

# DISCUSSION PAPER SERIES

No. 6724

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*INTERNATIONAL TRADE AND  
REGIONAL ECONOMICS*



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Discussion Paper No. 6724  
February 2008

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## ABSTRACT

### Heterogeneous Responses of Firms to Trade Protection

This paper uses EU firm-level panel data to estimate the effect of Antidumping (AD) protection on the productivity of EU domestic firms in import-competing industries. We find that firms with relatively low initial productivity - laggard firms - have productivity gains during AD protection, while firms with high initial productivity - frontier firms - experience productivity losses. While the productivity of the average firm is moderately improved during AD protection, productivity remains below that of firms never involved in AD cases, thus questioning the desirability of protection. Our empirical results are consistent with recent theoretical work supporting the view that trade policy can have a differential effect on firms depending on their initial productivity.

JEL Classification: O30, C2, F13 and L41

Keywords: antidumping protection, firm heterogeneity and total factor productivity

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Submitted 21 February 2008

## Heterogeneous Response of Firms to Trade Protection<sup>2</sup>

### I. Introduction

There is a growing consensus that in many cases Antidumping (AD) policy is an industrial policy tool in disguise. Rather than being targeted at keeping ‘unfair imports’ out, it is often aimed at fostering the interests of inefficient domestic producers, irrespective of the intent of importers (Shin, 1998). In view of the industrial policy nature of AD measures, it is surprising that so little empirical work exists on measuring the effects of AD policy on domestic producers. A natural question that comes to mind is whether AD protection makes domestic firms more inefficient or whether domestic firms use the protection period as an adjustment period during which they engage in restructuring to become more productive by the time AD protection comes off. The recent availability of micro level data sets implies that this question can now be analyzed.

In general the demand and supply of trade protection tends to be stronger in industries facing strong import-competition resulting from a change in comparative advantages (Hillman, 1982). In the absence of trade protection, neo-classical trade theory would predict that firms in those industries are likely to exit and resources to shift to sectors with higher returns. Trade protection fully or partially prevents this reshuffling of resources and is likely to result in sub-optimal levels of exit. This is bad for domestic consumers since trade protection prevents domestic prices to fall to lower world market levels. Traditional trade theory would also predict that all incumbent industry-specific interests unequivocally benefit from trade

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<sup>2</sup> We thank the CEPR meeting 2007 in Tarragona, a CEPR-Productivity workshop 2006 at UCD Dublin, the EIIIE conference in Slovenia 2005, a CENter-Tilburg 2005 and CORE-Louvain seminar, the Midwest 2004 Spring meetings in Indianapolis, a World Bank seminar in 2004, the ETSG conference in Madrid, the LSE-IFS seminar on Productivity, and the Antidumping conference in Nottingham 2004. We thank Jan De Loecker, Rachel Griffith, Jim Harrigan, Beata Javorcik, Richard Rogerson, Ray Riezman, Stephen Redding, Mary Amity, Maurice Schiff, Johannes Van Biesebroeck and Joe Clougherty. In particular we would also like to thank two anonymous referees for constructive comments. A special thanks goes to the editor Dan Trefler for additional guidance.

protection. However, recent trade literature (i.e. Melitz, 2003) has pointed out the importance of heterogeneity between firms implying that several traditional trade results need to be more qualified. Indeed when allowing for firm heterogeneity in initial productivity this paper finds that trade protection is not in the interest of all domestic firms. We find that highly productive firms-frontier firms- are negatively affected by AD protection with productivity falling during protection. Lowly productive firms are positively affected by AD protection with productivity rising during protection. The falling productivity of frontier firms is an additional cost of protection emerging from the heterogeneous firms' literature that adds to the loss in domestic consumer surplus and the sub-optimal levels of exit.<sup>3</sup>

To better understand the theoretical link between trade policy and firm-level productivity, we turn to several strands of theoretical models that deal with this. Lileeva and Trefler (2007) is particularly useful as a background model to interpret the empirical results we obtain. They show that when trade policy results in an increase in market size, firm-level productivity responses are heterogeneous. In addition to a fixed cost of exporting (Melitz, 2003; Helpman, 2006), the model assumes a fixed cost of productivity improving investment. While productivity gains raise profits on all units sold, only firms with a low initial productivity and high potential productivity gains invest when market size increases. Using tariff cuts by the US against Canadian imports resulting from the US-Canada Free trade Agreement, Lileeva and Trefler (2007) find that the labor productivity of small and lowly productive Canadian plants increase more than the productivity of large and highly productive firms. While their paper deals with trade liberalization its results can easily be transposed to the context of AD trade protection described in the present paper. AD trade protection can increase the market size of existing domestic firms to the detriment of foreign importers. This implies that some domestic

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<sup>3</sup> Gallaway et al. (1999) have estimated the welfare cost of US AD and Countervailing Duty law at \$4 billion a year.

firms that would have exited in the absence of trade protection can now engage in restructuring to improve their productivity by investing for example in new machinery or by hiring better skilled workers to cope with import competition once protection comes off. The most productive domestic firms that already operate at competitive cost levels and minimum efficient scale and in no danger of exiting in the face of foreign competition are much less affected by the increase in market size and have a lower incentive to improve their productivity during protection. Another but related explanation for the AD heterogeneity we observe between highly and lowly productive firms is provided by the recent literature linking exports to productivity. More in particular Melitz (2003) showed that only the most productive firms engage in exporting. Despite the fact that we do not have data on exports at the firm level, from the high correlation between productivity and exporting we can conjecture that the highly productive firms in our sample are also the exporting firms. These firms realize a substantial part of their sales outside their own market and therefore benefit relatively less from an increase of the domestic market size than purely domestic firms that do not export. High productivity exporters may even experience reduced market access abroad if domestic trade protection results in retaliatory action whereby trade partners in turn protect themselves (Vandenbussche and Zanardi, 2006; Prusa, 2001). Reduced market access abroad for exporters offers a possible explanation for the loss in productivity that we observe for highly productive firms during protection. Also, according to the “learning-by-exporting” literature, reduced market access abroad would lower learning resulting from exporting and negatively impact firm-level productivity (De Loecker, 2007; Van Biesebroeck, 2005)

An additional interpretation for the AD heterogeneity could be related to the high correlation that exists between exports and imports at the firm level. Exporting firms tend to

source a relatively higher share of their intermediates from abroad. Trade protection is likely to raise the price of imported intermediates which undermines the productivity of domestic exporting firms (Amiti and Konings, 2007). While we can not formally test this due to a lack of data on exports and imports at the firm level, these interpretations are all consistent with our finding that only lowly efficient domestic firms benefit from AD protection while highly productive domestic firms loose.

Another line of literature that is related to our findings is the relationship between firms' adoption of new technology and trade policy (Miyagiwa and Ohno, 1995; Ederington and McCalman, 2008). These papers have explored how trade policy can induce domestic firms to restructure and accelerate the speed of adoption of more efficient production technologies.<sup>4</sup> Finally, our results can also be usefully compared to recent work by Aghion et al. (2005) who showed that a reduction in product market competition reduces the technology gap in an industry. Also, Boone (2000) shows that when firms operate under weak product market competition, the incentive to innovate in such markets is stronger for less efficient firms. The intuition underlying this result is that with weak competition, strategic effects between firms are smaller than under tough competition.

Our data set includes all newly initiated European AD cases in three consecutive years 1996, 1997 and 1998. We turn to European data for two reasons. AD protection in Europe is of a more temporary nature than in the US<sup>5</sup> and in Europe, in contrast to the US, non-listed firms also disclose firm level information on an annual basis.

