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Heterogeneous Productivity Response to Abolishing Antidumping Protection: A Study of French Manufacturers

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Heterogeneous Productivity Response to Abolishing Anti-dumping Protection: A Study of French Manufacturers*

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Abstract

This study empirically investigates the effects of abolishing anti-dumping (AD) protection on the productivity of manufacturers operating in import-competing sectors. A panel of French firms protected by AD protection is identified between 2000 and 2008. While for some firms AD protection was abolished at some point during this period, for others AD protection continued. Employing a Difference-in-Difference approach, the empirical analysis indicates that the abolition of AD protection is associated with an on average rise in total factor productivity (TFP) of 4,1% for firms that are cut off from AD protection, as compared to firms protected by a continued AD protection. However, it is found that firms respond heterogeneously to the abolition of AD protection depending on their relatively distance to the domestic productivity frontier and exporting status. The empirical results indicate that the abolition of AD protection has a greater positive effect on the productivity of less efficient and inward-orientated firms.

JEL classification: C2; F13; L41; O30

Keywords: Anti-dumping Protection; Heterogeneity of firms; TFP; Difference-in-Difference

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1. Introduction

A recent World Bank (Bown, 2010) report revealed a distressing 29,5% increase in the imposition of anti-dumping (AD) protection tariffs during 2009, as compared to 2008. In addition, this report addresses a likely continuation of this trend in 2010 due to the substantial investigations which are currently in progress. This sudden rise in AD impositions might be explained by the belief of policy decision makers that a relief of foreign competition could be used to protect the domestic industry (Konings and Vandenbussche, 2009). Regardless of whether products are deliberately dumped by foreign producers, AD protection is often imposed to reinforce inefficient domestic manufacturers, rather than to repress “unfair” imports from alleged countries (Shin, 1998). According to neo-classical trade theory, protection is likely to lead to sub-optimal exit levels of firms in protected industries, which prevents a reallocation of resources to industries with greater returns (Hillman, 1982). Sub-optimal firm exits in protected industries penalizes domestic consumers, since it hampers domestic prices to align with lower world market prices.

If an AD duty is enforced by the EU Commission, the imposition protects the importing competing sectors of all EU member states against imports from the dumping countries with a common duty. The EU Commission imposes an AD protection under the “Sunset Clause”, which implies that after a protection period of five years free trade is restored. However, the initial protection period can be extended for an additional period of five years, to protect domestic firms from “unfair” imports. In some AD cases the imposed protection measures even continue for more than two periods of five years[3]. Thus, while for some firms AD protection is abolished and product market competition is back in place, for others the AD protection continues in order to protect the domestic import competing sector.

According to models on protection and technology adoption, temporary trade protection allows technological lagging firms to catch-up with the technological frontier. For example, Miyagiwa and Ohno (1995, 1999) describe that import competing firms have a higher incentive to adopt efficiency improving technologies when protected by a duty on foreign imports, as compared to a period of free trade. Although there is empirical evidence suggesting that AD tends to raise the productivity of a representative protected firm in the

[3]For example In the case of “Tungsten carbide and fused tungsten carbide” imports from China, measures are even in force from 1990. These measures are currently under investigation for the period of protection due to an expiry review initiated in 2009 (“Anti-dumping and Anti-subsidy measures list” EU commission http://trade.ec.europa.eu/doclib/html/113191.htm).

import competing industry. These findings also indicate that protected firms are not able to become as efficient as companies that do not apply for protection, which raises questions on the desirability of anti-dumping protection. Moreover, firms tend to respond heterogeneously to the effect of AD protection, depending on a firm' exporting and productivity status. Therefore, the effect of AD protection on firm-level productivity can either be positive or negative (Konings and Vandenbussche, 2008, 2009).

In contrary to Miyagiwa and Ohno (1995, 1999), a recent strand of theoretical literature has addressed productivity improvements at the firm-level arising from reductions in import tariffs. Reducing tariffs on foreign import products may induce firms in the import competing industries to increase their innovation efforts (Ederington and McCalman, 2008; Aghion et al., 2004, 2005, 2009), or to restructure as a result of the exit of less efficient firms and reallocation of output to more efficient firms (Melitz, 2003; Helpman et al.; 2004, Bernard et al., 2007). A positive effect of reducing import tariffs on productivity seems to be confirmed by a growing literature on domestic liberalization, however this effect also seems to be subject to firm heterogeneity, and could either be negative or positive.

The fact that under the EU anti-dumping policy some firms face product market competition after an exogenous period of protection, while others remain protected by import restrictions, reveals an interesting research setting. To the author's knowledge, it has not been investigated how firms respond to an abolished AD duty, and if this response is subject to firm heterogeneity. This study aims to fill this gap in the empirical literature on AD protection. Since theoretical literature predicts that efficiency improving incentives for firms in the import competing sector can go either way after the abolition of AD tariffs, the aim of this thesis is captured in the following research question:

Research question: *What is the effect of abolishing anti-dumping tariffs on firm-level productivity of domestic import competing firms? Is this effect the same for all the firms?*

This study aims to provide a contribution to the limited empirical literature on effects of AD protection on domestic manufacturers. In addition, this study could provide a meaningful insight for policymakers facing an increased number of AD investigations in the aftermath of the global financial crisis.

The remainder of this paper is organized as follows. First, Section 2 presents two theoretical models, which provide an insight in the possible co-existing mechanisms when the protection comes off an its implications on firm-level productivity. Section 3 presents an overview of the related empirical literature and Hypotheses of this study. Next, Section 4 focuses on the employed data and methodology. Thereafter, Section 5, presents the descriptive statistics and empirical findings. In addition, this section discusses the main results in more detail. Finally, Section 6 concludes.

2. Theory

As discussed in the introduction, the abolition of AD protection might generate opposite competing effects from a theoretical point of view. To gain more insight in the theoretical mechanisms at play, this section presents two theoretical models that seem to contradict each other. On one side, the model presented in the next section implies that a decrease in import tariff will result in a delay of new technology adoption by firms in the tariff reducing country, as compared to a period of protection. A the same time, the model introduced in section 2.2 elaborates on possible productivity enhancing efforts resulting from a decrease in tariffs, due to an increased threat of entry by foreign competitors. Therefore, the abolition of AD might also lead to enhanced efforts by domestic firms in becoming more efficient, to "escape competition" from abroad.

2.1 Technology adoption and profits

This section presents a simple model developed by Miyagiwa and Ohno (1995), which implies that free trade delays the adoption of a new technology for firms, as compared to a temporary period of tariff protection[4]. Throughout the model it is assumed that imposition of import tariffs in the home market increases the profit of domestic firms, and alters the benefit of marginal cost reductions arising from adopting a new technology. Miyagiwa and Ohno (1995) imply that the firms protected by a temporary increase in tariff barriers have an incentive to restructure as they are lagging behind in the international technology frontier, and lower their marginal costs earlier during an AD protection period as compared to free trade.

Miyagiwa and Ohno (1995) elaborate on a two-country model, with a home and a foreign firm. Throughout each period in t with $t \in (0, +\infty)$, both firms are competing in the home market for output. It is assumed that earlier on a new technology became available, which reduces costs in q. By $t = 0$ the foreign firm adopted the new technology. Henceforth, the marginal costs of production of the foreign firm is defined as $c_{(\underline{\theta})}$. The home firm is lagging behind in efficiency, since it did not adopt the new cost reducing technology, and produces at higher marginal costs $c_{(\overline{\theta})}$(i.e. $c_{(\overline{\theta})} > c_{(\underline{\theta})}$). The home firm can adopt the new technology at the cost of $k(t)$, which denotes the one-time fixed cost to upgrade the

[4] It is assumed that the protection is temporary with an exogenous termination date, in line with EU anti-dumping protection, which lasts for 5 years under the "Sunset Clause".

technology and efficiency standards to the level of the foreign company at time $t = t^*$. However, due to the assumption that $k(t)$ falls over time at a declining rate as a result of ongoing research, the home firm compares the gains in efficiency to the expense of adopting the new technology in each period. Thus, a trade-off arises, and the home firm decides on the adoption date according to the benefits of an early adoption against the higher one-time fixed cost $k(t)$ of adopting early. Miyagiwa and Ohno (1995) assume that profits are lower during free trade as compared to a period of temporary protection. Therefore, the benefits of early adoption might be lower during free trade, and the timing of adoption might change as compared to a period of temporary protection period. Hereafter the model of Miyagiwa and Ohno (1995) is discussed in more detail.

In what follows, it is assumed that the demand for both the domestic and foreign firm in the domestic market is given by:

$$P^i = 1 - q^i - bq^i \text{ with } i, j = H, F \text{ and } i \neq j \tag{1}$$

Where the market size is normalized to 1, b denotes the product differentiation between both firms and $0 < b \leq 1$. Additionally, it is assumed that marginal costs of production is lower than the market size (i.e $1 > c_{(\overline{\theta})} > c_{(\underline{\theta})}$).

Under free trade (FT), the home firm's profits before the new technology is adopted are denoted by:

$$\prod{}^{H}{}_{FT(\overline{\theta})} = (\, P^H - \, c_{\overline{\theta}})\, q^H \tag{2}$$

After adoption of new the new technology, home firm's profits are equal to:

$$\prod{}^{H}{}_{FT(\underline{\theta})} = (\, P^H - \, c_{\underline{\theta}})\, q^H \tag{3}$$

While profits of the foreign firm during free trade (FT) are given by:

$$\prod{}^{F}{}_{FT(\underline{\theta})} = (\, P^F - \, c_{\underline{\theta}})\, q^F \tag{4}$$

For simplification purposes, it is assumed that the marginal costs of production under the new technology is equal to zero (i.e. $c_{\underline{\theta}} = 0$). Thus, the marginal costs under the old technology is $c_{\overline{\theta}} > 0$. Moreover, it is assumed that lower marginal costs of production will result in lower equilibrium prices by the foreign firm as compared to the home firm, which enables the home firm to initiate an AD complaint against the foreign firm at the home firm's government. When an AD duty is imposed by the home firm's government, the profits of the foreign firm become:

$$\prod{}^{F}{}_{FT(\underline{\theta})} = (\,P^F - \tau)\, q^F \tag{5}$$

2.1.1 Free trade

The home firm and the foreign firm play a Cournot game, at any point in time before the adoption of the new technology by the home firm (i.e. $t < t^*$). The outcome of this quantity-setting game under free trade[5] is characterized by the result of the below presented problem.

$$\max_{q^H}\ \prod{}^{H}{}_{FT(\overline{\theta})} = (\,P^H - \ c_{\overline{\theta}})\, q^H \tag{6}$$

$$\max_{q^F}\ \prod{}^{F}{}_{FT(\underline{\theta})} = \ P^F q^F \tag{7}$$

At $t < t^*$, equilibrium profits are:

$$\prod{}^{H}{}_{FT(\overline{\theta})} = \frac{(2-b-2c)^2}{(4-b^2)^2} \tag{8}$$

$$\prod{}^{F}{}_{FT(\underline{\theta})} = \frac{(2-b+bc)^2}{(4-b^2)^2} \tag{9}$$

[5] Free trade refers to an absence of Anti-dumping import tariffs.

