposed safeguard measures on certain steel products in response to a large influx of steel from the rest of the world during the US safeguard protection.

Second, the response to the US safeguard protection amongst the EU steel firms was heterogeneous. The fact that single-product firms suffered more from protection than multi-product firms indicates the larger dependency of single-product firms on adverse market reactions. Multi-product firms appear to be less dependent on individual international markets and seem to have a better ability to adjust their markups to the high-variance trade shocks in the global trade arena. Our results show that there is a benefit from being a multi-product firm in the sense that multi-product firms seem less vulnerable to adverse shocks than single product firms. In conclusion, we find a considerable negative effect of the US safeguards on the EU markups, suggesting that one country's safeguard protection generates adverse externalities for its trading partners.

[27] The concept of domino effects in the multilateral trade framework has been introduced into the international trade literature in the early nineties by Baldwin (1993). His paper presents a theoretical model where an established trade agreement can trigger requests from countries that were previously non-members. His model implies that one country's trade policy action can trigger echoing trade actions by other countries.

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APPENDIX A: Description of the Theoretical Model in Section 3

European and US firm compete in Cournot fashion and face iceberg transport costs per unit of their shipments. The EU firm's exports to the US are additionally constrained by the US safeguard tariff. The EU firm produces the output x for the EU market and the output x^* for the US market, denoted by the asterisk *. The US firm produces the output y for the EU and the output y^* for the US market. Each firm sells its output at the price P in the EU and at the price P^* in the US and maximizes its profits with respect to the output in each market taking into account shipments of the other competitor. The first order conditions for profit maximization imply:

$$P(Q)[1-\frac{x}{\varepsilon Q}]=c \tag{A.1}$$

$$P^*(Q^*)[1-\frac{x^*}{\varepsilon^* Q^*}]=\frac{c}{g}+\tau \tag{A.2}$$

where $P(Q)$ and $P^*(Q^*)$ are the inverse demand functions in the EU and the US markets, respectively. Consider that the European firm's market share in the US market is defined by $\sigma^*=\frac{x^*}{Q^*}$ and the US firm's market share in the EU market is defined by $\sigma=\frac{y}{Q}$, where Q and Q^* denote total outputs at the output prices P in the EU and P^* in the US. Defining the price elasticity of demand with $\varepsilon=-\frac{P}{Q}\frac{\partial Q}{\partial P}$, the best response functions for both firms in the US market can be implicitly expressed as:

$$x^*(y^*): P^*=\frac{c\varepsilon^*+\tau g\varepsilon^*}{g(\varepsilon^*-\sigma^*-1)} \tag{A.3}$$

$$y^*(x^*): P^*=\frac{c\varepsilon^*}{\varepsilon^*+\sigma^*-1} \tag{A.4}$$

and analogously best reply functions can be derived for the EU market. The above equations imply that the European firm needs to consider the tariff τ imposed on each unit of its output shipped to the US. The equilibrium market shares and prices are then given in the US market as:

$$\sigma^*=\frac{\varepsilon^*(g-1-\frac{\tau g}{c})+1+\frac{\tau g}{c}}{1+g+\frac{\tau g}{c}} \tag{A.5}$$

$$P^*=\frac{c\varepsilon^*(1+g+\frac{\tau g}{c})}{g(2\varepsilon^*-1)} \tag{A.6}$$

And the equilibrium in the EU is defined as:

$$P=\frac{c\varepsilon(1+g)}{g(2\varepsilon-1)} \tag{A.7}$$

$$\sigma=\frac{\varepsilon(g-1)+1}{1+g} \tag{A.8}$$

Rewriting best reply functions and solving (A.3) and (A.4) for price levels and market shares with respect to demand elasticities yields expressions for the Nash equilibrium market shares of the EU and the US firm in each other's market:

$$\left.\begin{aligned} \sigma^* &= \tfrac{\varepsilon^*(g-1-\frac{\tau g}{c})+1+\frac{\tau g}{c}}{1+g+\frac{\tau g}{c}} \\ \sigma &= \tfrac{\varepsilon(g-1)+1}{1+g} \end{aligned}\right\}\sigma^* < \sigma \tag{A.9}$$

The equilibrium prices in both markets can then be expressed as:

$$\left.\begin{aligned} P^* &= \tfrac{c\varepsilon^*(1+g+\frac{\tau g}{c})}{g(2\varepsilon^*-1)} \\ P &= \tfrac{c\varepsilon(1+g)}{g(2\varepsilon-1)} \end{aligned}\right\}P^* > P \tag{A.10}$$