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<sup>4</sup> We use the term restructuring to refer to firms engaging in cost reducing investment, broadly defined and interpreted.

<sup>5</sup> Europe has always had a Sunset Clause limiting the protection period to 5 years. The US adopted the Sunset clause much later after the Uruguay Round.

We identify firms in the European Union (EU)<sup>6</sup> in sectors directly affected by the AD policy and use their corresponding firm-level company accounts data to obtain output and input measures for the period 1993 to 2003 to estimate Total Factor Productivity (TFP) before and after AD protection. We estimate TFP using the approach proposed by Olley and Pakes (1996), which controls for sample selection of firms and the endogeneity of input factors.

Using a difference-in-difference (DD) approach with firm-level fixed effects we evaluate the effect of AD protection using two different control groups. A first control group consists of all firms that filed for AD protection but did not receive it since the outcome of the case was ‘termination’ without protection. But since the firms in this control group belong to industries that filed for protection, there could be selection at work in terms of which industries receive positive rulings versus negative rulings. To control for endogeneity of AD protection and potential selection effects, we also turn to a ‘matched’ control group of firms inspired by the matched sampling techniques developed by Heckman et al. (1997). For this, we estimate the probability of AD protection using a multi-nominal logit model similar to the one in Blonigen and Park (2004) to “match” the protected firms to firms in similar sectors but that never filed an AD case nor received protection. The use of a ‘matched’ control group in the difference-in-difference analysis is generally regarded as an acceptable way to deal with the potential endogeneity of trade policy such as AD protection<sup>7</sup>.

Firms that file for protection on average have a lower productivity compared to firms in the control group outside AD. This corresponds to Regev and Griliches (1995) reporting that firms under threat of exiting tend to have low levels of productivity. We find that AD

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<sup>6</sup> During the period of our analysis the European Union consisted of 15 countries.

<sup>7</sup> De Loecker (2007) used a similar approach to analyze the effects of learning by exporting on productivity.



protection raises the short-run productivity of the average protected firm by about 3% with long-run effects on productivity levels ranging between 6% and 8%.

We engage in a number of empirical experiments to show that the effect of AD we identify on measured productivity are not or at least not entirely attributed to price movements. Our data like most firm-level data does not have information on output prices at the firm level. Instead we use unit values of goods traded on the internal EU market and protected by AD as an alternative deflator in the TFP calculations.

A logical question following our analysis is where do the average productivity improvements come from. Although data limitations do not allow us to measure exit rates of firms very precisely<sup>8</sup>, it is unlikely that average productivity improvements during AD protection are driven by exit rates. First, the Olley-Pakes approach for estimating TFP takes into account biases that emerge from estimating TFP in the presence of firm exit. Although we have an imprecise measure of firm exit, we do take this into account when estimating TFP. Second, a growing number of papers show that free trade promotes efficient exit as shown by Trefler (2004) in the context of the Canada-US free trade agreement and Amiti and Konings (2007) in the context of trade liberalization in Indonesia. Therefore it is safe to conjecture that trade protection is likely to result in sub-optimal levels of exit. Our exit measure, despite its poor quality seems to confirm this. For the ‘matched control group’ the average exit rate over the sample is 3% while for the protected firms we find it to be much lower and around 1.8%.

Recent trade models like Melitz and Ottaviano (2005) have shown how trade affects the average productivity in an industry by enabling more productive firms to take a higher market

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<sup>8</sup> The firm-level data that we use entails inclusion criteria with minimum levels in terms of employment, turnover and sales. This makes it difficult to distinguish a true exit from a firm that falls forever below the inclusion criteria. Furthermore, the way firm level data are stored on Amadeus implies that especially for the earlier years of the data not all firms that exit are kept on the data records. The same applies for the measurement of entry.

share and less productive firms to shrink. This paper, however, is not concerned with these general equilibrium reallocation effects between firms, but instead focuses on how trade protection affects the evolution of within firm level productivity. In our empirical analysis we find evidence of labor shedding, increased R&D spending and an increase in investment in fixed assets at the firm level during AD protection. But there can be additional channels through which productivity can be improved that we can not measure. Bernard et al. (2006) argue that plants in import-competing sectors facing tough competition from abroad are likely to change their output mix towards products with more capital and more skilled labor content. While “product switching” is a very likely source of productivity improvement our data does not hold information on that. Also, our data does not have information on skilled versus unskilled labor preventing us to analyze skill upgrading in production. We do find that average wages at the firm level go up after protection which could be consistent with an increase in the skill mix. However increased wages may also be consistent with rent-sharing where some of the profits resulting from protection are shared with workers in the form of a higher wage. Whatever the correct interpretation, in both cases productivity is likely to go up. An increase in the skill mix is likely to boost productivity, just as a wage increase for existing workers is likely to induce more effort since workers stand to loose more when fired.

The results of this paper should by no means be interpreted in favor of a wider use of AD protection. Our firm-level analysis clearly reveals that firms that file for protection on average have a much lower initial productivity than unprotected firms outside AD. Even after the protection period, average productivity of protected firms is still below that of firms in the matched control group belonging to other sectors of the economy. This suggests that although lowly productive protected firms realize productivity gains during protection, these are not

sufficient to close the productivity gap with firms outside AD. An alternative scenario where in the absence of AD protection the lowly productive firms would have exited the market and resources would shift to other more productive sectors in the economy where productivity levels are higher, would therefore seem a better idea. Under such an alternative scenario the productivity gains realized by firms are likely to go beyond the ones that we measure in this paper. Therefore a process of dynamic creation and destruction still seems the best guarantee from an economy wide perspective to realize most productivity gains.

In the next section we discuss our data and in section III we present the empirical methodology and results. Section IV concludes.

## **II. The Data**

### ***II.1. Firm-level data***

An important innovation of our work is that we use firm-level data to test for the relationship between AD-protection and productivity of the protected firms. An AD-case typically involves an investigation of the evolution of imports and import prices from countries that are accused of dumping by the import-competing EU industry. The dumping complaint is investigated by the EU Commission and can result in ‘Protection’ or in ‘Termination’.<sup>9</sup> If protection is decided upon, a final AD duty is imposed on the ‘dumped’ imports to protect all the firms in the EU import-competing industry. Protection can also be implemented in the form of price-undertakings. This involves a voluntary price increase offered by the alleged dumpers to offset the injury to the EU import-competing industry (EU regulation 386/94). Case reports reveal very little information on the details of price-undertakings agreed upon between the EU Commission and individual exporters. While in some AD cases, all exporters from a particular

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<sup>9</sup>In the U.S. many cases end in “withdrawals” by the complaining industry as shown by Prusa (1992). This is hardly ever the case in the EU where a “Termination” usually refers to a negative ruling by the EU Commission.

country are subject to a price-undertaking, in other cases a mixture of duties and price-undertakings applies. When the Commission decides to ‘terminate’ the AD case, the dumping complaint is rejected and the EU industry does not get further import relief.

For the purpose of analyzing the relationship between AD-protection and productivity of EU producers, we identify 4,799 EU firms that operate in the same sector as the dumped products. We obtain their company accounts from a commercial database sold under the name of AMADEUS<sup>10</sup> that runs from 1993-2003. This is a pan-European set of company accounts with harmonized entries for all European enterprises on an annual basis.