When both firms adopted the new technology (i.e. $t > t^*$), the characterization of the equilibrium is symmetric as the new technology is adopted by both firms. In this case profits are equal to:

$$\prod^{H}{}_{FT(\underline{\theta})} = \prod^{F}{}_{FT(\underline{\theta})} = \frac{(2-b)^2}{(4-b^2)^2} \tag{10}$$

It should be noted that profits for the home firm after adoption of the new technology are higher, as compared to profits under the old technology (i.e. $\prod^{H}{}_{FT(\underline{\theta})} > \prod^{H}{}_{FT(\overline{\theta})}$). This induces an incentive for home firm to adopt the new technology. By maximizing the below presented inter-temporal profit function, the home firm decides on the optimal adoption date $t^*$of the new technology under free trade.

$$\max_{t^*} \Psi = \int_0^{t^*} e^{-rt} \prod^{H}{}_{FT(\overline{\theta})} dt + \int_{t^*}^{+\infty} e^{-rt} \prod^{H}{}_{FT(\underline{\theta})} dt - e^{-rt^*} k(t^*) \tag{11}$$

Where r represents the interest rate. The first integral denotes the present discounted sum of profits before the adoption of new technology and the second integral denotes the discounted sum of profits after the new technology adoption. Whereas, the present discounted adoption cost value is denoted by the last term of the equation. In what follows, the equilibrium condition which gives a solution to $t^*$is presented.

$$rk(t) - k'(t) = \prod^{H}{}_{FT(\underline{\theta})} - \prod^{H}{}_{FT(\overline{\theta})} \tag{12}$$

The expression shows that the home firm equates the marginal benefit and the marginal cost of technology adoption at the optimal timing. By postponing the technology adoption, the home firm benefits of a decrease in the technology adoption cost by $[k'(t)]$, and saves $[rk(t)]$ as interest. However, not postponing the technology adoption raises the firm's momentary profit by ($\prod^{H}{}_{FT(\underline{\theta})} - \prod^{H}{}_{FT(\overline{\theta})}$).

2.1.2 Protection

This section discusses the implementation of a temporary protection with an exogenous ending date, implemented by the government of the home firm. This resembles the characteristics of an AD protection. During a period of AD protection, the home firm government installs a tariff on imported products from alleged dumping countries for an exogenous fixed period.

The following equations are centered on the profit of the home firm. Throughout the equations it is assumed that the period of protection extends the technology adoption date under free trade (i.e. $T > t^*$). The profits of the home firm before the new technology is adopted are given by:

$$\prod{}^{H}{}_{D(\bar{\theta})} = \frac{(2-b-2c+b\tau)^2}{(4-b^2)^2} \tag{13}$$

Where τ denotes the import duty imposed by the home firm's government. After the new technology is adopted, the profits of the home firm during protection are:

$$\prod{}^{H}{}_{D(\bar{\theta})} = \frac{(2-b+b\tau)^2}{(4-b^2)^2} \tag{14}$$

The optimal technology adoption date t_τ under temporary protection can then be derived from maximizing the inter-temporal profit of the protected home firm presented in equation (15).

$$\max_{t^\tau} \Psi = \int_0^{t_\tau} e^{-rt} \prod{}^{H}{}_{D(\bar{\theta})}\, dt + \int_{t_\tau}^{T} e^{-rt} \prod{}^{H}{}_{D(\underline{\theta})}\, dt + \int_{T}^{+\infty} e^{-rt} \prod{}^{H}{}_{D(\underline{\theta})}\, dt - e^{-rt_\tau} k\,(t_\tau) \tag{15}$$

The optimal cost reducing investment date, derived by the first-order condition, satisfies:

$$rk(t) - k'(t) = \prod{}^{H}{}_{D(\underline{\theta})} - \prod{}^{H}{}_{D(\bar{\theta})} \tag{16}$$

2.1.3 Free trade vs protection

The theoretical model developed by Miyagiwa and Ohno (1995) implies that temporary import duty speeds up the adoption date of a cost reducing technology compared to free trade ($t_\tau < t^*$). In other words, free trade delays the timing of new technology adoption compared to protection. While the cost of adoption remains the same under protection as compared to free trade, the benefit of adoption is higher under protection. Hence, an import tariff enhances the early adoption of a cost reducing technology.

$$\Pi^{H}{}_{D(\underline{\theta})} - \Pi^{H}{}_{D(\overline{\theta})} > \Pi^{H}{}_{FT(\underline{\theta})} - \Pi^{H}{}_{FT(\overline{\theta})} \tag{17}$$

In addition, it can be shown that the derivative of the marginal adoption benefit under protection is an increasing function of the imposed import tariff, which implies that the an increasing (decreasing) tariff speeds up (delays) the technology adoption.

$$\frac{\partial(\Pi^{H}{}_{D(\underline{\theta})} - \Pi^{H}{}_{D(\overline{\theta})})}{\partial\tau} = \frac{4bc}{(4-b^2)^2} > 0 \tag{18}$$

2.2 Innovation and the threat of entry

While the model presented in the previous section implies that a decrease in import tariff will result in a delay of new technology adoption by firms in the tariff reducing country, as compared to a period of protection. The model introduced in this section elaborates on productivity enhancing efforts resulting from a decrease in tariffs, due to an increased threat of entry by foreign competitors. When this outcome is transposed to the case of AD protection it suggests that, in contrast to Miyagiwa and Ohno (1995), the abolition of an AD case might lead to an increase in productivity.

Building on extensive work of Aghion et al. (2004; 2005), Iacovone (2009) has developed a theoretical model, based on Neo-Schumpeterian growth models allowing for both positive and negative effects of abolishing import tariff to interplay and coexist. The model explicitly incorporates a distinction between an advanced firm and a more backward firm. The model implies that the optimal innovation effort for both the advanced and backward firm will increase after a reduction in tariff. In contrast with Aghion and Griffith (2005), Iacovone (2009) relaxes the assumption that increased competition has an invariably negative impact on laggard firms, which allows these firms to be able to come closer to the technological frontier, even though their backward position in the productivity distribution declines the likelihood of this occurrence. This model is in line with Aghion et al. (2004) at the industry level, because it also predicts that advanced firms have a greater incentive to innovate as compared to more backward firms. The following subsections discuss the content of the model developed by Iacovone (2009).

2.2.1 Domestic production

A final good y is produced by a competitive sector in each period t using a continuum of intermediate goods $v \in [1,0]$, corresponding to the technology:

$$y_t = \frac{1}{\alpha}\int_0^1 A_t^{1-\alpha}(v)x_t^{\alpha}(v)dv \tag{18}$$

where, $x_t(v)$ denotes the employed quantity of the intermediate input v at time t and $A_t(v)$ represents a productivity parameter that captures the quality of the intermediate input v in producing y , α is a parameter $\alpha \in (0,1)$. It is assumed that the final good can only be used for three purposes, which are: consumption, producing intermediate inputs, investing in innovation.

Iacovone (2009) assumes that only one firm[6] (i.e. a monopolist) is active in manufacturing each intermediate good v. This firm maximizes its profits by producing each intermediate good at a constant marginal production cost equal to one in terms of the final good. However, a group of "fringe firms", that could manufacture the same input using χ unit of output, but do not operate in equilibrium, restricts the monopoly power of the only active firm. In essence, χ is a parameter which captures the intensity of competition, and $\chi > 1$. In what follows, equation (19) describes the maximum intermediate good price $p_t(v)$ that the active firm can charge in terms of the output.

$$p_t(v) = \chi \tag{19}$$

The perfectly competitive setting of the final good producing industry, requires an intermediate good price to equal its marginal product

[6] According to Iacovone (2009) this assumption can be altered. For example, it can be transposed to a situation of two manufacturers competing under Bertrand competition.

$$MP_t(v) = \frac{dy_t}{dx_t(v)} = \alpha(\frac{x_t(v)}{A_t(v)})^{\alpha-1} \quad (20)$$

Following from (19) and (20), the used quantity of the intermediate input at time t can be obtained.

$$x_t(v) = \left(\frac{\chi}{\alpha}\right)^{\frac{1}{\alpha-1}} A_t(v) \quad (21)$$

Hence, the model can be solved. The profit function is described in equation 23. As shown by Aghion and Griffith (2005), the profit function is positively correlated with the intermediate input producing firm' productivity, and inversely correlated with the competition strength.

$$\pi_t(v) = A_t(v)\delta(\chi) \quad (23)$$

Where,

$$\delta(\chi) = (\chi - 1)\frac{\chi^{\frac{1}{\alpha-1}}}{\alpha} \quad (24)$$

2.2.2 Innovation decision

In each period the technology frontier can be described by the following equation:

$$\bar{A}_t = \bar{A}_{t-1}(1 + g) \quad (25)$$

where, g denotes the exogenous growth rate. It is assumed that a firm can be classified in one type of firm characterization, depending on its state of technology:

$$\text{Firm type} = \begin{cases} \text{Advanced or type 1} & \text{if at the end of } t-1 \;\; A_{t-1} = \bar{A}_{t-1} \\ \text{Backward or type 2} & \text{if at the end of } t-1 \;\; A_{t-1} = \bar{A}_{t-2} \end{cases} \quad (26)$$

An important novel feature of Iacovone (2009) as compared to Aghion and Griffith (2005), is the possibility for both the backward firm (i.e. "laggard") and advanced firm to successfully innovate. However, there are some differences regarding the probability of catching up with the technology frontier. It is assumed that the advanced firm will catch-up with probability z, where z captures its effort in research to successfully innovate. In contrary, if the backward successfully innovates with probability z, it is only able to move "one step forward", which implies that it is not able to catch up with the technology frontier, due to its relatively underdeveloped technology state (i.e. $A_{t-1} = \bar{A}_{t-2}$). In order to catch up with the technology frontier, the backward firm needs to make an additional innovation effort to move "two steps ahead". The backward firm will accomplish a successful additional innovation with probability s. However, since it is more difficult for the backward firm to successfully move "two steps ahead" as compared to "one step ahead", it is assumed that probability s is smaller than z.

$$. \qquad s = \theta z \tag{27}$$

Where, θ is a parameter that is assumed to be varying between 1 and g. Therefore, the backward firm is able to catch-up with the technology frontier.

$$g \leq \theta \leq 1 \tag{28}$$

In line with Aghion et al. (2004), it is assumed that the innovation cost of a firm is linear in its current state of technology and quadratic in its effort in research, as described in equation 29. In addition, it should be noted that the innovation cost of the backward firm, c_{2t}, includes the extra cost of additional effort.

$$\text{Innovation Cost} = \begin{cases} c_{1t} = \frac{1}{2} z^2 A_{t-1}(v) \\ c_{2t} = \frac{1}{2} z^2 A_{t-1}(v) + \frac{1}{2} s^2 A_{t-2}(v) \end{cases} \tag{29}$$

Due to the presence of spillovers, all backward firms that do not succeed in innovating by the end of each period, automatically remain in the backward position by moving one step forward in the technology ladder. However, any firm might exit at any moment t with an exogenous probability h, where after a new advanced firm enters the market at $t + 1$.

2.2.3. Foreign competition

Foreign competitors have the possibility to enter the domestic country in every period. Each period a foreign firm decides either to enter the market or postpone market entry, after observing the innovation effort outcome of the domestic firms and the sunk cost to enter the market. Once the foreign firm has paid a sunk cost, ξ, it will be able to enter domestic market successfully with probability μ[7].

$$\text{Entry Threat}_t = \begin{cases} 0 & \text{if domestic firm is at frontier in } t-1 \text{ and innovastes succesfully in t} \\ & \text{or is backward in } t-1 \text{ but able to reach the frontier in } t \\ \mu & \text{otherwise} \end{cases} \quad (30)$$

Iacovone (2009) assumes that foreign firms are at the technological frontier[8]. The gain of entering the domestics market will depend on the type of domestic firm the foreign firm faces in the domestic country. If the foreign firm does enter the domestic market and competes with a backward domestic firm, it will be able to take over the entire market if, otherwise, it engages in a Betrand competition with an advanced domestic firm and the profits of both foreign firm and domestic firm will drop to zero.

2.2.4. Equilibrium innovation

The solution of the backward firm's expected profit maximization problem can be obtained by solving the below presented equation:

$$\max_{z} E[\pi_{2t}] = \delta(\chi) \begin{bmatrix} z(1-\mu)\bar{A}_{t-1} + (1-z)(1-\mu)\bar{A}_{t-2} + sA_t + \\ (1-s)\bar{A}_{t-2} \quad (1-\mu) \end{bmatrix} - \frac{1}{2}(z^2 + s^2)\bar{A}_{t-2} \quad (30)$$

If the foreign firm successfully enters the domestic market with probability μ, the backward firm retains its domestic market only if it is able to catch up with the technology frontier with probability s. When the foreign firm does not enter the market with probability $1-\mu$, the

[7] μ is a proxy for barriers that the foreign firm has to overcome to enter the domestic market (i.e. import tariffs from an anti-dumping protection).