The price in the US market will exceed the EU price due to the tariff τ imposed on the US imports. Under free trade both prices would be equal and firms would have equivalent shares in exporting markets. By contrast under the US safeguard protection, the EU firm will supply less to the US than the US firm to the EU, i.e. $\sigma^* < \sigma$. Each firm will export as long as it can charge a price that covers the variable cost of each unit shipped. There is an anti-competitive effect of the safeguard tariff, assuming that the price elasticity of demand ε^* falls as the European firm's market share in the US decreases.

In equilibrium, the European firm will maintain its market share in the US as long as it will find it profitable to export. In other words, the European firm needs to cover its costs per each unit of product supplied to the US, so that $P^* > \frac{c}{g} + \tau > 0 \wedge \sigma^* > 0$. Analogously will the US firm export to the EU market as long as it gilts that $P > \frac{c}{g} > 0 \wedge \sigma > 0$. Rewriting the equilibrium price levels, the price elasticities of demand can be expressed as:

$$\varepsilon^* < \frac{1+\frac{\tau g}{c}}{1-g+\frac{\tau g}{c}} \tag{A.11}$$

$$\varepsilon < \frac{1}{1-g} \tag{A.12}$$

Furthermore, the EU firm will export to the US market as long as the tariff τ is set below its prohibitive level, i.e. as long as $\tau < \frac{c(\varepsilon^*(g-1)+1)}{g(\varepsilon^*-1)}$. This is an important implication of the model, showing that the elasticity of demand in the US is lower than in the US due to the US safeguard tariff, i.e. $\varepsilon^* < \varepsilon$. The adverse effect of the safeguard tariff on the markups of the European firm can be shown from the inverse relationship between price markups and the price elasticity of demand $\frac{P-\bar{c}}{P} = \frac{1}{\varepsilon^*}$, where $\bar{c} = c + \frac{c}{g} + \tau$ denotes the aggregate marginal costs of the European firm that exceed marginal costs of the US firm by amount of the US tariff imposed. The US safeguard tariff moreover adversely affects the European firm's profits, whereas its magnitude depends on the elasticity of demand in the US and the size of its exports there, that is:

$$\frac{\partial\pi}{\partial\tau} = -x^*(\frac{\varepsilon^*-1}{2\varepsilon^*-1}) < 0 \tag{A.13}$$

APPENDIX B: Description of the Data

The data used in this study are the annual company accounts data reported at the end of each year. The data are compiled from Amadeus (September, 2006) organized by the Bureau van Dijk. The data cover the steel industry across the EU-15 countries for the period 1995-2005. We focus our study on those firms that have reported their primary activity in this sector. The additional annual data on control variables, i.e. the real GDP growth rates and the product-level trade data, are downloaded from Ameco and Eurostat.

The information on steel products covered by the US safeguards was retrieved from the official statements from the White House Press on the US Steel Products Proclamation from March 2002. From this source, we also obtained all the necessary information about the type, level, and length of the US safeguard tariffs. We identify 2,263 affected EU firms as those that are engaged in the production of steel products, accounting for 42 percent of all firms in the steel sector.[28] Each firm in Amadeus has a trade description that enables the identification of the activities pertinent to production of steel products subject to the US safeguard protection. Firms that do not report any secondary activities are referred to as "single-product firms". "Multi-product firms" by contrast refer to firms reporting at least one secondary activity.

The variables used in our econometric models are the following. The firm-level operating revenue in each year provided in Amadeus is used to proxy the output variable. For the value of capital we use the book value of tangible fixed assets for each firm in each year. The labour costs reported in Amadeus proxy the wage bill variable. The material costs variable is simply proxied by the firm-level total material costs consisting of the factor price multiplied by the quantity of materials. The country-level real GDP growth rates, the real long-term interest rates, and the price index of investment goods are obtained from the Ameco database from the ECFIN department at the European Commission.

We construct our capital variable in line with Konings and Vandenbussche (2005) as the user cost of capital multiplied by its nominal value. We define the user value of capital as $Z_{jt}(r_t + \delta_{it})$, where we consider a country-level price index of investment goods, Z_{jt}, a long-term real interest rate r_t at time t, and depreciation of capital δ_{it} of the average rate of 10 percent. We simulated the sensitivity of markups towards different depreciation rates, price indices of investment goods, and real interest rates in (4.5) and (4.6). Allowing for 5 percent changes, our point estimates vary within the range of 1 percent, without altering the signs of estimated coefficients.

