Heterogeneous Responses of Firms to Trade Protection

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Abstract

This paper uses firm-level panel data to estimate the effect of import protection on the productivity of domestic firms in import-competing industries. The type of import protection we study is antidumping protection (AD). Two key results emerge from our analysis. First, while the productivity of the average firm is moderately improved during AD protection, the productivity of firms in protected sectors remains below that of domestic firms never involved in AD cases, which questions the desirability of protection. Second, when we introduce firm heterogeneity we find that domestic 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. 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-codes: F13, L 41, O30, C2

Keywords: Total Factor Productivity, antidumping protection, firm heterogeneity

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Heterogeneous Responses of Firms to Trade Protection[2]

I. Introduction

The effects of trade liberalization on productivity have been widely reported in the literature.[3] But while tariffs on industrial goods have never been lower, their decrease has gone hand-in-hand with a strong increase in newer types of trade protection. In particular, the use of antidumping protection has risen sharply in the last decade. Antidumping protection is supposed to keep "unfair imports" out, but there is a strong suspicion that it is often aimed at fostering the interests of inefficient domestic producers.[4] Therefore, an important question is how antidumping import protection affects the productivity of domestic import-competing firms. For this purpose, we study European antidumping cases where protection is temporary and typically ends five years after the starting date.[5]

We identify firms in the European Union (EU)[6] in four-digit sectors directly affected by AD policy and use their firm-level data[7] to obtain output and input measures for estimating Total Factor Productivity (TFP) before and after AD protection. We first estimate firm-level TFP using the methodology of Olley and Pakes (1996) to correct for the simultaneity in the choice of inputs and firm exit.

Second, we use a difference-in-difference (DD) approach to evaluate the differential productivity effects of AD protection. For this purpose, we apply the matched sampling techniques developed by Heckman et al. (1997),[8] and use various control groups of firms that did not receive protection. We estimate the probability of

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3 Important contributions are Levinsohn (1993), Harrison (1994), Tybout and Westbrook (1995), Head and Ries (1999), Pavcnik (2002) and more recently Trefler (2004).

4 A few examples include Shin (1998), Veugelers and Vandenbussche (1999).

[5] The EU has always had a sunset clause limiting the protection period to 5 years while the US only adopted the sunset clause after the Uruguay Round.

[6] During the period of our analysis the European Union consisted of 15 countries.

[7] From Amadeus, Bureau Van Dijck.

[8] The use of a "matched" control group in the difference-in-difference analysis is generally regarded as an acceptable way to deal with selection effects. De Loecker (2007) uses a similar approach to analyze the effects of learning-by-exporting on productivity.

AD protection by using a multi-nominal logit model similar to the one used by Blonigen and Park (2004) to "match" the protected firms to firms in similar sectors but that never filed for nor received protection. Third, we introduce firm heterogeneity. We examine whether the effects of AD protection depend on firms' initial productivity. For this purpose, we construct a firm-level measure of "distance-to-the-frontier" where distance is an indication of how productive each firm is relative to the most productive firm in its four-digit EU industry at the outset of the sample period.

Our main results can be summarized as follows. Firms that file for protection have, on average, a lower initial productivity than firms in the control groups.[9] We find that AD protection raises the average productivity of the protected firms but that the productivity increase is never sufficient to close the productivity gap with firms in sectors not involved in AD, which casts doubt on the desirability of protection.

Analysis of the average AD effect reveals substantial heterogeneity across firms that can be related to the "distance-to-the-frontier-firm". Highly productive firms – frontier firms – are negatively affected by AD protection as their productivity declines during protection. Less productive firms are positively affected by AD protection as their productivity rises during protection. Our results are significant and robust across specifications. On average, we find that AD protection raises the productivity of the protected firms by about 2% to 8% depending on the specification used with the smallest estimates arising when we use the long differences approach as in Trefler (2004). Including multi-sector firms also weakens the results with respect to those obtained by an analysis that includes only single-sector firms.

Measuring total factor productivity is problematic because of the difficulty of distinguishing true productivity effects from price movements. We conduct a number of experiments to show that the effects of AD protection on measured productivity cannot be attributed entirely 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

[9] This can be compared to Regev and Griliches (1995), who found that firms under threat of exiting tend to have low levels of productivity.

values of goods traded on the internal EU market and protected by AD to control for price movements.

A logical question following our analysis concerns where the average productivity improvements come from. It is unlikely that average productivity improvements during AD protection are driven by exit rates. First, trade protection typically prevents a reshuffling of firm-level resources across sectors and results in sub-optimal levels of exit (Hillman, 1982). Second, the Olley-Pakes methodology accounts for biases in measured TFP due to firm exit. Third, 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[10] seems to confirm this. For the "matched control group", the average exit rate over the sample is 3% while we find it to be much lower and around 1.8% for the protected firms.