[8] In the case of Anti-dumping protection it is likely that producers from alleged dumping countries are more productive, than producers in the domestic import-competing industry.

backward firm retains its domestic market regardless of the outcome of the innovation effort. In what follows, the optimal effort of the backward firm is obtained by solving (30):

$$z_{2t}^{*}=\frac{\delta}{1+\theta^2}[g(1+2\theta+\theta g)+\mu(\theta-g)] \quad (31)$$

The advanced firm chooses its optimal innovation effort at the same time by maximizing its expected profit as described in equation 32.

$$\max_{z} E[\pi_{1t}]=\delta(\chi)[z\bar{A}_t+(1-z)(1-\mu)\bar{A}_{t-1}]-\frac{1}{2}z_t^2\bar{A}_{t-1} \quad (32)$$

The advanced firm keeps its domestic market when it is able to innovate successfully with probability z. Hence, the foreign firm does not enter the domestic market. However, if the advanced firm does not innovate successfully with probability $1-z$, it only keeps its market if the foreign firm is not able to enter the market with probability $1-\mu$. Therefore, the advanced firm's optimal innovation effort is described by:

$$z_{1t}^{*}=\delta(g+\mu) \quad (33)$$

Following from (32) and (33), the effect of reducing import barriers (i.e. increasing entry threat) can now be obtained:

$$\frac{dz_{2t}^{*}}{d\mu}=\frac{\delta}{1+\theta^2}(\theta-g) \;\; >0 \quad (34)$$

$$\frac{dz_{1t}^{*}}{d\mu}=\delta \;\; >0 \quad (35)$$

From the fact that both δ and $\frac{(\theta-g)}{1+\theta^2}$ are positive, the above two equations imply that the optimal innovation effort for both the advanced firm and backward firm will increase after a reduction in tariff. When this outcome is transposed to the case of AD protection, it suggests that the expiry of an AD case (i.e. termination of import tariff) might lead to an increase in productivity by the threat of entry of foreign competitors. In addition, Iacovone (2009) shows that $\frac{(\theta-g)}{1+\theta^2}$ is smaller than one, which implies that the impact of the abolition of AD protection is bigger for firms closer to the technology frontier, and the inequality between firms should increase as a consequence of AD tariff abolishment.

This model is in line with Aghion et al. (2004) at the industry level, because it also predicts that advanced firms have a greater incentive to innovate as compared to more backward firms. Therefore, productivity inequality within an industry should increase as foreign competition increases. However, at the firm-level, the model developed by Iacovone (2009) predicts that the average effect is positive for both advanced and backward firms, while in Aghion et al. (2004) an increase in competition always has a negative effect on the innovation effort of the backward firms.

3. Empirical literature and Hypotheses

From the previous section it can be noted that the theoretical models discussed are not aligned on the expected average effect of abolishing AD protection tariffs and address the existence of two co-existing mechanisms. Therefore, this section provides a review of related empirical literature to get an insight on evidence from previous related studies. Thereafter, the hypotheses are presented in section 3.3

3.1 Anti-dumping protection and productivity

Throughout the empirical literature there exists little work on the effects of AD protection on the productivity of domestic producers. The recent availability of firm-level data enables Konings and Vandenbussche (2008) to investigate the impact of AD protection on the productivity of European domestic manufacturers. Their novel approach allows them to identify European manufacturers operating in import-competing industries through narrowly defined industry codes. Konings and Vandenbussche (2008) find evidence of a positive impact of AD protection on the productivity of domestic firms, by comparing the productivity evolution of firms protected by AD protection before and during protection, to firms not subject to AD protection. In addition, Konings and Vandenbussche (2008) find support for a heterogeneous responses of firms to this protection policy. Their results show that the positive effect of AD protection is stronger for initial inefficient firms, while it is lower for initial efficient firms, which might even experience productivity losses. This implies that the productivity dispersion between low and high productive firms decreases, due to productivity catching-up by the initial inefficient firms.

More recent work by Konings and Vandenbussche (2009), which extends the evidence on heterogeneous responses of firms to AD protection, examines the effects of AD protection on the exports and firm-level productivity of protected firms from France. Konings and Vandenbussche (2009) find that while the productivity of non-exporters increases after AD protection, the productivity of exporters drops as a result of AD protection. In addition, they find that AD protection has a positive effect on sales for firms that only operate on the domestic market (i.e. non-exporters). However, the export sales of internationally more integrated firms (i.e. exporters and firms with foreign affiliates) are negatively affected by AD measures, and their losses are not compensated by an increase in domestic sales. According to

Konings and Vandenbussche (2009), an increase in domestic prices resulting from a fall in product variety in the domestic market, combined with a reduced ability for exporters to lower their prices in foreign markets[9], are likely to reduce exporters' ability to compete in foreign markets, which results in lower export sales. In addition, Konings and Vandenbussche (2009) argue that exporters tend to engage more in outsourcing activities than non-exporters. The imposition of AD protection might negatively affect an exporter if it outsources a share of its production to alleged dumping countries. Hence, exporters that outsource their production to a targeted country encounter higher cost of imports when they have to incur the AD duty imposed on their imports. The higher cost of inputs is likely to reduce the exporters' competiveness in foreign markets and to temper exports. Moreover, Konings and Vandenbussche (2009) emphasize the limited role of retaliatory AD duties from targeted countries in the decline of exports. Although exports to target countries decline more than exports to other non-EU countries, the economic significance seems to be low[10].

According to Konings and Vandenbussche (2009) the drop in exporters' productivity might be explained by the "learning-by-exporting-literature". This strand of literature emphasizes that exporters learn from their exporting activities. A reduction in export sales might reduce exporters' leaning effects and negatively affect their productivity (De Loecker, 2007; Van Biesebroeck, 2005).

3.2 Trade liberalization and productivity

3.2.1 Developing countries

Since there is no research on the responses of firms to abolishing AD protection, it is not possible to draw information from similar research. However, an extensive line of research has been focusing on import liberalization, which resembles the abolition of AD protection in the sense that it also lifts import restrictions. In particular, the massive trade liberalization by southern American countries and other developing countries during the past few decades, which exposed its firms to foreign competition, has attracted researchers to investigate the effects of decreased import tariffs and increased import competition on the productivity and efficiency of domestic sectors and firms.

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[9] Konings and Vandenbussche (2009) argue that: "Whenever exporters price discriminate between their home market and abroad , they run the risk of being themselves charged with dumping practices" (p. 3).

[10] In the case of Konings and Vandenbussche (2009), exports to alleged dumping countries represent only 1% of the total export value of products.

A first generation of studies obtained mixed results on the effect of liberalization of productivity, by using various measures of productivity (Tybout et al., 1991, Tybout and Westbrook, 1995, Harrison, 1994, Krishna and Mitra, 1998). By investigating the effect of the dramatic Chilean trade liberalization of the 1970s on the domestic manufacturing industry, Tybout et al. (1991) find little support for overall intra-firm improvements in productivity after the liberalization. In addition, they find that sectors subject to relatively large tariff reductions (i.e. less protection), exhibit relatively large gains. Using plant-level data, Harrison (1994) finds a positive effect of the Cote D'ivoirian trade reform during the mid 1980s on productivity growth. However, she also finds evidence of decreased mark-ups among firms, forced by the entry of foreign competitors on the domestic market. Krishna and Mitra (1998) find more weak support for productivity improvements arising from an unilateral trade liberalization in India. It arises from these studies that the various measures of productivity and market openness are crucial in addressing the observed mixed results (Dovis and Milgram-Baleix, 2009).

3.2.1.2 Endogeneity bias

More recent studies on developing countries (Pavcnik, 2002, Muendler 2004) have attempted to overcome discrepancies on measuring productivity, by correcting their measures for a possible endogeneity bias. The total factor productivity (TFP) estimation methods of both Olley and Pakes (1996) and Levinsohn Petrin (2003) adjust for this simultaneity bias. In addition, these studies also apply more accurate indicators of market openness by using narrowly defined import tariffs or import penetration ratios.

In the case of Chile, Pavcnik (2002) empirically investigates the effects increasing competition from abroad on plant productivity. Chile abandoned its inward-looking development strategy by a massive trade liberalization in the 1970s. Hence, decreased import tariffs significantly exposed Chilean import-competing plants to foreign competition. Pavcnik (2002) finds evidence of within-plant improvements in productivity that can be assigned to the trade liberalization regime. As compared to firms in the nontraded-goods sector, the productivity of manufacturers of import-competing goods increased on average with 3 to 10%. Pavcnik (2002) argues that the intensified foreign competition forced import-competing firms to trim their fat. Moreover, Pavcnik (2002) finds evidence of aggregated productivity improvements emerging from allocated output and resources from less efficient firms to more efficient firms.

Similar results are obtained by Muendler (2004), after using the trade liberalization of Brazil between 1990 and 1993, to examine the trade effect on productivity. During this trade liberalization, tariffs and non-tariff barriers for imports were significantly dropped, but the tariffs on exports were kept largely unchanged. In order to investigate how the trade reform may affect the productivity of domestic manufacturers, Muendler (2004) identifies three primary "channels":

- (1) *Availability of World-market Inputs*: Both foreign high-quality intermediate goods and equipment might engage domestic manufactures in adopting new means of production.

- (2) *Foreign Competitive Pressure*: Termination of import tariffs increases foreign competition on the domestic market, which induces manufacturers to improve their efficiency.

- (3) *Induced Turnover*: Fierce foreign competition causes the least efficient manufacturer to close down, which enables the surviving incumbent manufacturer to gain in market share. However, this aggregated productivity increase can only be observed at the industry or sector level.

Meundler (2004) finds that the *Availability of World-market Inputs* is a relative unimportant channel, since its impact on productivity is very small. In addition, Meundler (2004) finds that *Foreign Competitive Pressure* is a relatively strong channel, little changes in import tariffs induce substantial changes in productivity at the firm-level. Regarding the third channel, he finds evidence that the survival probability falls with liberalization, and less efficient firm are more likely to shut down. Therefore, *Induced Turnover* has a positive influence on a sectors' productivity.

3.2.1.3 Heterogeneous responses of firms

Studies during the past decade have provided a more nuanced view on the responses of firms to trade liberalization in developing countries. Instead of assuming that the impact of trade liberalization is the same for all firms, this line of research raised evidence that firms might respond heterogeneously to such a policy (Schor, 2004; Topalova, 2004; Amiti and Konings, 2005; Fernandes, 2007; Dimova, 2008).

Research by Schor (2004) on the above discussed Brazilian trade liberalization addresses a weak effectiveness of measuring the effect of liberalization upon a representative firm. Although Schor (2004) finds support for a negative impact of nominal tariffs and tariffs on input, which implies that along with increased competition, improved access to foreign inputs also contributes to an increase in firm-level productivity after trade liberalization. She argues that this impact might differ across firms depending on their observed and unobserved characteristics. Therefore, Schor (2004) additionally examines the effect of reducing tariffs on productivity depending on a firm's relative productivity and finds that there is a clear-cut difference on the marginal effect of reducing tariffs on productivity when firms are classified by their relative productivity. She finds robust evidence on a marginal positive effect of reducing nominal tariffs and tariffs on input for less productive firms and a marginal negative effect of reducing nominal tariff for more productive firms.

Similar results are obtained by Dimova (2008), which uses the radical liberalization and macro-financial crisis in Bulgaria to examine the effects of competitive pressure and labour reallocation on productivity growth among firms in the manufacturing industry. Dimova (2008) points out that increased competition has a positive impact on productivity growth among less efficient firms in the domestic industries, due to their efforts to survive. In contrast, firms at the domestic frontier were not able to boost their productivity and leapfrog foreign competition.

Fernandes (2007) provides support for another type of firm-level heterogeneous response to trade liberalization. This study explores the Colombian trade policy during 1977-1991, to investigate the impact of import liberalization on firm-level productivity gains. Besides the strong positive effect of import liberalization on firm-level productivity of manufacturers, Fernandes (2007) also finds evidence that this positive effect is greater for larger firms. This implies that larger firms tend to gain more in productivity after import liberalization, as compared to smaller firms. According to Fernandes (2007), these productivity improvements do not stem from plant exit, but are rather driven by an increase in: (i) machinery investments at the firm level (ii) skilled labor (iii) foreign intermediate inputs.