In Table 1 we give an overview of all the new AD cases<sup>11</sup> that were initiated in 1996, 1997 and 1998 and for which we could retrieve all the variables from the company accounts required for our analysis. In total, 29 new AD investigations were initiated when we count by product group which corresponds to 81 cases when we count cases by defending country. For each case we list the year of initiation, the corresponding 4 digit industry NACE revision 1, the average number of 8-digit HS codes involved, the year of decision, the average duty and the importing countries involved. We collect firm-level data for the EU import-competing sector based on the 4-digit NACE sector the product under investigation was classified in. The NACE classification is a detailed industry classification used by the European Union with 622 different 4-digit codes. One notable advantage of this approach is that for the DD estimations, a control group can be found by “matching” protected sectors with other NACE 4-digit sectors that were never subject to AD filings.

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<sup>10</sup> AMADEUS is a commercial dataset that can usefully be compared to COMPUSTAT data in the US, but in addition to listed firms, AMADEUS also includes unlisted firms. The AMADEUS data set has increasingly been used in other academic work. Recent examples include Budd, Konings and Slaughter (2005), Konings & Vandenbussche (2005) and Helpman, Melitz and Yeaple (2004).

<sup>11</sup> ‘New’ implies that these cases were not subject to protection when the case was initiated.

In 17 of the new cases (by product group), the outcome was protection, usually in the form of an AD duty but in some protection cases, price-undertakings were also offered and accepted by the EU Commission. Duties range between 13% and 82%, with an average duty of 27%. In 12 other cases (by product group), the EU Commission did not grant import relief, after which the case was terminated.

A number of remarks are in order here. In dealing with the cases we came across a number of overlaps. For example, in 1996 the case involving “Synthetic Fibre Ropes” was initiated against India but was terminated without protection later that year. The next year, in 1997, a new petition by the EU producers of “Synthetic Fibre Ropes” was initiated against India and this time round the EU Commission decided to grant protection from 1998 onwards. This implies that the EU firms in the import-competing sector were protected from 1998 onwards. For this particular case, we let the period before protection run from 1993-1997 and the period after protection from 1998 onwards. Another type of overlap arose when two different cases map in the same NACE 4-digit. A good example is “Cotton Fabrics”, a case initiated in 1996 and again in 1997, both resulting in a termination, which maps into the same NACE sector as “Woven Glass Fibre”, initiated at the end of 1997, also ending in a termination<sup>12</sup>. After dealing with the overlaps described above, we still have 23 different AD cases of which 16 ended in Protection and 7 were terminated. In view of the large number of AD-cases included in the analysis, it is not our intention to engage in an in depth industry-by-industry analysis. While more in depth industry studies are clearly an interesting line of future research, our purpose here is to present evidence on productivity estimates of a large set of cases.

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<sup>12</sup> One other type of overlap occurred i.e. a case that first got terminated but in a later year ended in protection. For that case, we considered the sector as protected from the moment the product belonging to that sector received protection.

For clarification, we point out that when the EU Commission decides to impose a duty, it applies to all EU-member states producing the protected product and can be compared to a ‘common tariff’ protecting the EU import-competing sector against imports from the dumping countries. AD protection remains in place for five consecutive years, after which AD-measures in principle come off. However, industries have the option to initiate an “expiry review” case. Such an “expiry” case can be initiated 3 months before the ending of protection, provided there are indications that when the protection comes off, injury and dumping would continue. The law stipulates that a decision regarding the continuation of the protection has to be reached within a year after the initiation of an expiry review. During the investigation the protection stays in place.<sup>13</sup> If the expiry review is affirmative, the industry obtains 5 more years of protection. For the cases included in our analysis, in only 4 of them, an expiry review was initiated which is documented in Table 1. For example, “Seamless steel tubes”, a case originally initiated in 1996, whose protection period normally ended in 2002, applied for an expiry review which was decided affirmatively in 2004. Another affirmative expiry review case is the 1997 case “Synthetic Fibre Ropes”. In two other cases, notably the 1996 case “Bed linen” and the 1998 case “Steel Stranded Ropes and Cables”, an expiry review was initiated but the Commission ruled negatively and the protection was ended.

We conduct our analysis both with and without expiry review cases. Including them in our analysis moderates the average productivity increase of protected firms that we find. This suggests that firms for whom protection is extended beyond a five year period engage less in restructuring than other firms. Extension of AD protection appears to temper restructuring and therefore appears even more distortive than the case where protection ends after 5 years.

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<sup>13</sup> The latest EU AD law is Regulation 384/96.

### III. Empirical Methodology and Results

#### III.1. Estimating Total Factor Productivity (TFP)

We estimate Total Factor Productivity (TFP) using our firm-level data for firms operating in each 4-digit NACE industry affected by AD initiations. Let us describe firm  $i$ 's technology at time  $t$  by a Cobb-Douglas production function:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \eta_{it} \quad (1)$$

where  $y_{it}$ , denotes the log of value added at the firm level, deflated by 4 digit sector-specific producer price indices,  $l_{it}$  denotes the log of labor and  $k_{it}$ , denotes the log of real capital measured by fixed tangible assets deflated by a capital price deflator<sup>14</sup> and  $\eta_{it}$  is the residual. We use the Olley-Pakes methodology to estimate equation (1). The estimation procedure takes account of the simultaneity between input choices and productivity shocks, as well as sample selection bias. This allows us to estimate the coefficients in the production function (1),  $\beta_l$  and  $\beta_k$ , consistently for each product group. Using these estimates we define the log of TFP of firm  $i$  at time  $t$  denoted by  $tfp_{it}$ , as the residual of the production function<sup>15</sup>, or

$$tfp_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} \quad (2)$$

The revenue based TFP estimates from equation (2) are likely to reflect differences in prices. Deflating firm level nominal value added with an industry wide price deflator would be fine if all firms were producing a single and homogeneous product and all face the same price for their products. However, with differentiated and multiple products this is unlikely to be the

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<sup>14</sup> The capital price deflator is country specific and obtained from the Annual macro economic (Ameco) database of the department of Economic and Financial Affairs of the European Commission. We thank Werner Roeger for providing the data.

<sup>15</sup> Summary statistics of the variables used in (1) and estimated coefficients with OLS and Olley-Pakes can be found in the working paper Konings and Vandenbussche (2004).

case (Klette and Griliches, 1996; Levinsohn and Melitz, 2002 and Katayama, Lu and Tybout, 2003). In addition, measured productivity can change as a result of changes in the product mix over time (Bernard, Redding and Schott, 2006)<sup>16</sup>. We therefore report a number of robustness checks. We report separate estimates for single versus multiple product firms and we report results where we use instead of a 4-digit industry producer deflator, a deflator constructed from the unit values of the products that were involved in an AD initiation. We also analyze the evolution of the unit values of the products involved in an AD initiation to assess whether a potential price effect might dominate the measurement of TFP. Our results clearly show that the productivity improvements are not a mere price effect. In fact, a recent paper by Mairesse and Jaumandreu (2005) on a panel of firms for which they have individual firm output prices find that whether value added is deflated with an industry output-price index, with an individual firm-output price index or not at all makes little difference for the estimation of the coefficients in the production function. This suggests that the customary practice of simply deflating output measures (sales, value added etc.) by industry output-price indices when estimating production functions is an acceptable approach.