The data are clean of clearly wrong entries, such as extremely high growth rates in employment, material or labour costs. We only consider observations where the share of material costs and the

[28] We use the services of the Tariff Information Center to classify protected products according to the 8-digit HTS of the US. Under Chapter 99 within Section XXII on Special Temporary Legislation, we identify subject products and match them with products specified in the Section XV on Base Metals and Articles of Base Metal product descriptions. Using the UN correspondence tables between the HTS and the PRODCOM industry classifications we identify groups of activities at the 4-digit NACE Rev.1.1 level. The firms are identified at the 4-digit production activity level.

share of labour costs in turnover is larger than 1 percent and smaller than 100 percent and exclude the extreme values of nominal growth in input and output to rule out large mergers in the first year of their operation. By doing so, we excluded 2 percent of observations from the raw data retrieved from Amadeus.

We also use only unconsolidated financial statements to avoid double-counting firms and subsidiaries. The advantage is that by using unconsolidated statements we focus on the local operations of firms and do not overestimate the values of variables. Since not all EU countries require consolidation of accounts for all firms, it also increases the comparability of steel and counterfactual firms.

APPENDIX C: Tables and Figures

Table 1: *Protected steel products, tariff levels, and the US import market shares*

		US tariff		US market share[b]		△ US imports[d]	
				RoW[c]	EU15	RoW[c]	EU15
Product group	HTS[a]	2002	2003	2002-03	2002-03	2002-03	2002-03
TOTAL[e]	9903.72.30-73.96	-	-	59.2%	16.0%	-26.7%	-38.4%
Slabs	9903.72.30-48	TRQ	TRQ	21.6%	0.9%	7.9%	-70.8%
Flat steel	9903.72.50-73.14	30%	24%	22.2%	8.9%	-47.8%	-42.8%
Tin mill products	9903.73.15-27	30%	24%	0.5%	1.1%	-62.5%	-13.2%
Hot-rolled bars & rods	9903.73.28-38	30%	24%	2.4%	2.6%	-26.9%	14.5%
Cold-finished bars & rods	9903.73.39-44	30%	24%	0.3%	0.5%	-26.9%	-37.0%
Reinforcing bars	9903.73.45-50	15%	12%	5.0%	0.4%	-20.5%	-32.1%
Stainless steel bars & rods	9903.73.74-89	15%	12%	0.4%	0.4%	-22.7%	-24.1%
Welded tubular products	9903.73.51-62	15%	12%	6.1%	1.0%	-0.1%	-28.0%
Fittings & flanges	9903.73.66-72	13%	10%	0.6%	0.2%	7.2%	-5.2%
Stainless steel wire	9903.73.91-96	8%	7%	0.2%	0.1%	20.8%	-19.5%

Notes: [a] HTS stands for the classification under the Harmonized Tariff Schedule of the US. — [b] The share of the US imports of steel products, covered by the US protection, in the total US imports of steel products during the US safeguard protection. — [c] The US imports from the rest of the world (RoW), excluding the NAFTA countries and the EU15 for better comparability with the US imports from the EU15. — [d] The change in the US imports during the US safeguard protection with respect to the period 1995-2005. — [e] All steel products covered by the US safeguard protection.

Table 2: *Summary statistics*

Affected EU steel producers	Total	Obs.	Sales[a]	L[b]	K/L[c]	VA/L[d]	Lerner[e]	ROA[f]
All firms	2263	13399	33900	129	58.026	55.001	0.224	4.684
			(1511)	(6.410)	(1.673)	(1.006)	(0.023)	(0.099)
Single-product firms	1846	10827	31107	118	58.882	55.288	0.221	4.649
			(1522)	(6.253)	(1.796)	(1.168)	(0.029)	(0.112)
Multi-product firms	417	2572	45655	180	54.363	53.752	0.239	4.832
	(100%)		(4568)	(20.600)	(4.350)	(1.768)	(0.003)	(0.213)
Basic and fabricated metals	280	1805	43794	164	53.938	53.738	0.235	4.926
(NACE 27 & 28)	(67%)		(5600)	(23.036)	(4.525)	(1.913)	(0.003)	(0.248)
All manufacturing	319	2068	41473	153	50.358	52.353	0.234	5.046
(NACE 15-36)	(76%)		(4934)	(20.233)	(3.984)	(1.713)	(0.003)	(0.230)
Non-manufacturing	98	504	62815	293	71.255	59.632	0.259	3.954
(All but NACE 15-36)	(24%)		(11535)	(65.309)	(15.247)	(5.725)	(0.008)	(0.534)

Notes: The first two columns refer to the number of firms and observations, respectively. Other columns report mean values of variables with standard errors in brackets.