Contrary to latter three studies, in the case of India, Topalova (2004) finds no support for a different impact of trade liberalization on productivity regarding firm characteristics such as initial productivity and size. However, this study points out that there exists a heterogeneous response between public-sector firms and privately-held firm, while privately-held firms seem to increase productivity after the trade liberalization, public-sector firms are not affected by this policy.

Amiti and Konings (2007) investigate the effects of reducing tariffs on final goods and intermediate inputs separately, using Indonesian data. A previous discussed study by Schor (2004) shows that the effects of reducing tariffs of final goods and intermediate goods on productivity are of an equivalent magnitude. However, Schor (2004) is not able to separately investigate the impact of reducing intermediate input tariffs on productivity for importing firms. Amiti and Konings (2007) show that the effect of decreasing input and output tariffs significantly enhances productivity. However, the effect of decreasing input tariffs on productivity is much larger than decreasing output tariffs. Amiti and Konings (2007) hypothesized that the effect of reducing intermediate input tariffs is larger for importing firms, due to benefits arising from foreign high-quality intermediates, or learning effects. Although Amiti and Konings (2007) find evidence that the effect of reducing input tariffs on productivity is larger for importing firms as compared to non-importing firms, they argue that it is not certain if this effect is caused by their hypothesized channels, since suitable measures are lacking.

3.2.2 Developed countries

As pointed out by Trefler (2004, p. 870-871): “While case-study evidence abounds about efficiency gains from liberalization, solid econometric evidence for industrialized countries remains scarce……what is needed is at least some research focusing on industrialized countries”. Using the Canada-U.S. Free Trade Agreement, Trefler (2004) is able to investigate the impact of a reciprocal trade agreement on Canadian firms and industries. Thus, in contrast to most studies on trade liberalization, Trefler (2004) examines the effects of *bilateral tariff cuts* on firms and industries in a *developed country*. According to Trefler (2004), the Canadian import-competing industries, which are most affected by the changes in Canadian import tariffs, experienced a significant gain in productivity. Trefler (2004) points out that these changes seem to stem from a market share reallocation from less efficient firms to more efficient firms, since the import liberalization effect is not significant at the firm-level. In addition, Trefler (2004) finds evidence of a significant positive effect of U.S. tariff cuts on Canadian export-minded firm's productivity. However, this positive effect is not significant at the industry level. Trefler (2004), argues that this might be caused by the entry of younger less efficient firm.

Bertrand et al. (2006a) investigate the effects of changes in trade costs on U.S. manufacturing plants and industries. They show that industries facing relatively large cuts in trade costs experience relatively strong productivity improvements. Bertrand et al. (2006a) find evidence that aggregate productivity improvements are likely to stem from allocated output and resources from less efficient firms to more efficient firms. They argue that declining trade costs increase the likelihood that less efficient firms shutdown and raise the likelihood that more efficient firms expand by starting to export or increase their sales to export markets. In addition they seem to find evidence of a positive relationship between trade liberalization and within firm productivity improvements in a developed country. Bertrand et al. (2006a) hypothesize that the observed productivity growth within firms may arise from incentives to invest in innovation. However, they are not able to investigate this channel. In addition Bertrand et al. (2006a) suggest that the firm itself may adjust its output mix in response to trade liberalization: "it may be that the underlying productivity of manufacturing each good is unchanged but plant-level productivity is affected by the change in output mix" (p. 19). This is in line with Bertrand et al. (2006b), who examine the role of imports from low-wage countries in the development of U.S. manufacturing plants and industries. Bertrand et al. (2006b) find that plant growth and survival are negatively correlated with the share of industry imports from low-wage countries. They provide evidence that firms facing competition from low-wage countries may change their output mix and switch to industries that are more skill and capital intensive. However, Bertrand et al. (2006b) find that firms tend to respond heterogeneously to low-wage imports, depending on their input characteristics. They provide evidence that capital-intensive firms have a lower shutdown probability, and expand more quickly, than the average firm.

De Loecker (2007) examines the effect of trade liberalization on productivity for the Belgian textile industry. This study measures trade liberalization in the Belgian textile industry by the reductions of its quota protection. At the industry level, De Loecker (2007) provides support for a significant improvement of the average productivity. However, De

Loecker (2007) argues that this increase mostly arises from the exit of less efficient firms, since the average firm-level improvements of the survived incumbent firms are small.

Similar results are obtained by Raff and Wagner (2010). This study measures the effects of eliminated quotas on productivity for the German clothing industry. In line with de Loecker (2007), results of Raff and Wagner (2010) showed a positive effect of eliminating quotas on industry productivity. While De Loecker (2007) finds evidence on little within firms improvements in the Belgian textile industry, Raff and Wagner (2010) find more robust evidence for within firm improvements of surviving incumbent firms in the short-run, although they argue that this might erode in the long-run.

Dovis and Milgram-Baleix (2009) examine the effects of import tariffs[11] and import penetration rates on firm-level productivity of manufacturers in the case of Spain. They show that tariffs have a significant negative effect on firm-level productivity and import penetration rates have a strong significant positive effect on firm-level productivity. This is comparable to the results obtained by Altomonte et al. (2008) on the effect of import penetration on productivity. Moreover, Dovis and Milgram-Baleix (2009) find evidence that the effects of tariff and import penetration are complementary. They show that in addition to an increase in competition, an increase in intermediate input diversity[12], also seems to have a positive influence on a firm's productivity. In line with previous discussed studies on developing countries, Dovis and Milgram-Baleix (2009) provide evidence of heterogeneous responses of firms to trade openness. Results of Dovis and Milgram-Baleix (2009) show that the effect of increased competition on productivity does not differ for small and large firms. Regarding tariffs, differences in the effect on productivity are more evident. Tariffs have a strong negative effect on the productivity of small firms, while this effect is not significant for large firms. Which implies that reducing tariffs would only have a positive effect on smaller firms. In addition, it can be noted that Dovis and Milgram-Baleix (2009) show that non-exporters and non-importers gain more in productivity by a reduction in tariffs than exporter and importers, respectively.

[11] During the period of analyses, tariffs applicable to Spain are imposed by the EU, and therefore are the same for all EU countries.

[12] Dovis and Milgram-Baleix (2009) argue that the diversity of foreign intermediate inputs increases due to lower import prices.

3.3 Hypotheses

It can be noted that the empirical literature and theoretical models are not aligned on the expected average effect of abolishing AD protection tariffs on within-firm productivity. On the one hand, the theoretical model on technology adoption developed by Miyagiwa and Ohno (1995), implies that a temporary AD protection increases the productivity of protected firms, which is in line with the obtained results of Konings and Vandenbussche (2008). Therefore, one might expect that the abolishment of AD protection leads to a decrease in firm-level productivity. On the other hand, the model introduced by Iacovone (2009), emphasizes the possible pro-competitive effects as a result of decreasing tariffs, due to an increased threat of entry by foreign competitors. A positive effect of reducing import tariffs on firm-level productivity is confirmed by an extensive line of empirical studies on import liberalization (Harrison, 1994; Pavcnik, 2002; Meundler, 2004; Schor, 2004; Dimova, 2008; Fernandes, 2007; Amiti and Konings, 2007; Dovis and Milgram-Baleix, 2009). In order to test if the abolishment of AD protection has a positive impact on firm-level productivity the following hypothesis is tested in the empirical analysis:

Hypothesis 1: *The abolishment of EU anti-dumping protection has a significant positive effect on the productivity of import-competing manufacturers.*

Recent empirical studies on the effect of import liberalization (Schor, 2004; Amiti and Konings, 2007; Fernandes, 2007; Dimova, 2008; Dovis and Milgram-Baleix, 2009) and AD protection (Konings and Vandenbussche, 2008; Konings and Vandenbussche, 2009) on productivity address the weak effectiveness of measuring the effect of trade policy on a representative firm, and raise evidence on a heterogeneous response of firms to trade policies. The theoretical model developed by Iacovone (2009), states that firms closer to the technology frontier have a greater incentive and ability to innovate when facing tougher competition as a results of tariff reductions as compared to technological laggards. Also, Boone (2000) argues that when firms are operating under tough product-market competition, firms at the technology frontier have stronger incentives to innovate. However, recent empirical studies on import liberalization find evidence that contradicts latter theories (Schor, 2004; Dovis and Milgram-Baleix, 2009; Dimova, 2008), by showing that reduced protection has a greater positive effect on firms at the lower end of the productivity distribution, due to their efforts to survive. The heterogeneous response on the effect of abolishing AD-tariffs on productivity considering the initial efficiency level of a firm can be captured in the following hypothesis:

Hypothesis 2a: *The effect of abolishing EU Anti-dumping protection on productivity significantly differs across manufacturers, depending on a manufacturers' initial position in the productivity distribution of the industry.*

The effect of abolishing EU AD protection might also differ for exporters compared to non-exporters, since exporters tend to be more productive and larger than non-exporters (Eaton et al., 2004; Helpman et al., 2004; Mayer and Ottaviano, 2008). A recent study by Konings and Vandenbussche (2009) provides evidence on the existence of a heterogeneous response of exporters to AD protection. In addition, Dovis and Milgram-Baleix (2009) and Amiti and Konings (2007) found evidence on a heterogeneous response of exporters to import liberalization. To investigate if the effect of abolishing AD protection on productivity differs for exporters, the below presented hypothesis is constructed:

Hypothesis 2b *The effect of abolishing EU Anti-dumping protection on productivity significantly differs across manufacturers in a protected industry, depending on a manufacturers' exporting status.*

4. Data and Methodology

This chapter will discuss the construction of data, sample selection, and the description of the group of variables used in the analysis in sections 4.2, 4.3 and 4.6 respectively. In addition, it gives an insight in AD proceedings as a guideline for interpreting the construction and sample selection. Moreover, the methodology of the research will be discussed in two steps. In section 4.4, the first step of the empirical analysis is described, which elaborates on estimating the total factor productivity using OLS and by applying the value-added version of the Levinsohn-Petrin (2003) algorithm. In sections 4.5 and 4.7 of this chapter, the second step of the empirical analyses is discussed, covering the difference-in-difference approach and the estimation methods used in this study.

4.1 EU Anti-dumping protection proceedings

If an EU Community industry initiates an AD case, the EU Commission undertakes an investigation on exporting countries that are subject to dumping accusations by the EU import-competing industry. Hence, the evolution of product level import volumes and prices of exporting producers from non-EU countries are investigated. During the investigation, the EU Commission induces a provisional finding[13] on the initiated AD case, which determines a possible imposition of provisional AD duties throughout the continuation of the investigation[14]. After completing an investigation, the EU Commission decides either to impose an AD protection to all 'injured' firms in the importing competing industry, or to reject the complaint[15]. When the EU Commission decides to reject the complaint, the AD case is terminated and the EU industry does not attain any protection. Imposition of an AD protection can take two forms, i.e. AD duty and price-undertakings. If an AD duty is enforced by the EU Commission, the imposition protects the importing competing sectors of all EU member states against imports from the dumping countries with a common duty. Henceforth, EU importers bear the expense of an AD duty on imports of dumped products from alleged countries. Alternatively, the EU importing industry is protected by price-undertakings, if an

[13] A Provisional finding has to be reached by the EU Commission within 9 months after the notice of initiation (regulation 386/94).

[14] 80% of the definitive 'protected 'AD case initiations between 1998 and 1999, received provisional protection during the AD case investigations..

[15] A definitive anti-dumping measure has to be reached by the EU Commission within 15 months after the notice of initiation (regulation 386/94).

offer by the foreign exporting producers to sell their dumped products at a minimum price is accepted by the EU Commission[16]. Hence, AD duties will not be applicable on the EU imports of their products. However, in practice a combination of AD duty and price undertakings can also be observed on individual AD cases. Usually, an AD measure is imposed for 5 sequential years, after which the AD protection measure automatically expires. However, the industry can initiate an expiry review, if the EU manufacturers indicate that dumping and injury would likely continue or reoccur when the protection comes off[17]. The initial protection measure continues during an expiry review investigation. If the expiry review determines an affirmative likelihood on reoccurrence or continuation of dumping and injury without continuation of the protection, the import competing industry acquires 5 additional years of protection[18]. The protection conditions during an additional period of protection remain at the same level as under the initial protection period, since an expiry review cannot lead to any changes in the import duty tariff.