### ***III.2 Evaluating the Effects of Antidumping-Protection***

#### ***III.2.1. Difference-in-Difference (DD) Equations***

A Difference-in-Difference (DD) approach consists of comparing TFP of the ‘treated’ group, i.e. the firms that got AD protection, to a control group of firms. A first natural candidate control group for the protection cases is clearly the termination cases. Termination

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<sup>16</sup> Other potential biases emerge from the way in which input factors are measured, e.g. the labor input is measured in terms of number of employees rather than hours worked. Van Biesebroek (2007) compares different methods for estimating production functions on data characterized by known measurement errors and finds that the semi-parametric methods, like the O-P one we use here, is least sensitive to measurement error when estimating productivity.



cases involve firms in sectors that filed for AD protection but did not get it. We also turn to a second control group inspired by the matched sampling techniques developed by Heckman et al. (1997). To identify a matched control group we first estimate a multi-nominal logit model at the 4-digit NACE level. The variables included in our multi-nominal logit model are similar to the model of Blonigen and Park (2004). The data that we use includes information on filings and outcomes of all the AD cases at the 4-digit NACE level between 1995 and 2002. Our dependent variable can take three outcomes, 'no filing', 'filing that resulted in a termination' and 'filing that resulted in protection'. As explanatory variables we include 'lagged import penetration' defined as yearly imports from outside the EU into the 4-digit NACE sector over the sum of domestic production in the EU in the NACE 4 digit and imports from outside the EU.<sup>17</sup> We also include 'lagged industry employment', 'EU GDP growth' and the 'number of previous AD filings' in the NACE sector up to year  $t-1$ , where we count the number of previous AD filings from 1985 onwards. To control for pre-policy trends in productivity we also include the 'lagged labor productivity' in the sector as an additional variable. The inclusion of this variable is to account for the fact that the DD estimator assumptions may be violated if pre-treatment characteristics that are thought to be associated with the dynamics of the outcome variable are unbalanced between the treated and the untreated group (Abadie, 2005). The results of the multi-nominal logit model are shown in the Appendix. Firms in industries with high import penetration, previous AD filings and lower average labor productivity seem more conducive to filing. The probability of protection seems mainly determined by a sector's past experience in AD filings.

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<sup>17</sup> Trade data come from EUROSTAT and production data from PRODCOM.

The “matched” control group consists of sectors with a similar probability of protection but that never had protection.<sup>18</sup> This resulted in a control group of 4,678 firms.<sup>19</sup> We now test the following DD specification:

$$tfp_{ijt} = \alpha_i + \alpha_1 AD\_EFFECT_j + \alpha_2 YEAR\_DUMMIES + \alpha_3 COUNTRY\_DUMMIES + \alpha_4 YEARXCOUNTRY + \varepsilon_{it} \quad (3)$$

$\alpha_i$  is a firm-level fixed effect that captures all unobservable characteristics between firms that do not vary over time. The YEAR dummies capture for both the firms in the control group as well as the firms that received AD-protection any time effect on TFP, common to all firms, due to e.g. business cycle effects, demand shocks or other common macro shocks. The COUNTRY dummies control for location specific effects for firms in particular countries inside the EU. We also interact these location specific fixed effects with the year effects to capture differences in shocks across various EU countries. Finally the term AD\_EFFECT is a dummy equal to 1 for the years following protection and zero in the years before but only for the group of firms in sectors j that got protection. For all other firms in the control group the dummy is zero. This AD\_EFFECT captures the essence of the DD approach since its coefficient estimates the *differential* effect that AD-policy has on protected firms versus firms in the various control groups.

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<sup>18</sup> Based on this we find that 69% of all NACE 4-digit sectors never faced AD protection. The matched control group consists of sectors that never received AD protection but with a predicted probability that was at least equal to the 75<sup>th</sup> percentile of the predicted probability of protection in the group of sectors that did receive AD protection. In addition we impose that average values of the explanatory variables - used in the multi-nominal logit model - of the matched group are statistically similar to the treatment group, the so called balancing property.

<sup>19</sup> In the working paper version we report the NACE sectors in the “matched” control group with the OLS and O-P estimates of the labor and capital coefficient in the production function per sector.

### ***III.2.2. Results***

We start by discussing some summary statistics shown in Table 2. Firms that file for protection on average are less productive than firms outside AD. This can be seen by comparing TFP across groups of firms in the period before filing as shown in column 1. A firm that files for protection but fails to get it is on average only 65% as efficient as the average firm in the matched control group of firms that never filed. A firm that files and gets protection later on is only about 60% as efficient as the average firm in the matched control group in the period before filing. In the five year period after filing, the average protected firm becomes slightly more productive. It seems to catch up with those firms that filed for protection, but never received it. However, a productivity gap remains with those firms that never filed for protection. In particular, the protected firms reach an efficiency of 67% of that of an average firm in the matched control group, while a terminated firm in that same period is only 62% as efficient as the average firm never involved in AD filings. This suggests that while protection allows the average protected firm to catch up in productivity to the level of the average termination firm, it is not sufficient to raise productivity to the level of the control group of firms outside AD.

Next we proceed with the difference-in-difference (DD) estimations. In Table 3 we report the results of various specifications where we first use the termination cases (columns 1 to 4) and then the matched counterfactual (column 5, 6) as respective control groups. In all specifications the main coefficient of interest on AD\_EFFECT is positive and statistically significant irrespective of the control group we use. This suggests that firms in termination cases are a good counterfactual and that the potential selection effects at work are not too serious. The magnitude of the positive effect differs depending on the control group we use

and whether we control for an autoregressive process of the first order AR(1) to allow for hidden dynamics<sup>20</sup>. In the specifications where we include an AR (1) process, the coefficient on the AD\_EFFECT can be interpreted as a short-run estimate as in columns 3, 4 and 6 with coefficients ranging between 2 and 4% and with the estimated autoregressive coefficient reported at the bottom. Including the four expiry review cases where protection is prolonged for at least one additional year<sup>21</sup> in the analysis as we do in column (5) lowers the productivity effects of AD, confirming our prior that firms that file for an expiry review case have less of an incentive to engage in restructuring during the initial protection period. A lower level of restructuring may make it easier to convince the investigating authorities that “injurious” dumping from abroad is still going on which would justify the request for further protection. Therefore an extension of protection is clearly not desirable. Earlier we already argued that protection is a very poor instrument to boost average firm-level productivity since it prevents resources to be freed up and to move to more productive sectors in the economy. Extensions clearly seem to further reduces the efficiency of the protectionist instrument. While we feel that the issue of expiry reviews deserves further attention, we do not regard it as the main focus of the current paper. The small number of cases and firms involved and the relatively short time span of our data also prevent us to analyze what happens to firm-level productivity in the extension period.

In order to check whether the positive effect of AD on measured productivity is driven by a price effect we carry out a number of experiments. First, in column 2 of Table 3 we use

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<sup>20</sup> Allowing the error term to have an AR(1) is equivalent to including a lagged dependent variable. The problem with using a lagged dependent variable when simultaneously including firm-level fixed effects introduces a bias. Therefore we prefer to apply an AR(1) transformation, after which we perform a fixed effects estimation. We follow the procedure described by Baltagi and Wu (1999) and programmed in STATA.