The channels of productivity improvement within firms that we identify are labor shedding, increased R&D spending, and increased investment in fixed assets at the firm level during AD protection. However, there can be additional channels through which productivity can be improved that we cannot measure. In particular, "product switching", involving a change in the output mix towards products with higher capital and skilled-labor content (Bernard et al., 2006) is a very likely source of productivity improvement but cannot be tested due to data limitations.

In our data, we cannot distinguish between skilled and unskilled labor, which prevents us to analyze skill upgrading. 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, productivity is likely to go up in both

[10] The firm-level data we use involves 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 not all firms that exit are retained in the data records, especially for the earlier years of the data. The same applies for the measurement of entry.

cases. An increase in the skill mix is likely to boost productivity, just as a wage increase for workers is likely to induce more effort since workers stand to lose more when dismissed.

To understand the link between trade policy and firm-level productivity, we turn to various theoretical models. Lileeva and Trefler (2007) is a particularly useful background model for interpreting the empirical results we obtain. They show that firm-level productivity responses are heterogeneous when trade policy results in an increase in market size. In this model, domestic firms experience an increase in market size due to the trade liberalization in export markets. In addition to a fixed cost of exporting (Melitz, 2003; Helpman, 2006), the model assumes a fixed cost of productivity-improving investment. Under these assumptions, only firms with low initial productivity and high potential productivity gains invest when the size of the market increases. Using tariff cuts by the US against Canadian imports resulting from the US-Canada Free trade Agreement, Lileeva and Trefler (2007) found that the labor productivity of small and lowly productive Canadian plants increases more than does the productivity of large and highly productive firms. While their paper deals with trade liberalization, its results can be transposed easily to the context of AD trade protection described in the present paper. AD trade protection increases the market size of domestic firms to the detriment of foreign importers. This increase in market size allows lowly productive domestic firms that would have exited in the absence of trade protection, to engage in productivity-improving investment. The most productive domestic firms that already operate at competitive cost levels and that are in no danger of exiting are much less affected by the increase in market size and have less 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. Even though we have no data on exports at the firm level, from the high correlation between productivity and exporting (Melitz, 2003) 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 domestic market and therefore benefit relatively less from an increase of the size of the domestic market

than do purely domestic firms that do not export. Exporters may even experience reduced market access abroad if domestic trade protection results in retaliatory action whereby trade partners protect themselves in turn (Prusa, 2001; Vandenbussche and Zanardi, 2006). Also, according to the "learning-by-exporting" literature, reduced market access abroad would reduce 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 between exports and imports at the firm level. Exporting firms tend to source a relatively greater 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 cannot 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 less efficient domestic firms benefit from AD protection while highly productive domestic firms lose.

Another body of literature related to our findings concerns the relationship between firms' adoption of new technology and trade policy (Rodrik, 1992; Miyagiwa and Ohno, 1995; Ederington and McCalman, 2008). These authors explore how trade policy can induce domestic firms to restructure and accelerate the speed of adoption of more efficient production technologies.[11] 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. Moreover, Boone (2000) shows that the incentive to innovate in such markets is stronger for less efficient firms when they operate under weak product market competition. The intuition underlying this result is that, with weak competition, strategic effects between firms are less than they would be under tough competition.

The rest of this paper is organized as follows. In the next section, we discuss our data. In Section III, we present the empirical methodology and results. Section IV concludes.

[11] We use the "restructuring" to refer to firms engaging in cost-reducing investment, broadly defined and interpreted.

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'.[12] 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 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[13] 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[14] that were initiated in 1996, 1997 and 1998 and for which we could retrieve all the variables from the

[12]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.

[13] 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).

[14] 'New' implies that these cases were not subject to protection when the case was initiated.

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 difference-in-difference (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.

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 Fiber 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 Fiber 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 Fiber", initiated at the end of 1997, also ending in a

termination[15]. 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.

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 shortly before the ending of protection, provided there are indications that when the protection comes off, injury and dumping would continue. 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.[16] If the expiry review is affirmative, the industry obtains 5 more years of protection. For the cases included in our analysis, in only 4 out of the 23 cases, 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 Fiber 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. This suggests that when protection is extended beyond a five year period firms engage less in restructuring than other firms, possibly to

[15] 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.

[16] The latest EU AD law is Regulation 384/96.

convince the investigating authorities that "injurious" dumping from abroad is still going which is a condition to request for further protection. Therefore extensions of protection are clearly not desirable.