4.2 Construction of the data

For the purpose of identifying import competing firms operating in the same sector as dumped products, data are constructed by employing two separate databases. First, unconsolidated firm-level data are retrieved from AMADEUS, a commercial database generated by Bureau van Dijk, covering a period from 2000-2008[19]. This database covers European listed and non-listed firms, and includes information on several economic and financial variables, such as material costs, employment, turnover, tangible fixed assets and NACE[20] revision 2 codes.

Second, data are obtained from the Global Antidumping Database (Bown, 2010), which covers information on AD-cases initiated in the EU and non-EU countries between 1978 and 2010 and includes variables, such as the year of initiation, the final AD measure, the HS code, and the expiry date of protection[21]. Due to the absence of 4-digit NACE revision 2

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[16] The EU Commission does not have an obligation in accepting an offer of an undertaking (regulation 386/94)
[17] In addition, an expiry review can also be initiated by the EU Commission (regulation 386/94).
[18] An expiry review decision has to be reached within 1 year after the initiation (regulation 386/94).
[19] Recent examples of academic work employing the AMADEUS database: Altomonte, Colantone and Pennings (2010), Konings and Vandenbussche (2009).
[20] NACE is a EU classification framework of economic activities. In this study the NACE revision 2 classification is used, which is introduced by the European Commission in the beginning of 2008.
[21] Harmonized Commodity Description and Coding System (HS), is a an classification system for traded products, established by the World Customs Organization.

codes in the Global Antidumping Database, the available HS 2002 codes of dumped products are transformed to 4-digit NACE revision 2 codes through correspondence tables[22].

Additionally, the AD and Anti-subsidy measures list[23] of the EU Commission is consulted to gather additional information on the expected expiry year of AD-cases with additional protection, and to check for consistency of the data obtained from the Global Antidumping Database.

4.3 Sample selection

Anticipating on the time span of the firm-level data, new initiated AD cases between 1998 and 1999 are collected. In Table 1 all new AD cases initiated by the EU import competing industries between 1998 and 1999 are reported. For each case the year of initiation, the year of protection decision, the final protection measure, the year of expiry review initiation, the year of an expiry review decision, the expiry review decision, the (expected) expiry year of protection, the corresponding 4-digit NACE revision 2 code and the dumping countries involved, is listed. Counting by product group, 30 new AD cases were initiated by the EU import competing industries, corresponding to 84 defending countries. In 18 cases the EU Commission decided to impose an AD duty, of which 12 cases also involved price undertakings. In 12 other cases, the EU Commission decided to reject the complaint and terminate the initiation, after which the industries did not attain any protection.

In order to remove ambiguities on matching protected AD-cases to firm level data, two examples of solving such encountered events are explained. In 1998 two cases of "steel stranded rope and cables" involving a different set of defending countries were initiated. Both cases resulted in protection from 1999 onwards, after which the protection would normally come off in 2004. However, in one case the industry filed an expiry review, and the EU Commission granted an additional period of import-competition protection from 2006 onwards.

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[22] The correspondence tables of the UN Statistics Division are consulted in the transformation process.

[23] The "Anti-dumping and Anti-subsidy measures list" of the EU Commission is a publically available list of active and expired anti-dumping cases.

Table 1: Initiated anti-dumping cases between 1998 and 1999

PRODUCT	INT YEAR	AD DECISION YEAR	AD DESICION	EXPIRY REVIEW INITIATION YEAR	EPIRY REVIEW DESICION YEAR	EXPIRY REVIEW DECISION	REVOKE YEAR	NACE CODE	DEFENDING COUNTRY
Polypropylene binder	1998	1999	D/U				2004	**13.94**	Poland, Czech Republic, Hungary Saudi Arabia
Steel stranded rope & cable	1998	1999	D/U	2004	2005	D/U	2010	**25.93***	South Korea, China, South Africa, India, Ukraine
stainless steel wire	1998	1999	D/U				2004	**24.34**	India, South Korea
Steel stranded rope & cable	1998	1999	D/U				2004	**25.93***	Hungary, Poland, Mexico
Polyester filament yarn	1998	1999	T						India, South Korea
Stainless steel heavy plates	1998	1999	T						South Africa, Slovenia
Seamless pipes and tubes	1998	2000	D/U	2005 [a]	2006	D/U	2011	**24.20**	Ukraine, Croatia
Iron or Non-Alloy Products Flat Rolled	1999	2000	D/U				2004 [b]	**24.10***	Bulgaria, Taiwan, India, Yugoslavia, Iran, South Africa
Yellow Phosphorous	1999	2000	T						China
Television Camera Systems and parts	1999	2000	T					**26.30**	USA
Compact Disc Boxes	1999	2000	T						China
Video Tapes on Reels	1999	1999	T						South Korea
Polyester Staple Fibre	1999	2000	D	2005	2006	T	2006	**20.60***	Indonesia, Thailand, Australia
Non-Alloy Steel Hot Rolled Flat Products	1999	2000	D/U				2005	**24.10***	India, Romania, China
Steel Wire Rod	1999	2000	T						Turkey
Malleable Cast Iron Pipe Fittings	1999	2000	D/U				2005	**24.51**	Czech Republic, South Korea, Brazil, Japan, Thailand, China, Croatia, Yugoslavia
Urea and Ammonium Nitrate in Liquid Solution	1999	2000	D/U	2005	2006	D/U	2011	**20.15***	Lithuania, Slovakia, Algeria, Belarus, Russia, Ukraine
One Dye Black	1999	2000	D				2005	**20.12**	Japan
Certain Cathode-Ray Colour Television Picture Tubes	1999	2000	D				2005	**26.11**	India, South Korea, Malaysia, China, Lithuania
Hair Brushes	1999	2000	T						Hong Kong, South Korea, Thailand, Taiwan, China
Glycine	1999	2000	T						China
Styrene-Butadiene-Styrene Thermoplastic Rubbers	1999	2000	D				2005	**20.17**	Taiwan
Certain Electronic Weighing Scales	1999	2000	D				2005	**28.29**	South Korea, Taiwan, China
Coke of Coal in Pieces [c]	1999	2000	D				2005		China
Polyester Staple Fibres	1999	2000	D	2005	2005	D	2010	**20.60***	South Korea
Ammonium Nitrate	1999	2001	D	2006	2007	D	2012	**20.15***	Poland, Lithuania, Ukraine
Bicycle Forks	1999	2000	T						Taiwan, China
Bicycle Frames	1999	2000	T						Taiwan, China
Complete Wheels of Bicycles	1999	2000	T						China
Certain Polyethylene Terephthalate	1999	2000	D/U	2005	2007	D/U	2012	**20.13**	India, Indonesia, South Korea, Malaysia, Thailand, Taiwan

Source: Bown, Chad P. (2010) "Global Antidumping Database"
Notes: * refer to overlapping cases. [a] Initiation of an interim review by the Defence Committee of the Seamless Steel Tubes Industry of the European Union, which led to the an extended period of protection. [b] AD measures were repealed in 2004 due to an interim review.
[c] Corresponding firms are not included in the sample, due to lack of observations.

This implies that all firms in the import competing “steel stranded rope and cables” sector, are protected during the entire time span of the analysis. Another form of overlap arose when two different dumped products (“Iron or Non-Alloy Products Flat Rolled” and “Non-Alloy Steel Hot Rolled Flat Products”) classified in the same 4-digit NACE code. In both cases complaints were initiated in 1999, and in both cases protection was decided upon in 2000. In one case (i.e. “Iron or Non-Alloy Products Flat Rolled”) protection ended earlier on, due to an interim review. Although the protection of this case ended in 2004, the protection of the other case (i.e. “Non-Alloy Steel Hot Rolled Flat Products”) continued until 2005, which implies that the French import-competing firms of this sector received protection from 2000 until it expired in 2005.

In what follows, firms competing in the same sector as the dumped products are identified, by the allocated 4-digit NACE revision 2 code of the AD-cases. In this study, the unconsolidated firm-level data are limited in the sample to French firms, for the reason that unlike other European firms in Amadeus, French firms also report export turnover, which is required to test for Hypothesis 2b. After correcting the initiated AD-cases for overlaps, and checking for sufficient matching company accounts, 13 different protected AD-cases are identified[24]. It is worth emphasizing that in 8 AD-cases the protection period is limited to 5 years, and in 5 AD-cases the initial protection period of 5 years is extended after an affirmative review. In total 2076 French firms competing in the same sectors as the dumped products are identified by the allocated 4-digit NACE code of the AD-cases. After dropping firm-level observations with critical missing values (e.g. employment, turnover, material costs, tangible fixed assets), in total 8292 firm-level observations are present in the sample. Table 2 provides some information on the distribution of observations along the different sectors in the sample, each corresponding to the 4-digit NACE Code of an AD-case.

[24] AD case ‘Coke of coal in pieces’ is excluded from the sample, since too little company accounts could be observed during the time span of the analysis.

Table 2: Distribution of observations across sample

NACE code	Name of sector	Obs	Percent	Cum.
1394	Manufacture of cordage, rope, twine and netting	270	3.26	3.26
2012	Manufacture of dyes and pigments	179	2.16	5.41
2013*	Manufacture of other inorganic basic chemicals	430	5.19	10.60
2015*	Manufacture of fertilisers and nitrogen compounds	565	6.81	17.41
2017	Manufacture of synthetic rubber in primary forms	59	0.71	18.13
2060*	Manufacture of man-made fibres	71	0.86	18.98
2410	Manufacture of basic iron and steel and of ferro-alloys	369	4.45	23.43
2420*	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel	423	5.10	28.53
2434	Cold drawing of wire	88	1.06	29.59
2451	Casting of iron	385	4.64	34.24
2593*	Manufacture of wire products, chain and springs	1680	20.26	54.50
2611	Manufacture of electronic components	1233	14.87	69.37
2829	Manufacture of other general-purpose machinery n.e.c.	2540	30.63	100
Total		8292	100.00	

Note: * refer to 4-digit NACE industries that received an affirmative expiry ruling, corresponding to 3169 observations.

4.4 Estimating Total Factor Productivity (TFP)

In order to proxy for productivity in the second step of the empirical analyses, total factor productivity estimates are discussed and generated in this section. TFP is estimated using the firm-level data of firms operating in the same 4-digit NACE industry as the initiated AD-cases of 1998 and 1999.

To start, it is assumed that production takes the configuration of a Cobb-Douglas function:

$$Y_{it} = A_{it} K_{it}^{\beta k} L_{it}^{\beta l} \tag{36}$$

where Y_{it} denotes value added of firm i in period t ; A_{it} is the Hicksian neutral efficiency level, K_{it} and L_{it} are inputs of capital and labour of firm i in period t respectively. βk, βl and are the output elasticities of capital and labor, respectively, which values are constants, determined by the available technology. Values of Y_{it} , K_{it} and L_{it} are observable, while A_{it} is unobservable (Van Beveren, 2010). In what follows, a linear production function of (36) can be described by taking natural logs of observable variables:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \varepsilon_{it} \tag{37}$$

where, k_{it} , l_{it} and denote the natural logarithms of capital and labor, respectively, and

$$ln(A_{it}) = \beta_0 + \varepsilon_{it} \tag{38}$$

where, β_0 refers to the mean efficiency level over time across firms, and ε_{it} refers to the producers- and time-specific deviation from that mean. Moreover, the residual term in (37) can be further decomposed into a predictable time varying productivity shock v_{it}, and an unobservable white noise component u_{it}^q. Decomposition of the error term results in the following equation:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + v_{it} + u_{it}^q \tag{39}$$

where,

$$\omega_{it} = \beta_0 + v_{it} \tag{40}$$

represents firm-level productivity[25]. In order to calculate total factor productivity of firms operating in the same 4-digit NACE industry as the initiated AD-cases of 1998 and 1999, (39) is estimated for each separate 4-digit NACE industry using OLS, where, y_{it}, denotes the log of real value added, which is the difference between deflated turnover and deflated material costs for each firm per year. Hence, reports of turnover are deflated by annual sector specific gross output price indices, and reports of material costs are deflated by annual sector specific intermediate input price indices. Reported firm-level values are deflated by 2-digit NACE specific deflators obtained from the EU-KLEMS database[26]. In equation (39), l_{it} denotes the log of labor, measured by the number of employees, and k_{it} denotes the log of real capital,

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[25] The productivity is identified by ω_{it} , under the assumption that: "ω_{it} is a state variable in the firm's decision problem, and hence a determinant of both liquidation and input demand decisions, while u_{it}^q is not" (Olley and Pakes, 1996, p.1247).