<sup>21</sup> Protection continues during the expiry review investigation which usually involves one year.

the unit values of the products involved in the AD case as a deflator instead of a 4-digit industry deflator. These unit values stem from intra-EU trade flows of the 8-digit HS products involved in AD initiations. We retrieve the unit values over the same period as our firm level data and construct an price index for deflation purposes. Similar to Trefler (2004) we interpret changes in unit values within HS8 products as changes in prices. Using unit values as a deflator as we do in column (2) still yields a positive and significant coefficient on the AD-EFFECT, suggesting that the productivity effects that we measure are not solely driven by price effects. However, deflating by unit values yields an AD coefficient of 4.5% which is somewhat lower than the 6.7% when using a PPI industry deflator as we do in column 1 of Table 2. Note that for the matched control group we can not use unit values as a deflator since different products than the AD ones are involved in the matched sectors which is why we can only use the 4 digit PPI deflators. Second, we analyze the evolution of unit values to check whether prices increased after AD-protection. To this end, we estimate a difference-in-difference equation, but instead of analyzing the effects on firm level TFP we analyze the effects on the log of product level prices, proxied by the unit values of intra-EU imports. In particular we estimate the following equation and use the 8 digit HS unit values of goods in termination cases as our control.

$$\ln price_{kt} = \alpha_k + \beta_1 AD\_EFFECT + \beta_2 TIME + \varepsilon_{kt} \quad (4)$$

The dependent variable is the log of the unit values of intra-EU imports of good k,  $\alpha_k$  refers to the inclusion of product-level fixed effects, while TIME is a common time trend and AD-PRICE-EFFECT is a dummy equal to 1 for the years following protection and zero in the years before but only for the group of products k that got protection. The coefficient on the AD-PRICE-effect is the coefficient of interest and indicates whether price movements of protected

goods evolved differently than for those goods in terminated AD cases that never received protection. We assume an AR(1) process in the error term, which is equivalent to including a lagged dependent variable. The results in Table 4 show that there is little evidence of strong price increases after protection. In column (1) we fail to find a significant increase in the average prices as a result of AD. Interacting the AD-PRICE-EFFECT with time dummies in column (2) shows that price effects in most years are insignificant, with the exception of the fourth and the fifth year after AD protection where there is a positive effect on prices but only at the 10%. By and large these results suggest that effects on domestic EU prices are moderate. One possible explanation is the “Public interest” clause that prevails in the EU. In principle this clause prevents the EU from imposing AD protection if consumer interests - in the form of rising prices - would be hurt by it.<sup>22</sup>

Our findings are not in contrast to Prusa (1997) who shows that AD protection raises the unit values of foreign imported goods which results in domestic consumers paying more for foreign varieties than before the protection. A reasonable interpretation of this asymmetric response of foreign versus domestic prices seems to be that AD protection forces the foreign price to align on the price of domestic products to close the price gap between foreign and domestic prices. Interestingly, also Liebman (2006) for the US fails to find a significant increase in U.S. steel prices after a safeguard was put in place by the US government. Liebman (2006) using disaggregated product-level monthly panel data for steel finds that U.S. prices were much more affected by business cycle conditions and industry rationalization than by the safeguard protection imposed on imports of steel from abroad. The relative stability of EU domestic prices after AD protection suggests that the increase in EU firm-level markups after

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<sup>22</sup> In a recent AD case the EU Trade Commissioner Mandelson argued that antidumping duties on shoes against China and Vietnam were justified since the price of European shoes would at most go up by 1.5 Euros a pair ([http://ec.europa.eu/trade/issues/respectrules/anti\\_dumping/pr230206\\_en.htm](http://ec.europa.eu/trade/issues/respectrules/anti_dumping/pr230206_en.htm)).

AD protection as reported earlier by Konings and Vandenbussche (2005) seems at least in part driven by increases in the average efficiency of protected firms, rather than by increases in prices.

### ***III.2.3. Distance-to the-Frontier heterogeneity***

As discussed in the introduction, theoretically there are reasons to suspect that the effects of protection on productivity may differ across firms. In particular, we expect the effect of protection on productivity to be stronger for less efficient domestic firms. To get at this idea, we introduce firm heterogeneity within the group of protected firms, in terms of their initial “distance to the frontier firm”. We define the *initial* “distance-to-the-frontier” for each firm  $i$  as the ratio of TFP over the productivity in the frontier firm  $j$  in the initial year of our sample. This frontier firm is the firm with the highest TFP in the same NACE 4 digit industry:

$$DISTANCE_{ijt0} = \frac{TFP_{it0}}{Max_{jt0}(TFP)} \quad (5)$$

A distance of 1 implies that a particular firm is as efficient as the frontier firm, while a distance of 0 refers to a “laggard” with the lowest possible efficiency level compared to the frontier firm. In Table 5 we show the results of our DD specification, but now including the initial ‘DISTANCE’ variable and the interaction of that variable with our previous treatment variable AD\_EFFECT X DISTANCE. All specifications control for serial correlation and include fixed effects. For the moment we focus on column 1 and column 5 where we use the firms in termination cases and the matched firms as a respective control groups. The AD-EFFECT in both specifications is positive and significant. As expected the interaction of the AD-EFFECT with DISTANCE is negative and statistically significant. This confirms the notion that the further away a firm is from the EU frontier firm in its corresponding sector, the stronger the

impact of protection. Or in other words, the positive effect of AD protection on productivity is smaller for firms closer to the efficiency frontier. The mean and median initial distance of the EU firms in protected sectors is 34 % and 30% respectively with a standard deviation of 20%. Or put differently, the median firm is only about one third as efficient as the most efficient firm in its industry in terms of initial productivity. This suggests that the distribution of productivity in an industry is skewed to the left with relatively few very efficient firms that have productivity levels far higher than the median firm. This can be seen from Figure 1 where we plot the kernel density of initial distance of protected firms. The majority of lowly productive firms lie to the left. Incidentally, the lowly productive firms are small firms in terms of employment. When we weigh initial distance with employment it can be noted from Figure 1 that the kernel density function lies to the right of the unweighted one.

Using the results in column 1 of Table 5, we see that while the coefficient on the AD\_EFFECT is positive and equal to 0.053, the interaction effect is negative -0.06. The overall AD\_EFFECT of protection on productivity therefore depends on firms' initial relative productivity. For the mean distance firm in the sample, the AD\_EFFECT is positive and around 3.2% ( $0.053 - (0.06 \times 0.34)$ ). The result we obtain for the protected firms when compared to the matched control group is still positive but smaller i.e. 1.7% ( $0.079 - (0.181 \times 0.34)$ ).

#### ***III.2.4. Single-Product firms versus Multi-Product firms***

One of the problems we face is that a number of domestic firms in our analysis operate in different sectors and produce multiple products. One way we controlled for this thus far is that we only included firms in the analysis whose "primary sector of activity" corresponds with the import-competing sector that the dumped products belong to. Or put differently, we included firms whose operations predominantly belong to the sector filing for AD protection.



However, what we have not controlled for up to this point is that a substantial number of firms are also active in *other* 4-digit NACE sector. We would expect AD protection to have more of an effect on the productivity of those firms whose primary and only line of activity falls in the same NACE sector as the AD activity. Therefore we classify firms on the basis of their number of NACE codes. A firm that is active in only one NACE sector is defined as a single product firm, whereas a firm active in two NACE sectors or more, is considered a multi-product firm. This is obviously a rough way of classifying single versus multiple product firms, but even with this rough proxy we would expect the results to be stronger on the single product firms.

In Table 5 we report the results of a DD approach now distinguishing between single and multiple activity firms in the treatment and in the control groups.<sup>23</sup> Independent of the control group, the AD\_EFFECT is positive and significant in the case of single activity firms while for the multi-activity firms we fail to find any statistically significant effect, which confirms our expectation.