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[17] and η_{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), β_l and β_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[18], 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 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

[17] 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.
[18] Summary statistics of the key variables used in (1) are listed in the Appendix.

(Bernard, Redding and Schott, 2006)[19]. We therefore report a number of robustness checks. We report separate estimates for single versus multiple-sector 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 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

[19] 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.

'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.[20] 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.

The "matched" control group consists of sectors with a similar probability of protection but that never had protection.[21]. This resulted in a control group of 4,678 firms.[22] We now test the following DD specification:

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

α_i is a firm-level fixed effect that captures all unobservable characteristics between firms that do not vary over time. The YEAR dummies capture any time effect on TFP, due to e.g. business cycle effects, demand shocks or other macro shocks, common to all firms. The COUNTRY dummies control for location specific effects for firms in

[20] Trade data come from EUROSTAT and production data from PRODCOM.

[21] 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 75th 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.

[22] In the working paper version Konings and Vandenbussche (2004) 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.

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 get 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 the productivity of protected firms versus unprotected firms in the various control groups.

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 that did not file. This can be seen from column 1 where we compare TFP across groups of firms in the period before filing. Firms in termination cases that file for protection but fail to get it are on average only 65% as efficient as the average matched firm that never filed. Firms in affirmative cases are initially only 60% as efficient as the matched firms. 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 to the level of the average termination firm, it is not sufficient to raise productivity to the level of the control group of firms never involved in AD.

Next we continue 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[23]. Our estimates range from 2.6% (column 4) to 8.5% (column 5). Including the four expiry review cases where protection is prolonged for at least one additional year[24] in the analysis, as we do in column (4) 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. While 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 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 a 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. Since the results we obtain are

[23] 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.

[24] Protection continues during the expiry review investigation which usually involves one year.

qualitatively similar when we deflate TFP with a 4-digit PPI or with the unit prices, in the remainder of the paper we will report only results based on the 4-digit PPI deflator for brevity. 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.

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

The dependent variable is the log of the unit values of intra-EU imports of good k, α_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 if 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.[25] 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

[25] 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).

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 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:

$$DISTANCE_{ij1993} = \frac{TFP_{i,1993}}{Max_j TFP_{j,1993}} \qquad (5)$$

where TFP is the exponential of tfp_i as defined in equation (2) and t=1993 is the first year in our sample[26]. 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 the specification in (3), but now including the initial 'DISTANCE' variable and the

[26] For a number of firms the first year of data is not 1993, but 1994.

interaction of that variable with our previous treatment variable AD_EFFECT X DISTANCE. All specifications control for first order serial correlation and include fixed effects. For the moment we focus on column 1 and column 4 where we use the firms in termination cases and the matched firms as 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%.This implies that 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 many inefficient firms and very few efficient firms. This can be seen from Figure 1 where we plot the kernel density of protected firms in function of their initial distance on the horizontal axis. Incidentally, the lowly productive firms are small firms in terms of employment. When we weigh initial distance with employment the weighted 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-(0.06x0.34)). 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-(0.181x0.34).

III.2.4. Single-Sector firms versus Multi-Sector 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. Thus far we controlled for this by only including 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 sectors. We would expect AD protection to have a stronger 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-sector firm, whereas a firm active in two NACE sectors or more is considered a multi-sector firm. In Table 5 we report the results.[27] Independent of the control group, the AD_EFFECT is positive and significant in the case of single-sector firms while for the multi-sector firms we fail to find any statistically significant effect, which confirms our expectation.

Based on the results in Table 5 it is now possible to visualize who wins and who looses productivity during protection. Any regression specification with a "distance" interaction term can be used to obtain the estimated productivity change that corresponds to each protected firm's initial distance. A plot of the productivity changes for the entire range of initial distance values results in a downward sloping line like the one shown in Figure 1. The specification that we used for this is the one in column 2 of Table 5 where we estimate the productivity changes of single-sector protected firms compared to the control group of unprotected firms in termination cases. The vertical axis on the left in Figure 1 clearly demonstrates the heterogeneity of the productivity changes. At the intersection of the downward sloping curve with the horizontal zero axis, the 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 gain productivity, while firms to the right of the intersection loose productivity during protection. The kernel frequency distribution of protected firms, also shown on Figure 1, indicates the mass of firms that lie to the left and to the right of the indifferent firm and reflects the relative number of winners and losers from