[26] The EU-KLEMS database is a collection of data on several economic measures at the industry-level for EU member states.

approximated by tangible fixed assets deflated by a capital price deflator obtained from the AMECO database[27].

Table 3 reports the summary statistics for key variables in estimating TFP. The average summary statistics of firms in abolished AD-cases and firms in extended protected AD-cases are reported in terms of value added, capital stock, employment and materials.

Table 3: Summary statistics key variables measuring TFP

AD-cases	**Obs.**	**Value added**	**Capital**	**Employment**
Abolished AD-Cases	5123	21124	7586	135
		(103881)	(52158)	(498)
Protected AD-Cases	3169	19633	8152	89
		(241397)	(120950)	(319)

Note: reported values refer to deflated data of Value added, Capital and Employment.

Estimating (39) under OLS, requires the inputs of the production function to be exogenous (i.e. chosen independently from the efficiency level of the firm). According to Marschak and Andrews (1944), production function inputs are more likely to be chosen by firm characteristics (e.g. efficiency levels), than allocated independently. In addition, Olley and Pakes (1996) noted that endogeneity of input choices arise when firms decide on input levels with prior knowledge of ω_{it}. Hence, the level of inputs are adjusted by productivity expectations. Since productivity shocks are not observable for the econometrician it is expected when estimating (39) using OLS, labor and capital coefficients are biased by the correlation between the chosen levels of input and the error term (Olley and Pakes, 1996 and Levinsohn and Petrin, 2003). Specifically, this simultaneity bias is likely to introduce an upward effect in the input coefficient for labor, due to a positive correlation with the error term (De Loecker, 2007).

In order to overcome simultaneity biased estimates of labor and capital coefficients, the value-added version of the Levinsohn and Petrin (2003) algorithm is used in this study. By applying this semi-parametric estimation procedure the unobservable productivity shock υ_{it} can be identified using intermediate inputs as a proxy. Hence, intermediate inputs are formulated as a function of productivity and capital: $m_{it} = m_t(k_{it}, \omega_{it})$. Provided

[27] The annual macro-economic (AMECO) database of the EU Commission's DG for Economics and Financial Affairs, contains macro-economic data for all EU members states, candidate countries and other OECD countries.

intermediate inputs are monotonically increasing in ω_{it}, conditional on capital k_{it}, unobserved productivity can be expressed as a function of observables by inverting the intermediate cost function: $\omega_{it} = s_t(k_{it}, m_{it})$, where $s_t(.) = m_t^{-1}(.)$. As a result the productivity shock term in (39) can be substituted by the proxy, which results in the following equation:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + s_t(k_{it}, m_{it}) + u_{it}^q \qquad (41)$$

where m_{it} denotes the value of material costs of firm i in year t, deflated by annual sector specific intermediate input price indices obtained from EU-KLEMS. In order to estimate (41), a STATA command developed by Petrin, Levinsohn and Poi (2003) (*levpet*) is employed to generate estimates of the labor and capital coefficients for each separate 4-digit NACE industry[28].

Due to technology differences across sectors, estimations of (39) and (41) resulted in different capital and labor coefficients for each sector. As expected, the labor coefficients of each 4-digit NACE industry are over-estimated using OLS compared to the LP approach.

For each firm i TFP is generated at time t as the residual of the production function using the obtained coefficient estimates of (39) and (41). Table 4 reports some descriptive statistics of the estimation methods OLS and Levinshon Petrin (2003). In addition, Table 5 reports the correlations between TFP based on OLS estimates and Levinshon Petrin estimates. More specifically, it reports a positive correlation between the TFP estimates.

Table 4: TFP descriptive statistics

Variable: ln(TFP)	Obs.	Mean	Std. Dev.	Max
OLS	8292	4.150094	0.5513055	7,664191
Lev-Pet	8292	5.073077	0.8046446	8.977866

Table 5: TFP correlations

Correlation	Lev-Pet	OLS
Lev-Pet	1	0.67
OLS	0.67	1

[28] Further details on technical aspects of the Levinsohn Petrin approach are described by Levinsohn and Petrin (2003).

4.5 Difference-in-difference approach

In this study a difference-in-difference approach is employed to evaluate the effects of abolishing AD protection on firm-level productivity as compared to a continuation of AD protection. Difference-in-difference (DD) estimation is an often applied method in policy research. According to Bertrand et al (2004), it is attractive to employ a DD approach in policy research, due to its simplicity and its capacity to bypass arising endogeneity problems when comparing heterogeneous firms. A DD approach consists of identifying a specific treatment for a 'treated' group of firms, and comparing the difference in outcome before and after the treatment to a group of firms similar to the 'treated' firms, but not subject to the treatment. Therefore, it is important to indentify a control group of firms that are comparable to the treated firms but did not get the treatment, to control for other forces that may affect the treated firms in the same period. In this study the difference-in-difference approach is used to compare the firm-level TFP of a treated group of firms before and after the abolishment of AD duty, to a control group of firms, to evaluate the effects of the abolishment of protection on firm-level productivity. The treatment group is identified by firms that received AD-protection for one period of 5 years, after which protection came off due to the abolishment (i.e. 'treatment'). The control group consists of firms not treated by an import tariff abolishment. Hence, firms in the control group received AD protection during the entire time span of the analysis. Therefore, the control group can be used as a benchmark to assess how the 'treated' group would have evolved in the absence of an import tariff abolishment. To capture the primary element of the difference-in-difference approach, the binary variable *Abolition_effect* is included in all following models.

In line with Konings and Vandenbussche (2008), all models in this study control for individual fixed effects of firms, to capture all time-invariant observable and unobservable characteristics. Moreover, *Year_dummies* are included in all DD specifications, in order to control for common fixed time effects that may affect firms in both abolished and non abolished AD cases, e.g. demand shocks, macroeconomic effects[29]. Hence, the DD models employed in this study are equivalent to Fixed Effect models with inclusion of time dummies, which can be estimated by applying a Fixed Effects estimation technique (Allison, 1994).

[29] In total T-1 year dummies are included in the specifications to avoid the dummy variable trap.

The following specifications are estimated, based on the log of TFP and the log of labor productivity as a dependent variable. In order to investigate the effect of abolishing AD protection on productivity in Hypothesis 1, the specification below is estimated:

$$\ln TFP_{it} = \alpha_i + \alpha_1 Abolition\_effect_{it} + Year\_dummies + \varepsilon_{it} \qquad (43)$$

Where $\alpha_i$controls for unmeasured fixed firm-level characteristics of firm i, and ε is the error term for firm i in period t. The main coefficient of interest on *Abolition_effect* represents the difference-in-difference estimate of the effect of abolished AD tariff on productivity. If the coefficient on *Abolition_effect* in (43) is significantly different from zero, it could be concluded that the abolition of AD protection has an effect on productivity, either positively or negatively. The former outcome would indicate that the TFP growth is relatively higher for firms in the abolished cases as compared to firms in protected cases. This means that Hypothesis 1 would be supported since firms in abolished cases restructure more than to protected cases. However, when the coefficient on *Abolition_effect* is not statistically different form zero, it could suggest that it does not matter from the point of view of TFP if the AD protection is abolished or not.

As discussed in section 2.4, it is hypothesized that the abolishment effects of AD protection on productivity differs across firms. In order to investigate if firms respond heterogeneously to the effect of AD protection, depending on a firm' efficiency level, the following specification is estimated:

$$\begin{aligned}\ln TFP_{it} &= \alpha_i + \alpha_1 Abolition\_effect_{\,it} \\ &\quad + \alpha_2 Abolition\_effect\ X\ Initial\_distance + Year\_dummies + \varepsilon_{it}\end{aligned} \qquad (44)$$

where *Initial_distance* denotes the relative efficiency level for each firm in the initial year of the sample. The value of *Initial_distance* approaches to zero as a firm is relatively less efficient, and its value approaches to 1 as a firm is relatively more efficient. The interaction effect indicates whether the productivity effect of AD abolishment for relatively efficient firms is different than for relatively inefficient "laggard" firms. If the coefficient on *Abolition_effect X Initial_distance* in equation (44) is significantly different from zero, it could be concluded that there are heterogeneous responses of firms in terms of productivity effect, which would imply that Hypothesis 2a will be supported. If the coefficient is positive it would indicate that in the abolished AD cases, the TFP growth (decline) is relatively higher (lower) for efficient producing firms than for less efficient "laggard" firms. Contrarily, a negative coefficient would indicate that the TFP growth (decline) is relatively higher (lower) for inefficient firms as compared to more efficient firms.

The final specification is comparable with (44) in the sense that it also includes a interaction term in addition to the first specification to test for heterogeneous responses. To test for Hypothesis 2b, exporter and non-exporter heterogeneity is included in (43) resulting in specification below:

$$\ln TFP_{it} = \alpha_i + \alpha_1 Abolition\_effect_{it} + \alpha_2 Abolition\_effect\ X\ Initial\_exporter + Year\_dummies + \varepsilon_{it} \qquad (45)$$

where the interaction effect indicates whether the productivity effect of AD abolishment for exporters firms is different compared to firms merely competing on the domestic market. If the coefficient on *Abolition_effect X Initial_exporter* is different from zero, it could be concluded that there is a heterogeneous response of exporters to a AD tariff abolishment in terms of productivity, which would imply that Hypothesis 2b is supported. A positive coefficient would suggest that in the abolished cases, the TFP growth (decline) is relatively higher (lower) for exporters than for non-exporters. Contrarily, a negative coefficient would suggest that the TFP growth (decline) is relatively higher (lower) for non-exporters than for exporters.

4.6 Variables

This section is intended to provide a description of the variables employed in conducting the second step of the empirical analysis. In order to provide solid ground for the results obtained, most variables have also been used in previous studies (Konings and Vandenbussche, 2008; 2009).

4.6.1 Dependent variables

As discussed, the aim of the analysis is to test for an effect of abolishing AD protection on productivity. Therefore, the dependent variable is required to be a proxy for productivity. Since two estimation methods for TFP are employed to in the first step of the empirical analysis, two separate dependent variables are generated by these estimates. First, the dependent variable *TFP_OLS* is created by the estimates of total factor productivity for firm i at time t measured by OLS. Second, the dependent variable *TFP_LevPet* is constructed by the TFP estimates for firm i at time t, generated by the value-added version of the Levinsohn Petrin (2003) algorithm.

In addition to latter discussed dependent variables based on the TFP, a simple measure of *labor_productivity* is generated as a proxy for productivity, by the ratio of real value added per worker, where real value added is the difference between deflated turnover and deflated material costs for each firm per year. Reported firm-level values are deflated by 2 digit NACE specific deflators obtained from the EU-KLEMS database. Hence, data on turnover are deflated by an annual sector specific gross output price indices, and data of material costs are deflated by annual sector specific intermediate input price indices. In order to generate the real value added per worker ratio, the calculated real value added is divided by the reported number of employees in the database. A notable advantage of testing several dependent variables separately, is the possibility for consistency checks between the proxies, which contributes to a more robust test of the hypotheses.