Based on the results that we obtain for the single product firms it is now possible to visualize who wins and who loses productivity during protection as we do in Figure 2. We show the change in productivity of protected firms on the vertical axis as a function of their initial productivity (distance) on the horizontal axis, both when compared to terminated firms (specification in column 2 of Table 5) and to matched firms (specification in column 5). Figure 2 nicely illustrates the heterogeneous response of firms to trade protection depending on their initial productivity. The downward sloping curves intersect with the horizontal axis when productivity gains of protection are zero and a firm is indifferent towards protection. Firms with an initial productivity to the left of the indifferent firm have a productivity gain during

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<sup>23</sup> Note that the number of observations used in this analysis is smaller, because the data for French firms do not distinguish between single and multiple product firms so we excluded data of French firms.

protection, while firms to the right of the intersection lose productivity during protection. We clearly see that who wins and who loses from protection depends on which control group was used. Relative to firms in Terminated cases, all protected firms with an initial distance smaller than 0.72, gain in productivity and win from protection. Inspection of the frequency distribution of protected firms in terms of initial distance as documented earlier in Figure 1 makes it clear that this involves the large majority of protected firms although the number of winners is clearly smaller under the employment weighted productivity distribution. Compared to a matched group of firms, fewer protected firms win namely only those with an initial distance below 0.4. This involves about two thirds of the firms under the unweighted kernel and about one half of the firms under the employment weighted kernel distribution. The smaller number of protected firms that win when compared to the matched control group seems to suggest that the productivity gains for the matched firms were stronger than for firms in termination cases.

### *III.2.5. Mis-specified Dynamics*

Recently Bertrand et al. (2004) argues that standard DD approaches may result in biased estimates of the treatment effect due to mis-specified dynamics. They show in simulations that including a simple auto-correction process like we do in Tables 3 and 5, does not necessarily perform well and may still bias the estimates as the dynamic process may still be mis-specified. One simple way to correct for that proposed by Bertrand et al (2004) is to collapse the time series into a “pre-“ and “post-“ period. Using this approach, we compute the average TFP pre-AD protection and the average TFP post-AD protection. In doing so, we average out any temporary shock in TFP. The results of this approach are shown in the first two columns of Table 6, giving qualitatively similar long-run effects as we obtained earlier. In addition, we

also turn to a long-run differences approach similar to the approach used by Trefler (2004) where we compare TFP *growth* in the pre- and post- AD period. We compute TFP growth as in Trefler (2004) by the annualized 5-year long run change in log TFP, where initial TFP is taken as the level of TFP prior to protection<sup>24</sup>. The results are shown in columns 3 and 4 of Table 6. We find that TFP growth increases by 1.7% as a result of AD. Allowing for firm heterogeneity in column 4 by interacting the AD-Effect with distance and applying it to the average firm yields an effect of AD protection of TFP growth of 2%. We can interpret these results as the short run effect of AD protection on TFP, similar as the results reported in Table 3.

Finally in column 5 of Table 6 as an additional robustness check we interact the AD-Effect with year dummies to check whether the treatment effect takes some time before it affects TFP. For this we return to our original firm-level panel and interact the AD-Effect with year dummies. It can be noted that productivity increases occur every year of the five year AD protection period. To what extent the productivity continues to improve when protection comes off is an equally interesting question but one we can not address given the time span that we have.

### ***III.2.6. Digging Deeper: Where do Productivity Improvements come from?***

Finally the question can be raised where the productivity improvements come from. Given that we have estimated TFP after taking into account variation in input factors, the increase in TFP that we measure here is unlikely to be explained by a scale effect, but seems rather to be consistent with the idea that the average firm has stronger incentives to engage in cost reducing restructuring efforts once they receive temporary protection. Also, looking more

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<sup>24</sup> For computing the long difference prior to protection it was not possible to compute the 5-year long difference for the cases initiated in 1996 since our data only started in 1992, so we used the 4-year long difference instead, but recomputed on an annual basis by dividing through the number of years.

in depth at some of the other firm level variables in our data suggests that productivity improvements go beyond spare capacity utilization. In Table 7 we report the results of a difference-in difference analysis with firm-level fixed effects where we compare gross investment, employment, R&D<sup>25</sup> and wages between firms in AD protection cases and firms in terminations, which are arguably the most similar to the protected firms. We find that the average protected firm seem to reduce employment, increase gross investment in tangible fixed assets, increase R&D spending and pay higher wages after AD protection compared to non-protected firms. All this suggests that protected firms are downsizing more in terms of employment and are investing relatively more in tangible and intangible fixed assets. This implies that the capital intensity of production is going up possibly resulting in higher value added or high quality products. Protected firms are paying more to their workers which could either be a reflection of rent-sharing or of an alteration of the skill mix at the firm level where unskilled workers are replaced by more skilled workers. Unfortunately, our firm level dataset only allows us to verify a limited number of channels through which productivity can be improved. Other effects are likely to be at play. For instance recent work by Bernard et al. (2006) points at evidence of product switching in industries that face tough import competition. They find that trade shocks often coincide with firms dropping uncompetitive products. While we can not verify this in our dataset, it is clear that such a change in the product mix is likely to result in higher productivity.

#### **IV. Conclusion**

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<sup>25</sup> Researchers have pointed out that antidumping protection often targets R&D-intensive industries (Niels, 2000).

This paper empirically measures the effect of temporary Antidumping (AD) protection on firm-level productivity of domestic import-competing firms. For this purpose we identified around 4,800 European producers affected by AD cases. While we find the productivity of the average firm to be moderately improved during AD protection, productivity remains below that of firms never involved in AD cases, thus questioning the desirability of protection. The effect of protection on firm level productivity that we find is subject to firm heterogeneity. Firms with relatively low initial productivity – laggard firms – have productivity gains during AD protection, but firms with high initial productivity – frontier firms – experience productivity losses during protection. The falling productivity of frontier firms is an additional cost of protection emerging from this paper that adds to the loss in domestic consumer surplus and the sub-optimal levels of exit. These empirical results are consistent with recent theoretical findings that have pointed at the relationship between market size (Lileeva and Trefler, 2007), product market competition (Aghion et al. 2005, Boone, 2000), temporary tariff protection and the adoption speed of new technology (Miyagiwa and Ohno, 1995; Ederington and McCalman, 2007). An interesting future line of research would be to engage in more in depth industry studies to explore the channels through which productivity changes at the firm-level in response to trade policy are made.

**Table 1: New Antidumping Cases Initiated by the EU between 1996-98**

Year of AD Initiation	Product	# HS per case	NACE rev.1	Decision (Duty/Undertak/Termination)	Year of AD Decision	Average Duty <sup>(b)</sup> (%)	Expiry Review <sup>©</sup> Initiation	Decision of Review	Defendants
1996	Cotton fabrics-unbleached	17	1720	T	1997	0			China, Egypt, India, Indonesia, Pakistan, Turkey
	Synthetic fibre ropes	4	1752	T	1997	0			India
	Briefcases, schoolbags, luggage & travel goods <sup>(d)</sup>	6	1920	T	1997	0			China
	Seamless pipes and tubes	5	2722	D/U <sup>(a)</sup>	1997	21	2002	D	Russia, Czech. Republic, Romania, Slovak Republic, Poland, Hungary
	Bed linen (cotton type)	5	1740	D	1997	16	2002	T	Egypt, India, Pakistan
	Stainless steel fasteners	7	2874	D	1998	32			China, India, Malaysia, Korea, Taiwan, Thailand
	Ferro-silicomanganese	1	2710	D	1998	58.3 ecu per ton			China
1997	Fax machines	1	3220	D	1998	43			China, Japan, S-Korea, Malaysia, Singapore, Taiwan, Thailand
	Potassium permanganate	1	2413	D	1998	21			India, Ukraine
	Polysulphide polymers	1	2417	D	1998	13			USA
	Synthetic fibre ropes	4	1752	D	1998	82	2003	D	India
	Monosodium glutamate	1	2441	T	1998	0			Brazil, USA, Vietnam
	Cotton fabrics	15	1720	T	1998	0			China, Egypt, India, Indonesia, Pakistan, Turkey
	Strips of iron or non-alloy s	4	2732	T	1998	0			Russia
	Synthetic fibre ropes	4	1752	T	1998	0			S-Korea
	Unwrought magnesium	2	2745	D	1998	32			China
	Stainless steel bright bars	4	2731	D	1998	25			India