[a] Sales are expressed in thousands of Euros in real terms. — [b] The number of employees. — [c] Total fixed assets over the number of employees. — [d] Value added per employee. — [e] The Lerner index is calculated by the PCM method (Tybout 2003) as the value added over sales. — [f] ROA denotes returns on total assets.

Table 3: *Estimates of markups of the EU steel producers*

Variable[a]	All firms[b]		Multi-product firms[c]		Single-product firms[d]	
	Robust FE	FE	Robust FE	FE	Robust FE	FE
	(1)	(1')	(2)	(2')	(3)	(3')
Markup	1.384	1.397	1.461	1.495	1.380	1.387
(μ_1)	(0.033)***	(0.014)***	(0.069)***	(0.034)***	(0.036)***	(0.015)***
Markup change	-0.108	-0.105	-0.106	-0.116	-0.119	-0.115
(μ_2)	(0.030)***	(0.014)***	(0.056)*	(0.027)***	(0.034)***	(0.016)***
Markup*GDP	-0.072	-0.078	-0.095	-0.109	-0.071	-0.074
(μ_3)	(0.013)***	(0.005)***	(0.023)***	(0.011)***	(0.016)***	(0.005)***
GDP	-0.017	-0.021	-0.008	-0.006	-0.022	-0.028
(β_1)	(0.004)***	(0.004)***	(0.008)	(0.008)	(0.006)***	(0.005)***
R-squared	0.880	0.871	0.919	0.913	0.870	0.864
Observations	10447	10447	2025	2025	8422	8422
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Standard errors are reported in brackets and corrected for serial correlation and heteroskedasticity in the robust fixed effects regression. FE denotes a regression using the fixed-effects estimator.

[a] Estimated coefficients in brackets refer to Eq. (4.5). — [b] All firms refer to all affected EU steel producers engaged in production of steel products subject to the US safeguard measures. — [c] Multi-product firms refer to all affected EU steel producers reporting their production activity in more than one 4-digit industries. — [d] Single-product firms refer to all affected EU steel producers reporting their production activity within one 4-digit industry.

Table 4: *Robustness results: The impact of tariffs and the EU trade flows on the EU firms' markups*

Variable[a]	All firms		Multi-product firms		Single-product firms	
	(4)	(5)	(6)	(7)	(8)	(9)
Markup	1.405	1.354	1.520	1.438	1.386	1.335
(γ_1)	(0.023)***	(0.019)***	(0.053)***	(0.044)***	(0.026)***	(0.021)***
US tariff	-0.067	-0.057	-0.070	-0.055	-0.057	-0.051
(γ_2)	(0.010)***	(0.009)***	(0.023)***	(0.019)***	(0.012)***	(0.012)***
Extra-EU imports	-0.006		-0.028		-0.003	
(γ_3)	(0.003)**		(0.007)***		(0.003)	
Extra-EU exports	-0.004		0.012		-0.007	
(γ_4)	(0.002)**		(0.006)**		(0.002)***	
EU imports from Russia		-0.032		-0.101		-0.027
(γ_3)		(0.014)**		(0.037)***		(0.016)*
EU exports to China		-0.048		0.100		-0.058
(γ_4)		(0.021)**		(0.059)*		(0.024)**
Markup*GDP	-0.059	-0.052	-0.098	-0.097	-0.048	-0.041
(γ_5)	(0.006)***	(0.006)***	(0.012)***	(0.012)***	(0.007)***	(0.007)***
R-squared	0.911	0.911	0.935	0.935	0.906	0.905
Observations	8385	8385	1715	1715	6670	6670
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Standard errors from the fixed-effects regressions are reported in brackets and corrected for serial correlation and heteroskedasticity. The main effects of the variables used to compute the interaction terms are included to exclude the possibility that main effects and interaction effects are confounded, but are not displayed in order to save space.