[27] 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 respectively. For the specification we choose for illustrative purposes (column 2 of Table 5) the intersection occurs around 0.72. This suggests that only protected firms with an initial distance smaller than 0.72, gain in productivity and win from protection. The frequency distribution shows that this is the large majority of protected firms although the winners tend to be the more lowly productive firms. We should point out that the number of winners and losers from protection depends on the control group that is used. A specification like the one in column 5 of Table 5 where the matched firms are used as a control group would result in a steeper downward sloping curve in Figure 1 with an intersection on the horizontal zero axis closer to 0.4 which yields a smaller number of winners from protection. This seems to suggest that the productivity gains for the matched firms are stronger than for firms in termination cases. This can be understood as follows. When matched firms experience productivity gains superior to the ones experienced by firms in termination cases, a comparison between protected firms with matched firms indeed results in smaller productivity differentials than comparing protected firms to termination firms.

III.2.5. Mis-specified Dynamics and other robustness checks

The difference-in-difference approach that we applied above may result in biased estimates of the treatment effect due to mis-specified dynamics. Productivity is likely to display autocorrelation over time. But the autocorrelation can be of a higher order than we assumed thus far. A failure to correct appropriately for dynamics may result in inconsistent estimates and standard errors that are too small. Therefore as a robustness check we turn to a long differences approach similar to the one used by Trefler (2004) where we compare the average 5-year long difference in TFP in the pre- and post- AD period. This approach has the advantage that we need not worry about dynamic panel estimation problems. 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[28]. The results with and without the distance interaction are respectively shown in columns 1 and 2 of Table 6. In both

[28] 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.

specifications we include all firms, use terminations as a control group and deflate TFP with 4-digit PPI deflators. The results in column 1 suggest that with long differences, TFP increases on average by 1.7% as a result of AD protection. This result is lower than the 3.2% that we obtained earlier in the specification in column 3 of Table 3 which is similar in terms of control group and use of deflators but where we used an AR(1) process to control for dynamics.

When we interact the long difference AD_EFFECT with DISTANCE as we do in column 4 of Table 6 and apply its coefficient to the average distance firm, we get a significant and positive effect of AD protection on TFP of 2%. Again it can be noted that the long differences estimate of 2% is smaller than the 3.2% (0.053–(0.06x0.34)) effect we obtained in column 1 of Table 5 which is a similar specification in terms of control group and deflators but where the dynamic process we assumed was AR (1).

The results obtained under the long differences approach are reassuring in the sense that the significance of AD protection on firm level productivity established in the previous section holds up. But the long differences approach where we avoid dynamic panel issues yield smaller estimates than previous specifications.

Another concern throughout our analysis has been the effect of prices on productivity. The results in Table 4 suggested that the effect of AD protection on unit values of intra-EU traded goods was weak and only seemed to affect prices some years after the protection started. Arguably we would like to complement this with a year-by-year analysis of the productivity effects. Therefore as an additional robustness check, we interact the AD Effect on firm level productivity 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 as in column 1 of Table 3 but now interact the AD-Effect with year dummies. The results are shown in column 3 of Table 6. It can be noted that productivity increases occur every year of the five year AD protection period. This evolution is sufficiently different from the price effects observed in Table 4 which allows us to further dismiss the notion that our productivity effects would entirely be driven by price movements. 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 in our data.

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 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 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[29] 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 seems 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) provides 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

29 Researchers have pointed out that antidumping protection often targets R&D-intensive industries (Niels, 2000).

our dataset, it is clear that such a change in the product mix is likely to result in higher productivity.

IV. Conclusion

This paper empirically measures the effect of 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. Therefore protection seems 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.

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 (Rodrik, 1992; 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[(b)] (%)**	**Expiry Review[©] 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[(d)]	6	1920	T	1997	0			China
	Seamless pipes and tubes	5	2722	D/U[(a)]	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 steel	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 & cables	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 & cables	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: Comparing Average Total Factor Productivity Across Groups

	TFP_{it} Before Filing	TFP_{it} After Filing
Matched Control Group		
Mean	2.23	2.32
Median	1.43	1.53
Standard Deviation	2.55	2.63
Termination Cases		
Mean	1.46	1.43
Median	1.14	1.18
Standard Deviation	1.51	1.13
Affirmative AD Cases		
Mean	1.32	1.55
Median	1.10	1.23
Standard Deviation	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: The Effect of AD Protection on Firm Level TFP

Dependent variable: ln (TFP_{it})						
Control group	Termination firms				Matched firms	
	(1)	(2)	(3) AR (1)	(4) AR (1) Including Expiries	(5)	(6) AR (1)
Deflator	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^2	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 for significance has to lie below 2, which is the case in all the specifications.