	Thiourea dioxide	2	2414	T	1998	0			China
	Hardboard	10	2020	D/U	1999	16			Japan, Korea, Malaysia, China, Taiwan
	Bicycles	2	3542	D	1999	18			Brazil, Bulgaria, Estonia, Latvia, Lithuania, Poland, Russia
	Electrolytic alumin. Capacitators	3	3210	T	1999	0			Taiwan
	Woven glass fibre	1	1720	T	1998	0			USA, Thailand
1998	Polypropylene binder	1	1752	D /U	1999	26			Japan
	Steel stranded rope & cable	1	2873	D/U	1999	45	2004	T	Poland, Czech. Republic, Hungary
	Stainless steel wire	4	2734	D/U	1999	56			China, India, South Africa, Ukraine
	Steel stranded rope & cable	1	2873	D/U	1999	44			India, Korea
	Polyester filament yarn	4	2470	T	1999	0			Hungary, Mexico, Poland
	Stainless steel heavy plates	1	2710	T	1999	0			Korea, India
	Seamless pipes and tubes	2	2722	D /U	2000	31			Slovenia, South Africa

- (a) This refers to a “mixed case” in which the EU Commission accepted the price-undertakings offered by some of the exporters. However, it is never revealed how many exporters are granted undertakings.
- (b) The average duty is the country wide duty that applies to “all other exporting producers”. Exporters that co-operate in the EU AD investigation often get a lower duty.
- (c) An expiry review case can be initiated at the earliest 3 months before the end of the 5 year AD protection period. Protection continues during the expiry review investigation. When the expiry review is affirmative, the AD protection is extended for another 5 year period.
- (d) This case consists of 3 cases belonging to the same sector: “Briefcases and Schoolbags”; “Luggage and Travel Goods”; “Leather Handbags”.

**Table 2: A Comparison of Average Total Factor Productivity Across Groups**

	<b>TFP Before Filing</b>	<b>TFP After Filing</b>
<b>Matched Control Group</b>		
<i>Mean</i>	2.23	2.32
<i>Median</i>	1.43	1.53
<i>Standard Deviation</i>	2.55	2.63
<b>Termination Cases</b>		
<i>Mean</i>	1.46	1.43
<i>Median</i>	1.14	1.18
<i>Standard Deviation</i>	1.51	1.13
<b>Affirmative AD Cases</b>		
<i>Mean</i>	1.32	1.55
<i>Median</i>	1.10	1.23
<i>Standard Deviation</i>	1.05	8.65

Note: TFP refers to the exponential of log TFP obtained from estimating equation (2). When we set the mean level of TFP in the matched group equal to 100, we can express the means of the Termination group and the Affirmative group as a percentage. For example before filing the Termination cases are only about 65% as productive as the Matched group, while the Affirmative cases are on average only 60% as productive compared to the Matched.

**Table 3: Difference-in-Difference Estimates of the Effect of AD Protection on Firm Level TFP**

<b>CONTROL</b>	<b>TERMINATIONS</b>				<b>MATCHED</b>	
	<b>(1)</b>	<b>(2)</b>	<b>(3) AR (1)</b>	<b>(4) AR (1) Including Expiries</b>	<b>(5)</b>	<b>(6) AR (1)</b>
<b>Deflator</b>	PPI 4-digit	Unit Values	PPI 4-digit	PPI 4-digit	PPI 4-digit	PPI 4-digit
AD- Effect	0.067*** (0.007)	0.045*** (0.007)	0.032*** (0.006)	0.026*** (0.006)	0.085*** (0.006)	0.040*** (0.008)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Location X Year	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) Coefficient	-	-	0.44**	0.44**	-	0.44**
Overall R <sup>2</sup>	0.03	0.03	0.06	0.07	0.07	0.20
# observations	40,686	38,768	36,253	39,171	69,303	61,102

Notes: (i) \*\*\*/\*\* refer to respectively significance at the 1%/5% level, (ii) Heteroskedastic robust standard errors between brackets, (iii) The statistical significance of the AR(1) coefficient is based on the Baltagi-Wu (1999) test statistic, of which the critical value has to lie below 2, which is the case in all the specifications.



**Table 4: Difference-in-difference Effects of AD protection on EU Prices of Protected versus non-Protected Goods**

	(1)	(2)
TIME	-0.066** (0.032)	-0.065** (0.032)
AD-PRICE-EFFECT	0.048 (0.042)	-
AD_PRICE-EFFECT x year 1 After protection	-	0.023 (0.046)
AD-PRICE-EFFECT x year 2	-	0.067 (0.050)
AD-PRICE-EFFECTx year 3	-	0.043 (0.052)
AD-PRICE-EFFECT x year 4	-	0.103** (0.052)
AD-PRICE-EFFECTx year 5	-	0.110** (0.053)
AD-PRICE-EFFECT x year 6	-	0.019 (0.057)
AD-PRICE-EFFECT x year 7	-	0.058 (0.074)
AR(1) coefficient	0.46**	0.47**
#observations	399	399
Overall R <sup>2</sup>	0.04	0.04
PRODUCT-FIXED EFFECT	YES	YES

Notes: as in Table 3

**Table 5: Distance-to-the-Frontier and Single versus Multiple Product Firms**

CONTROL	TERMINATIONS			MATCHED		
	(1) TFP levels	(2) Single products	(3) Multiple Product	(4) TFP levels	(5) Single products	(6) Multiple products
AD Effect	0.053*** (0.012)	0.056*** (0.016)	0.013 (0.034)	0.079*** (0.012)	0.092*** (0.017)	0.033 (0.042)
AD Effect X Distance	-0.060** (0.028)	-0.082** (0.037)	0.043 (0.107)	-0.181*** (0.045)	-0.242*** (0.056)	0.070 (0.207)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Location X Year effects	Yes	Yes	Yes	Yes	Yes	Yes
AR (1) coefficient	0.43**	0.40**	0.40**	0.43**	0.40**	0.40**
Overall R <sup>2</sup>	0.03	0.01	0.01	0.17	0.19	0.01
# observations	35,445	20,734	4,409	59,668	35,908	5,928

Notes: as in Table 3

We define Distance as the *initial* “distance-to-the-frontier” for each firm *i* as the ratio of Total Factor Productivity (TFP) over the productivity in the frontier firm *j* in the initial year of our sample. This frontier firm is the firm with the highest TFP in the same NACE 4 digit industry.