[a] Estimated coefficients in brackets refer to Eq. (4.6).

Table 5: *Robustness results: Estimates of markups (controlling for the exit and entry)*

Variable	No entry & exit during 1995-2005			No exit during the US protection		
	All	Multi	Single	All	Multi	Single
Markup	1.418	1.480	1.414	1.393	1.482	1.375
	(0.045)***	(0.082)***	(0.050)***	(0.038)***	(0.075)***	(0.044)***
Markup change	-0.084	-0.083	-0.097	-0.109	-0.090	-0.127
	(0.042)**	(0.073)	(0.048)**	(0.035)***	(0.060)	(0.041)***
Markup*GDP	-0.085	-0.103	-0.084	-0.078	-0.107	-0.073
	(0.017)***	(0.028)***	(0.020)***	(0.015)***	(0.026)***	(0.018)***
GDP	-0.022	-0.017	-0.027	-0.018	-0.014	-0.030
	(0.005)***	(0.008)***	(0.006)***	(0.005)***	(0.008)*	(0.006)***
Observations	8046	1590	6456	8659	1742	6409
R-squared	0.866	0.911	0.852	0.882	0.918	0.881
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Standard errors from the fixed effects regressions are reported in brackets and corrected for serial correlation and heteroskedasticity.

Table 6: *Robustness results: Estimates of markups across different cohorts of the EU steel firms*

Cohort	All firms		Multi-product firms		Single-product firms	
	Markup	Change[d]	Markup	Change	Markup	Change
Size[a]						
Small	1.531	-0.140	1.495	-0.171	1.533	-0.124
	(0.037)***	(0.031)***	(0.076)***	(0.052)***	(0.043)***	(0.038)***
Medium	1.373	-0.017	1.364	0.085	1.381	-0.077
	(0.021)***	-0.023	(0.056)***	(0.043)**	(0.023)***	(0.029)***
Big	1.454	-0.158	1.742	-0.341	1.389	-0.128
	(0.025)***	(0.032)***	(0.073)***	(0.099)***	(0.026)***	(0.032)***
Factor intensity[b]						
Low	1.530	-0.166	1.277	-0.047	1.605	-0.199
	(0.033)***	(0.026)***	(0.048)***	(0.037)	(0.041)***	(0.033)***
Medium	1.540	-0.121	1.677	-0.078	1.528	-0.175
	(0.031)***	(0.030)***	(0.080)***	(0.066)	(0.033)***	(0.034)***
High	1.293	-0.104	1.730	-0.422	1.258	-0.075
	(0.025)***	(0.031)***	(0.103)***	(0.112)***	(0.025)***	(0.032)**
Productivity[c]						
Low	1.273	-0.089	1.276	-0.071	1.278	-0.099
	(0.026)***	(0.020)***	(0.044)***	(0.032)**	(0.032)***	(0.026)***
Medium	1.445	-0.025	1.422	0.030	1.455	-0.055
	(0.029)***	(0.030)	(0.083)***	(0.066)	(0.031)***	(0.035)
High	1.613	-0.146	2.041	-0.484	1.550	-0.088
	(0.030)***	(0.039)***	(0.090)***	(0.118)***	(0.031)***	(0.042)**

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Standard errors from the fixed effects regressions are reported in brackets and corrected for serial correlation and heteroskedasticity. All regressions include business-cycle controls together with country and year dummies. The cohorts of the EU steel firms (small, medium and large) refer to equal fractions in the density function of a corresponding variable.

[a] Size is measured by the number of employees. — [b] Factor intensity is measured by total fixed assets per employee. — [c] Productivity is measured by value added per employee. — [d] Change refers to the change in the markups of the EU steel firms during the US safeguard protection.