Table 4: Effects of AD protection on EU Prices

Dependent Variable: ln ($Price_{kt}$)		
	(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^2	0.04	0.04
PRODUCT-FIXED EFFECT	YES	YES

Notes: (i) as in Table 3; (ii) The control group in the specifications above consists of unprotected products from the Termination cases.

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

Dependent Variable: ln(TFP_{it})						
Control group	Termination firms			Matched firms		
	(1) All firms	(2) Single Sector firms	(3) Multiple Sector firms	(4) All firms	(5) Single Sector firms	(6) Multiple Sector firms
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^2	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: (i) as in Table 3; (ii) 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

	TREFLER (2004) Long differences		Year-By-Year Productivity Effects
	(1)	(2)	(3)
AD-Effect	0.017** (0.009)	0.06*** (0.005)	–
AD-Effect X Distance	-	-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	No	No	Yes
Time Effects	Yes	Yes	Yes
Location X Year effects	Yes	Yes	Yes
Overall R^2	0.05	0.07	0.03
# observations	5,445	5,445	40,686

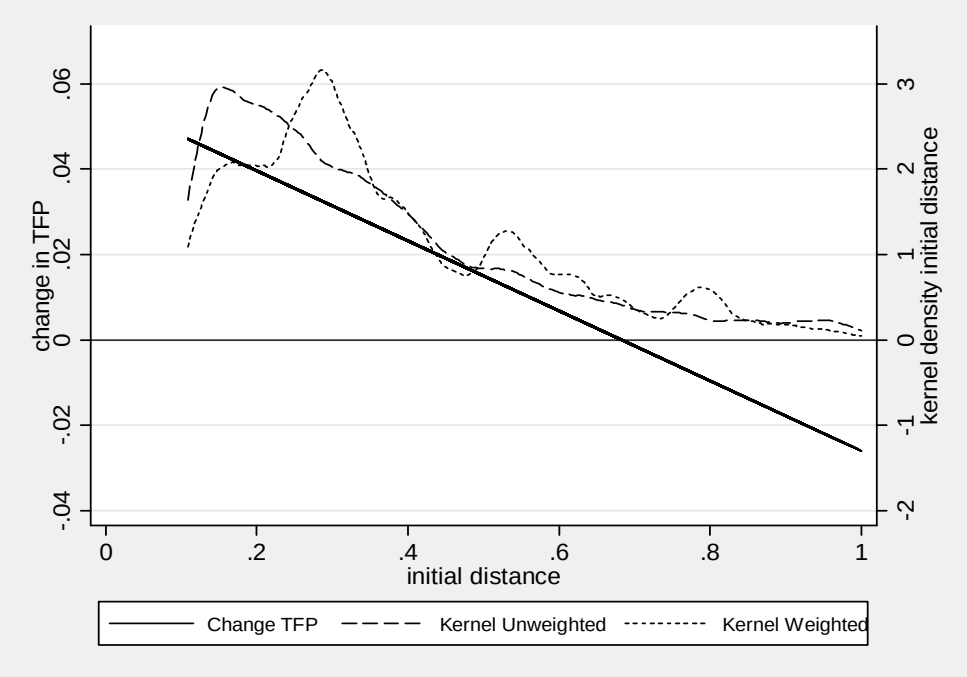
Notes: (i) ***/** refer to respectively significance at the 1%/5% level; (ii) Heteroskedastic robust standard errors between brackets; (iii) Distance is defined as in Table 5; (iv) Terminations are used as a control group in all dif-in-dif specifications.

Table 7: Where do Productivity Improvements come from?

Dependent variable	$\ln(Empl_{it})$	R&D-Sales Ratio	$(\ln Wage_{it})$	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

Notes: (i) as in Table 3; (ii) Terminations are used as a control group in all dif-in-dif specifications.

Figure 1: Frequency Distribution of Protected Firms and Productivity Changes during Protection



Notes:
1) Distance is defined as in the notes tot Table 5. A distance close to 1 refers to a very efficient firm while the closer to 0, the more inefficient a firm is.
2) The surface under the kernel frequency distribution indicates the mass of domestic firms with a particular initial productivity. We show both an unweighted kernel distribution and one where firms are weighted by their employment.
2) Changes in productivity are shown on the left vertical axis and are based on the regression coefficients of column (2) in Table 5.

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Table A.1.: Summary Statistics of key Variables in the Productivity Estimations

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

	Dependent variable:"1" if no filing;"2" if "Filing & Termination;"3" if "Filing & Protection	
Explanatory Variables	(a)	(b)
Determinants of Terminations given Filing		
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)
Determinants of Protection given Filing		
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^2	0.25	0.26
Number of observations	1,286	1,284

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