4.6.2 Main explanatory variables

As emphasized in section 3.3, Hypothesis 1 aims to determine whether abolishment of AD protection affects the productivity of firms operating in the EU import-competing sectors. To measure the effect of abolishing AD protection on the productivity of firms, the dummy variable *Abolition_effect* is created. This dummy variable captures the primary element of the difference-in-difference estimation discussed in section 4.5, since it measures the differential effect that the abolition policy has on the productivity of firms in the abolished AD cases compared to firms in the control group, which are not affected by the abolition policy. For the group of firms in the import-competing sectors that are affected by the abolition, the dummy variable *Abolition_effect* is equal to 1 from the year the AD protection is abolished onwards, and zero for all years prior to the abolition, i.e. years of protection. For all other firms, that are protected throughout the entire time span of the analyses due to an extended protection period, the dummy variable is zero for all years.

Additionally, it is hypothesized that the effect of the abolition of AD protection on productivity may be heterogeneous among firms. The following interaction variables are constructed to capture the heterogeneity among firms.

Recent research by Konings and Vandenbussche (2008) provides evidence that the effect of AD protection policy differs across firms. In their research they find evidence of a Distance-to-the-Frontier heterogeneous responses among firms to AD protection. To test for Distance-to-the-Frontier heterogeneous responses of firms in the analysis, the interaction dummy variable *Abolition_effect X Initial_distance* is created. The aim of the interaction term is to disentangle differences in the *Abolition_effect* on productivity between firms, by focusing on the efficiency levels at the beginning of the initial protection period. For each firm i, the *Initial_distance* is defined as the ratio of TFP [30]over the TFP of the frontier firm j in the initial year of the sample[31]. The frontier firm is identified by the highest TFP in the corresponding 4 digit NACE industry (Griffith et al. 2003; Aghion et al. 2005; Konings and Vandenbussche 2008).

$$Initial\_distance_{ijt0} = \frac{TFP_{it0}}{Max_{\ jt0}(TFP)} \qquad (46)$$

The frontier firm j has a value of 1, since it is the firm with the highest TFP in the initial year of the sample. Therefore, as the relative efficiency gap between firm i and firm j increases, the *Initial_distance* value approaches to zero. For firms subject to abolition of AD protection, the interaction variable is equal to the *Initial_distance* during the years of abolition, and zero for all other years of protection. For all other firms not subject to the abolishment of AD protection, the interaction term is zero for all years.

From previous research it can be noted that exporters tend to be more productive than non-exporters (Eaton et al., 2004; Helpman et al., 2004; Mayer and Ottaviano, 2008). This implies that there seems to be a positive correlation between TFP and exporting status. The availability of firm-level export data from AMADEUS makes it possible to test if the effect of abolishing AD protection on productivity differs for exporting firms. In order to capture the heterogeneous responses of exporting firms, the interaction term *Ábolition_effect X*

[30] This involves the total factor productivity measured by the Levinsohn Petrin (2003) approach.
[31] The initial year of the sample for firms corresponding to the AD case initiations of 1999, is the year the EU Commission decided on protection and the protection was imposed, but for firms corresponding to the AD case initiations of 1998 the initial year is one year after the protection was imposed.

Initial_exporter is constructed. For each firm, the *Initial_exporter* dummy variable is equal to 1 if the firm had export activities in the first year of the sample. The *Initial_exporter* dummy variable is zero for all other firms. Therefore, the interaction variable *Abolition_effects X Initial_exporter* is equal to 1 for initial exporters subject to the abolition effect during the abolition years, and zero for all years of protection. For all firms not subject to the abolition policy, the interaction term is zero for all years.

4.6.3. Control variables

Since common time effects may affect the productivity of both firms subject to AD protection abolishment and firms that received an additional period of protection, a set of *Year* dummy variables is created. For each year in the sample, a year dummy is constructed, which has a value equal to 1 for firm *i* in the corresponding year. The control variable *Capital_intensity* is computed to control for the effect of firm-level capital stock in the analysis when productivity is proxied by a simple measure of labor productivity (Konings and Vandenbussche, 2009). *Capital_intensity* is measured by the ratio of fixed tangible assets over firm-level employment, where firm-level fixed tangible assets are deflated by a French specific capital deflator obtained from the AMECO database.

Table 6: List of variables

Variable name	**Definition**
Dependent variables:	
TFP_OLS	Continuous variable. Total factor productivity measured by an OLS estimation.
TFP_LevPet	Continuous variable. Total factor productivity measured by employing the value-added version of the Levinsohn Petrin (2003) algorithm.
Independent variables:	
Abolition_effect	Dummy variable. Equal to 1 from the year the anti-dumping protection is abolished onwards, and zero for all years prior to abolition. Equal to zero for all other firms.
Initial_distance X abolition_effect	Continuous variable. Equal to a firm' initial distance to the frontier from the year the anti-dumping protection is abolished onwards, zero for all years prior to abolition. Equal to zero for all other firms.

Initial_exporter X abolition_effects	Dummy variable. Equal to 1 for an initial exporter from the year the anti-dumping protection is abolished onwards, and zero for all years prior to abolition. Equal to zero for all other firms.
Control variables:	
Year	Year dummy variable. Equal to 1 if the year is equal to the particular year the dummy controls for, 0 otherwise.
Capital_intensity	Continuous variable. Measured by ratio of fixed tangible assets over firm-level employment

4.7 Estimation method

In line with Konings and Vandenbussche (2008) all DD specifications are estimated by employing a Fixed Effect estimation technique. As discussed in section 4.2, the data used in the analysis consist of multiple firm-level observations over time for both firms subject to the abolition policy and firms not subject to this treatment. Firms (not) subject to abolishment are identified by the allocated 4-digit NACE revision 2 code of AD-cases that are (not) abolished. Therefore, like in most non-experimental research situations, there are possible unobserved differences between firms in the treated and control group, which are plausible to generate the perceived differences between the two groups instead of the treatment itself (Finkel, 2007). Fixed Effects estimation techniques correct for this heterogeneity by eliminating the firm-level unobservable time-invariant characteristics, which enables the difference-in-difference estimate to capture the net treatment effect. Indeed, if unobserved fixed characteristics are eliminated, then any adjustments in the dependent variable must be driven by influences other than time-invariant effects (Stock and Watson, 2003). In this study the emphasized specifications are estimated by applying the Fixed Effect/Within estimation method, with the xtreg, fe command[32] in STATA. This option automatically eliminates unobservable firm-level time-invariant characteristics by mean-differencing the data, after which the adjusted data are regressed by a Pooled OLS estimation as described below. To

[32] STATA additionally offers another technique to eliminate stable firm-level effects. The First-Differencing option eliminates the unobserved fixed effect by lagging (13) with one time period and subtracting the encountered results from (13), which yields First-Differenced data. Thereafter, this option also automatically regresses the First-Differenced data consistently by a Pooled OLS. However, in this study Fixed Effect/Within estimation method is preferred. Which is more extensively applied in panel data research, since the total over-time variation of X is used in its calculations (Finkel, 2007). In addition consistency in the First-Differencing method requires $T \to \infty$, and in the database employed in this study T =fixed and $N \to \infty$.

start, it is assumed that (47) is a standard fixed effect model, where α_i is a firm specific effect, x_{it} is a regressor of firm i over time t, and error ε_{it} is i.d.d.:

$$y_{it} = \alpha_i + x_{it}\beta + \varepsilon_{it}, \ \varepsilon_{it} \overset{idd}{\sim} N(0, \sigma^2) \tag{47}$$

This implies that taking the over time average yields the following equation:

$$\bar{y}_i = \alpha_i + \bar{x}_i\beta + \bar{\varepsilon}_{it} \tag{48}$$

Where bars indicate the within group average over T observations. By subtracting this average from y_{it} in (47), the difference from the mean is obtained for firm i in period t:

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + (\varepsilon_{it} - \bar{\varepsilon}_i), \quad i = 1, \ldots\ldots N, \quad t = 2, \ldots\ldots, T \tag{50}$$

As can be seen, the $\alpha_i$term is “swept away” by mean-differencing the data.

$$\tilde{y}_i = \tilde{x}_{it}\beta + \tilde{\varepsilon}_{it} \tag{51}$$

Thereafter, $\tilde{y}_i$ can be consistently regressed on $\tilde{x}_{it}$ with a Pooled OLS estimation, assuming there is an independency between the error term and the regressor for every time period, i.e.$Cov(\tilde{\varepsilon}_i, \tilde{x}_{it})$ = 0, and an absence of serial correlation and heteroskedasticity in the error term. Bertrand et al. (2004) argue that the presence of serial correlation in panel data lead to over rejection of the null hypothesis when estimating difference-in-difference models. To allow for possible serial correlation and heteroskedasticity in the error term, all models are computed with robust standard errors clustered at the firm-level by using the vce(cluster id) command in STATA (Cameron and Trivedi, 2009).

5 Results and discussion

To begin with, the descriptive statistics will give an insight in the main features of the data and subgroups in 4.1. Thereafter, this chapter provides the results of the analysis and discusses the outcomes per hypothesis in more detail in sections 4.2 and 4.3, respectively.

5.1 Descriptive statistics

Table 7 provides some understanding on the difference between the TFP of firms in abolished AD cases and in the control group within the pre- and post-treatment period. As can be seen, firms in the treatment group have a higher average TFP in both pre and post treatment period, compared to firms that are protected during the entire time span of the analysis. Hence, firms in the extended protected AD-cases do not seem to catch up with the treated firms during the additional period of protection. Additionally, a higher growth between periods is observed for firms in the treatment group. This seems to suggest the presence of a difference in productivity growth between firms in abolished AD cases and firms in the control group, predicted by theory and Hypothesis 1. However, it should be noted that these features are merely indicative and cannot be regarded as robust results.

Table 7: TFP of abolished and protected firms pre- and-post treatment period.

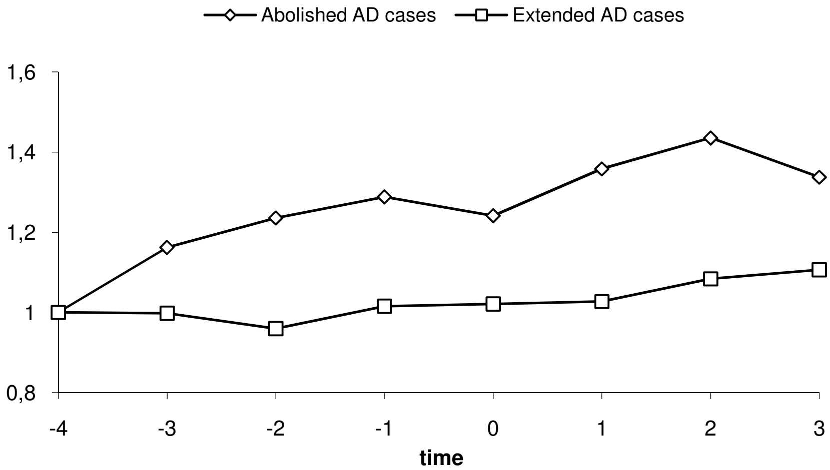
ln(TFP)	**Before treatment**	**After treatment**
Abolished Firms		
Mean	4.99	5.10
Median	4.87	5.02
Standard Deviation	0.76	0.80
Min	2.78	2.23
Max	7.93	8.30
Protected Firms		
Mean	4.92	5.01
Median	4.98	5.10
Min	0.91	1.12
Max	8.70	7.59
Standard Deviation	0.79	0.81

Note: ln(TFP) refers to the average firm-level TFP_LevPet obtained from estimating equation (42).

To present ancillary information regarding the TFP for firms in both treatment and control group, the evolution of TFP is portrayed in Figure 1. Konings and Vandenbussche

(2008) noted that firms in the extended cases seem to participate less in restructuring during the initial period of protection than firms not subject to an additional period of protection. This is confirmed when observing Figure 1, the TFP of firms in extended cases increases to a lesser extent during the pre-treatment period, compared to the TFP growth of firms in abolished cases during the same period. Overmore, it can be observed that the TFP of firms in the abolised AD cases on avarage increase more during the period of abolition as compared to firms in extended cases during an additional period of protection.

Figure 1: Evolution of index TFP change for Abolished and Extended AD cases



Note: TFP refers to the exponential TFP_LevPet obtained from estimating equation (42). Index TFP change is calculated by dividing the average exponential of ln(TFP) at time t divided by the average exponential of ln(TFP) at time -4. Time value 0 refers to the year the AD cases are abolished. Moreover, it refers to the first year the extended AD cases received additional protection.