Table 7: *Summary statistics for treated and counterfactual groups of firms*

Industry[a]	Size		Factor intensity		Productivity	
Treated group (steel)	3.129	(0.218)***	-1.941	(0.174)***	3.552	(0.159)***
All manufacturing[b]	3.081	(0.210)***	-1.984	(0.186)***	3.533	(0.156)***
Textiles	3.102	(0.206)***	-1.963	(0.191)***	3.545	(0.161)***
Apparel	3.064	(0.203)***	-2.066	(0.201)***	3.487	(0.189)***
Leather	3.056	(0.196)***	-2.021	(0.187)***	3.488	(0.173)***
Wood	3.014	(0.199)***	-1.935	(0.172)***	3.503	(0.149)***
Pulp & paper	3.141	(0.207)***	-1.915	(0.173)***	3.574	(0.140)***
Chemicals	3.118	(0.216)***	-1.954	(0.185)***	3.616	(0.152)***
Rubber & plastics	3.084	(0.205)***	-1.928	(0.172)***	3.549	(0.138)***
Other non-metalic	3.070	(0.202)***	-1.894	(0.174)***	3.563	(0.155)***
Fabricated metals	3.033	(0.196)***	-1.960	(0.179)***	3.507	(0.144)***
Machinery & equipment	3.082	(0.207)***	-2.038	(0.192)***	3.546	(0.145)***
Electrical machinery	3.102	(0.212)***	-2.041	(0.192)***	3.548	(0.147)***
Communication equipment	3.094	(0.209)***	-2.054	(0.199)***	3.533	(0.150)***
Medical & optical products	3.065	(0.219)***	-2.053	(0.195)***	3.548	(0.141)***
Vehicles	3.159	(0.224)***	-1.992	(0.186)***	3.532	(0.149)***
Furniture	3.043	(0.202)***	-1.996	(0.184)***	3.498	(0.159)***

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Mean values in logarithms are presented with standard errors reported in brackets.

[a] Industry refers to the 2-digit manufacturing industry as classified under the NACE Rev.1.1. — [b] Includes a 10 percent sample of all manufacturing firms (excl. steel firms), drawn by maintaining the proportions of firms across 4-digit manufacturing activities, years, and countries.

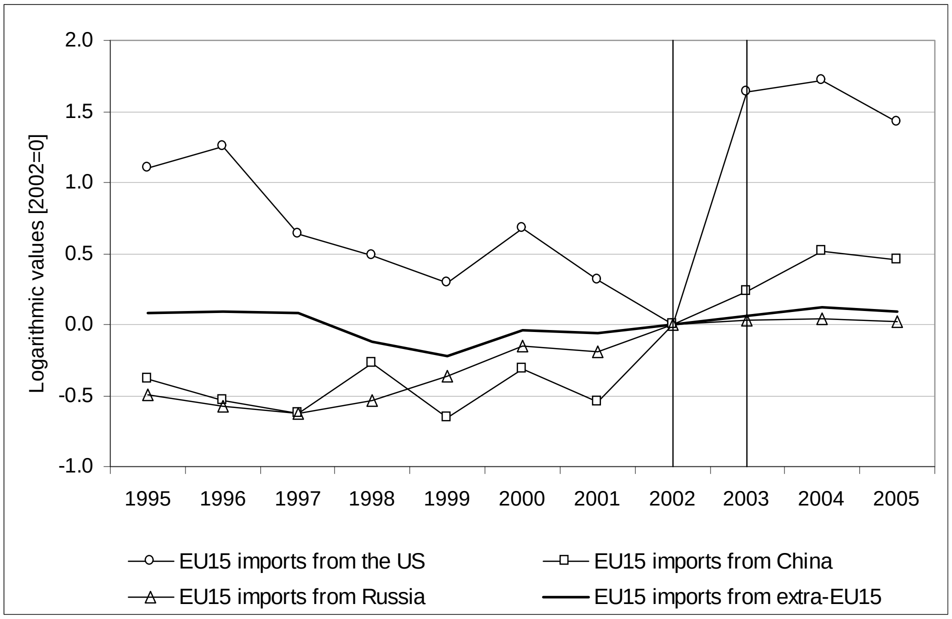
Table 8: *Robustness results: Estimates of markups across counterfactual groups*

Industry[a]	Markup		Markup change[c]	
Treated group (steel)	1.428	(0.003)***	-0.085	(0.002)***
All manufacturing[b]	1.417	(0.002)***	-0.044	(0.001)***
Textiles	1.372	(0.002)***	-0.047	(0.001)***
Apparel	1.194	(0.002)***	-0.021	(0.002)***
Leather	1.319	(0.002)***	-0.046	(0.001)***
Wood	1.347	(0.002)***	-0.074	(0.001)***
Pulp & paper	1.252	(0.002)***	-0.028	(0.001)***
Chemicals	1.421	(0.003)***	-0.034	(0.002)***
Rubber & plastics	1.377	(0.002)***	-0.051	(0.001)***
Other non-metalic	1.461	(0.002)***	-0.021	(0.001)***
Fabricated metals	1.508	(0.002)***	-0.027	(0.001)***
Machinery & equipment	1.375	(0.002)***	-0.047	(0.001)***
Electrical machinery	1.428	(0.002)***	-0.026	(0.001)***
Communication equipment	1.481	(0.003)***	-0.004	(0.002)*
Medical & optical products	1.521	(0.002)***	-0.044	(0.002)***
Vehicles	1.324	(0.002)***	-0.058	(0.001)***
Furniture	1.314	(0.002)***	-0.052	(0.001)***