**Table 6: Robustness checks**

CONTROL	TERMINATIONS				
	BERTRAND et al. (2004) correction		TREFLER (2004) Long Run differences		Year-By-Year
	(1) TFP level	(2) TFP level	(3) TFP growth	(4) TFP growth	(5) TFP level
AD Effect	0.062*** (0.018)	0.233*** (0.024)	0.017** (0.009)	0.06*** (0.005)	–
AD Effect X Distance	-	-0.456*** (0.046)	-	-0.116*** (0.011)	–
AD Effect after 1 year	-	-	-	-	0.042*** (0.008)
AD Effect after 2 years	-	-	-	-	0.049*** (0.008)
AD Effect after 3 years	-	-	-	-	0.041*** (0.009)
AD Effect after 4 years	-	-	-	-	0.039*** (0.008)
AD Effect after 5 years	-	-	-	-	Yes
Firm Fixed Effects	Yes	Yes	No	No	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes
Location X Year effects	Yes	Yes	Yes	Yes	Yes
Overall R <sup>2</sup>	0.01	0.04	0.05	0.07	0.03
# observations	5,445	5,445	5,445	5,445	40,686

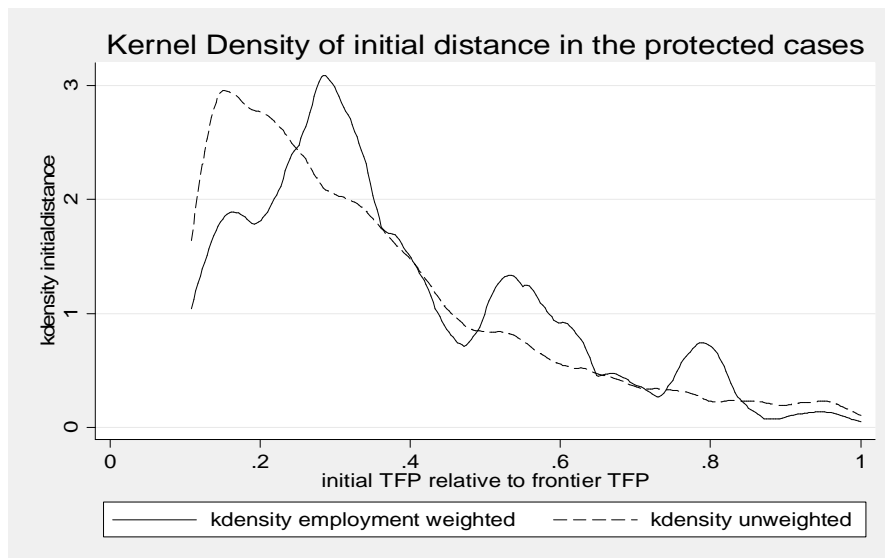
Notes: As in Table 5.

**Table 7: Where do Productivity Improvements come from? Dif-in-Dif results**

CONTROL GROUP	TERMINATIONS			
	ln(Empl)	R&D- Sales Ratio	(ln Wage)	Gross Investment (relative to tangible fixed assets)
AD Effect	-0.022** (0.01)	0.001* (0.0009)	0.064*** (0.010)	0.089*** (0.037)
Time Trend	0.025** (0.010)	-0.001 (0.008)	-0.012* (0.008)	-0.97*** (0.032)
AR (1) coefficient	0.61**	0.62**	0.44**	0.94**
Firm fixed effects	yes	yes	yes	Yes
# observations	36,783	36,832	36,038	47,518

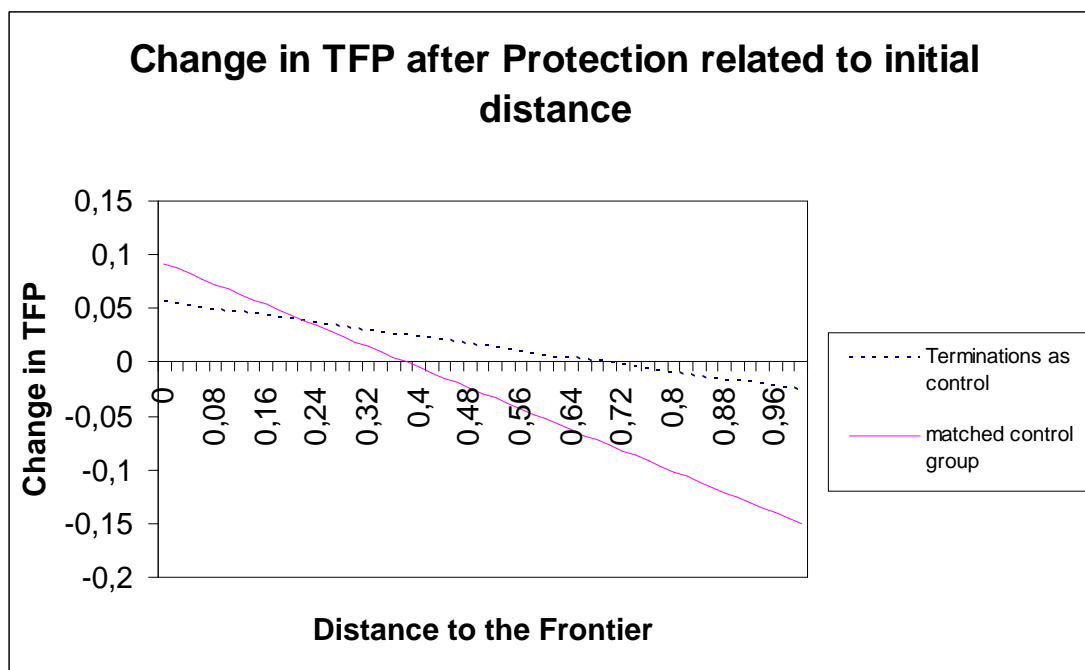
Note: as in Table 3

**Figure 1: Frequency Distribution of Initial Distance of Protected Firms**



Note: We define the *initial* “distance-to-the-frontier” for each firm *i* as the ratio of Total Factor Productivity (TFP) over the productivity in the frontier firm *j* in the initial year of our sample. This frontier firm is the firm with the highest TFP in the same NACE 4 digit industry. On the horizontal axis, a distance close to 1 refers to a very efficient firm while the closer to 0, the more relatively inefficient the firms are.

**Figure 2: Initial Distance and Productivity Change during Protection for Single Product Firms**



Notes: Distance on the horizontal axis is defined as in Figure 1. The changes in productivity are based on the regression coefficients in column (2) and column (5) in Table 5 where the protected firms are compared to the Terminations and to the Matched firms respectively.

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**Table A.1.: Summary Statistics of key Variables in the Productivity Estimations of Olley -Pakes**

AD-cases	Employment (units)	Capital (000€)	Value added (000€)
Affirmative Cases	140 (649)	7,272 (53,541)	8,554 (53,982)
Termination Cases	129 (462)	10,105 (61,819)	10,738 (57,291)
Matched control group	66 (242)	1,398 (7,398)	3,082 (16,427)

Note: Standard deviations are between brackets.

**Table A.2.: Multi-nominal Logit Estimation of the Probability of AD Protection and Termination**

Explanatory Variables	Dependent variable: "1" if no filing; "2" if "Filing & Termination;" "3" if "Filing & Protection"	
	(a)	(b)
<i>Determinants of Terminations given Filing</i>		
Industry import penetration share lagged	0.024** (0.012)	0.028** (0.014)
Real EU GDP growth rate	0.171 (0.290)	0.219 (0.305)
Previous n° of AD filings	0.135*** (0.026)	0.143*** (0.029)
Industry employment lagged	-0.002 (0.193)	-0.023 (0.188)
Average labor productivity lagged	-	-1.199* (0.728)
<i>Determinants of Protection given Filing</i>		
Industry import penetration share lagged	0.015* (0.010)	0.014* (0.01)
Real EU GDP growth rate	0.067 (0.245)	0.066 (0.254)
Previous AD filings	0.144** (0.027)	0.145*** (0.029)
Industry employment lagged	-0.034 (0.185)	-0.015 (0.188)
Average labor productivity lagged	-	0.197 (0.65)
Chi-squared statistic	92.70***	102.04***
Pseudo-R <sup>2</sup>	0.25	0.26
Number of observations	1,286	1,284

Note: \*/\*\*/\*\* denotes statistically significant at the 10%,5% and 1% level respectively

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