Notes: ***,**,* indicate statistical significance at the one, five, and ten percent level, respectively. Standard errors from the fixed effects regressions are reported in brackets and corrected for serial correlation and heteroskedasticity.

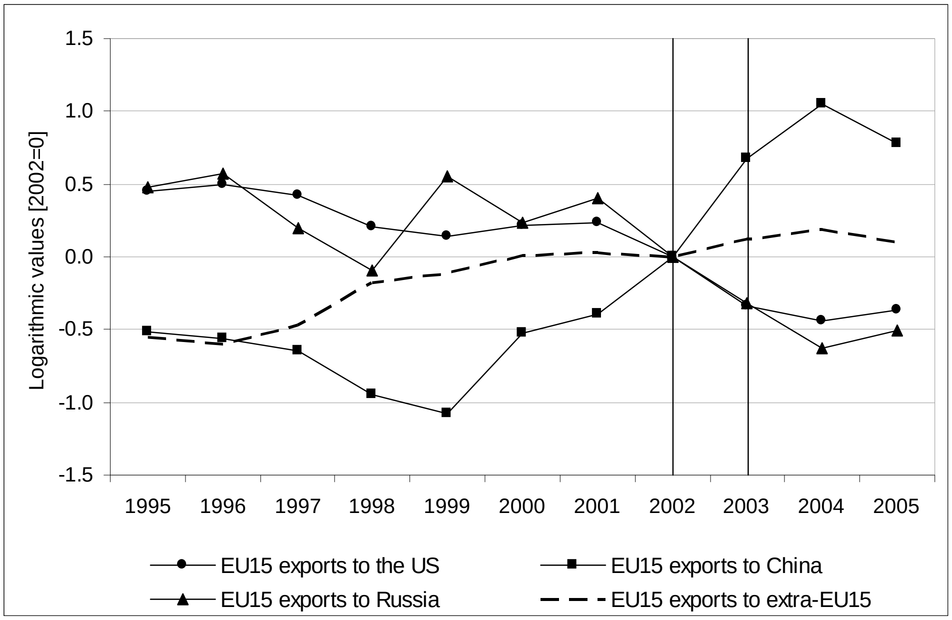
[a] Industry refers to the 2-digit manufacturing industry as classified under the NACE Rev.1.1. — [b] Includes a 10 percent sample of all manufacturing firms (excl. steel firms), drawn by maintaining the proportions of firms across 4-digit manufacturing activities, years and countries. — [c] Markup change refers to the change in the markups of the EU steel firms during the US safeguard protection.

Figure 1: *Evolution of the EU imports of steel products in 1995-2005 relative to 2002*



Notes: Vertical lines indicate the duration of the US protection, initiated in March 2002 and terminated in December 2003. Imports and exports are measured in logarithms and expressed with respect to the initial year of the US protection. The selection of countries is based upon the EU trade statistics (Eurostat 2006). The largest steel importing countries during the protection were China (33.2 mt), the US (32.8 mt), and the EU-15 (30.4 mt).

Figure 2: *Evolution of the EU exports of steel products in 1995-2005 relative to 2002*



Notes: Vertical lines indicate the duration of the US protection, initiated in March 2002 and terminated in December 2003. Imports and exports are measured in logarithms and expressed with respect to the initial year of the US protection. The selection of countries is based upon the EU trade statistics (Eurostat 2006). The largest steel exporting countries during the protection were the EU-15 (31.8 mt), Russia (30.4 mt), and China (20.0 mt).

Figure 3: *The Lerner index for the EU steel firms during 1995-2005*

Notes: Fig. 3 plots the annual mean values of the Lerner index calculated by the price-cost margin method (PCM) discussed in Tybout (2003). The observed firm-level Lerner index is defined as sales net of expenditures on labour and materials over sales. Vertical lines indicate the duration of the US protection, initiated in March 2002 and terminated in December 2003.