Table 8 provides information on the heterogeneity within the group of firms subject to the abolition of AD tariff. It is reported that 69 percent of the firms in abolished AD cases are an initial exporter in the first year of the sample, which is rather high[33].

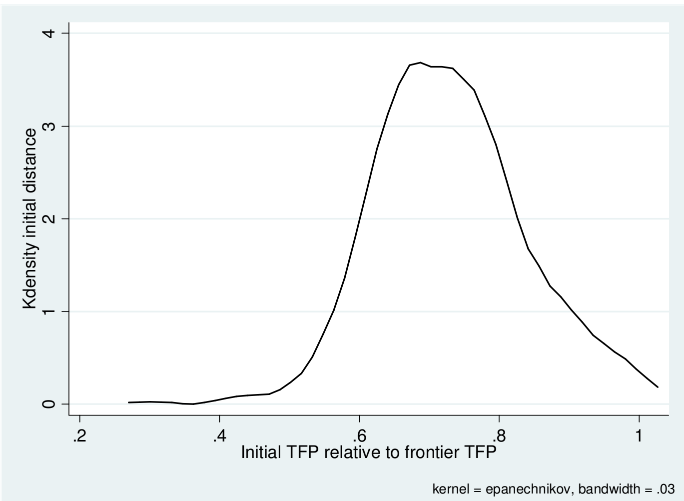
[33] In the sample of Vandenbussche and Konings (2009) the share of exporters is 33% after dealing with missing values.

Table 8: Heterogeneity firms in abolished AD cases

Abolished Firms	**Initial exporter**	**Initial distance**
Mean	0.69	0.73
Median	1	0.72
Min	0	0.30
Max	1	1
Standard Deviation	0.46	0.11

Before dealing with missing variables as discussed in section 4.2 the share of exporters is 34 percent, thereafter the share of exporter rises to 63 percent. This implies that especially non-exportering firms are lacking in providing their annual data, and the share of exporters is higher in the treatment group than control group. Moreover, features of the initial distance to the frontier firm are presented in Table 8. As can be seen, the median firm is more than two third as efficient as the frontier firm in the same manufacturing sector, in terms of productivity in the initial year of the sample. This suggests that the efficiency levels between the median firm and the most efficient firms in the abolished sectors do not differ that greatly (i.e. a small technology gap). This is also visible in the Kernel density graph, portrayed in Figure 2.

Figure 2: Kernal density initial distance to the frontier firm of abolished AD cases



Note: the initial distance is defined as the ratio of total factor productivity of firm i over the total factor productivity of frontier firm j in the initial year of the sample. The frontier firm is identified by the highest TFP in the corresponding 4-digit NACE industry. On the horizontal axis, a distance approaching to 1 denotes a relatively efficient firm while a value approaching to 0 refers to an inefficient firm.

5.2 Regression results

In what follows, an overview of the estimated output of the difference-in-difference regressions is presented. The results are introduced in order of the discussed hypotheses. First, the specification in equation (44) is estimated in order to test for Hypothesis 1. The results are provided in Table 9. It can be observed that approximately a similar coefficient on *Abolition_effect* is estimated by employing three different proxies of productivity as a dependent variable. The coefficient on *Abolition_effect* is positive, and significant at the 5 % level in all columns. Considering Hypothesis 1, there is sufficient evidence to support that firms in the abolished AD cases gain in productivity when the protection expires after 5 years, relatively to firms in extended AD protected cases. Following from column (3), it can be noted that the abolition of AD cases resulted in a significant increase in productivity of 4.1% on average across firms in the import competing sectors subject to the abolition of AD protection.

Table 9: AD abolition effect

Dependent variable	**Labor Productivity**	**TFP_Ols**	**TFP_LevPet**
	(1)	**(2)**	**(3)**
Abolition_effect	0.041**	0.043**	0.041**
	(0.017)	(0.017)	(0.017)
Capital intensity	0.122***		
	(.0140)		
Year dummies	yes	yes	yes
Fixed firm effects	yes	yes	yes
No. Observations	8292	8292	8292
Overall R^2	0.19	0.03	0.004

Notes: (i) Estimation output obtained by xtreg, fe in STATA (ii) All dependent variables are in logs (iii) ***/**/* represent significance levels at the 1%,5%,10%, respectively (iiii) Heteroskedastic standard errors between brackets are clustered at the firm level, obtained by the vce(cluster id) option in STATA

Consulting Table 10, which shows the outcome of testing the specification in equation (45), a significant negative relation between the effect of the abolition of AD protection and the initial distance to the frontier firm can be found in all columns. Although, columns (1) and (2) address a negative relation only at the 10% significance level. In addition, it can be observed that the coefficients on abolition effect remain positive and significant in all columns. Regarding Hypothesis 2b, it can be concluded there seems to be sufficient evidence to support a heterogeneous response on the effect of abolishing AD tariffs on productivity, considering the initial efficiency level of a firm. The negative interaction effect implies that the productivity of an initial less efficient firm increases as compared to the productivity of an initial more efficient firm in the same sector, when the protection comes off. The overall impact of abolishing AD cases on productivity depends on the coefficient on *Abolition_effect*, and should therefore be calculated by the sum of the coefficient of *Abolition_effect* plus the coefficient of the interaction term. Complying this with coefficients from column (3), entails a significant positive effect of abolition on productivity for the mean distance firm of approximately 1.7 % (0.10-(0.115x0.72). However, the abolition of AD-tariffs affects the most efficient firms in the industry negatively. More precisely, firms with an initial distance to the frontier of 0.87 onwards are negatively affected by the abolition policy.

Table 10: AD abolition effect and initial distance to the frontier

Dependent variable	**Labor Productivity**	**TFP_Ols**	**TFP_LevPet**
	(1)	**(2)**	**(3)**
Abolition_effect	0.076***	0.080***	0.100***
	(0.027)	(.0268)	(0.026)
Abolition_effect x	-0.066*	-0.072*	-0.115***
Initial_distance	(0.038)	(0.038)	(0.037)
Capital intensity	0.122***		
	(0.014)		
Year dummies	yes	yes	yes
Fixed firm effects	yes	yes	yes
No. Observations	8292	8292	8292
Overall R^2	0.19	0.03	0.001

Notes: as in table 9

With regard to Hypothesis 2b, the specification in equation (46) assesses whether there is a heterogeneous response of exporters to the effect of abolishing AD tariffs on productivity. Table 11 seems to confirm a hypothesized heterogeneous response of exporters to this trade policy for three different proxies of productivity as a dependent variable, which implies that there is sufficient evidence to support Hypothesis 2b. As can be seen, the coefficient on the interaction term is significantly negative in all columns. Moreover, it can be observed in column (3) that non-exporting firms experience an average productivity growth of 7.1% when the protection comes off, and initial exporters an average growth of 1%.

Table 11: AD abolition effect and initial exporters

Dependent variable	Labor Productivity	TFP_Ols	TFP_LevPet
	(1)	(2)	(3)
Abolition_effect	0.062***	0.067***	0.071***
	(0.0212)	(0.0212)	(0.0208)
Abolition_effect x Initial_exporter	-0.043*	-0.048**	-0.061***
	(0.0245)	(0.0243)	(0.0240)
Capital intensity	0.122***		
	(0.0140)		
Year dummies	yes	yes	yes
Fixed firm effects	yes	yes	yes
No. Observations	8292	8292	8292
Overall R^2	0.19	0.03	0.002

Notes: as in table 9

In addition to previous outcomes, it can be noted from unreported results on incorporating *Abolition_effect* and both interaction terms *Abolition_effect X Initial_distance* and *Abolition_effect X Initial_exporter* in a regression, that the sign of the coefficient on *Abolition_effect* is positive, and the signs on the interaction terms are negative, in line with previous results[34]. However, the coefficient on *Abolition_effect X Initial_exporter* is not significant, which is contrary to outcomes in Table 10. This might imply that part of the heterogeneous responses of exporters is captured by the relative efficiency of a firm. This seems to be confirmed by findings in empirical literature arguing that the productivity of exporters is generally higher as compared to non-exporters (Bernard and Jensen, 1995, Clerides et al., 1998; Baldwin and Gu, 2003).

Although it is not hypothesized, the dimension of firm size heterogeneity is well worth mentioning. By including the interaction term *Abolition_effect X LN_Firm_size* in equation (44), the relation of initial firm size to the effect of abolishing AD protection is estimated[35]. Unreported outcomes of this regression show that firm size is negatively related to the effect of abolishing AD-protection on productivity. This implies that TFP growth of initial smaller firms seems to be relatively higher than for larger firms, when the protection comes off. As larger firms are often more efficient (Tybout, 2003) and initial efficiency seems to be a negatively related to effect of abolishing AD protection on productivity, this outcome is consistent with already presented results.

[34] The regression is estimated with TFP_LevPet as a dependent variable.

[35] LN_Firm_size is measured by the log of the number of employees in the initial year of the sample. The regression is estimated with TFP_LevPet as a dependent variable.

As a robustness check, the *Abolition_effect* dummy and heterogeneity interaction terms are interacted with dummies that represent each year after the AD protection is terminated onwards, to provide some information on whether the *Abolition_effect* on TFP changes over time, and how this relates to the heterogeneous responses of firms. Since the abolition year of AD protection differs across AD cases, the after abolition year dummies are configured for each AD case separately. This implies that in the case of *Polypropylene binder*, the after 1 year dummy is equal to 1 in 2004 and zero for all other years, and the after 2 years dummy is equal to 1 in 2005 and zero for all other years. Since the AD protection of firms corresponding to *Malleable Cast Iron Pipe Fittings* abolished in another year, the after 1 year dummy for latter AD case is equal to 1 in 2005, and zero for all other years. For all AD cases with an extended protection period, all after abolition year dummies are zero. Table 12 presents the outcomes of the regression estimates. In column (1), the coefficients on the interaction of *Abolition_effect* and after abolition year dummies are reported. Additionally, column (2) presents outcomes of including the interaction between the after abolition year dummies with *Abolition_effect x Initial_exporter.* Finally, column (3) portrays the results on incorporating the interaction between the after abolition year dummies with *Abolition_effect x Initial_distance.*

From the estimated coefficients in column (1) it can be noted that there is an increase in productivity throughout the first 4 years of AD tariff abolition. Although, the coefficient is not significant in the fourth year. Moreover, the abolition effect increases per consecutive year in the first three years. As can be seen in column (2), the coefficient signs on *Abolition_effect and Abolition_effect x Initial_exporter* are positive and negative, respectively, throughout all four consecutive years after the abolition of AD protection. Although, it should be noted that the coefficient on *Abolition_effect x Initial_exporter* is not significant after 3 years. This implies that the productivity growth of non-exporters is significantly higher for all other years as compared to exporters, which is consistent with the results in Table 11. Following from column (3), which includes the result of interacting after abolition year dummies with the interaction term *Abolition_effect X Initial_distance,* a significantly negative relation between the *Abolition_ effect* and the initial efficiency level can be observed in all post abolition years, in line with the presented estimates in Table 10.

Table 12: Robustness check year-by-year

Dependent variable	**TFP_LevPet**	**TFP_LevPet**	**TFP_LevPet**
	(1)	(2)	(3)
Abolition_effec t after 1 year	0.031* (0.017)	0.054*** (0.020)	0.077*** (0.026)
Abolition_effect x Initial_exporter after 1 year		-0.046* (0.026)	
Abolition_effect x Initial_distance x after 1 year			-0.087** (0.038)
Abolition_effect after 2 years	0.042** (0.021)	0.068*** (0.026)	0.095*** (0.038)
Abolition_effect x Initial_exporter after 2 years		-0.053* (0.031)	
Abolition_effect x Initial_distance after 2 years			-0.102** (0.046)
Abolition_effect after 3 years	0.060** (0.023)	0.086*** (0.028)	0.117*** (0.033)
Abolition_effect x Initial exporter after 3years		-0.050 (0.032)	
Abolition_effect x Initial_distance after 3 years			-0.111** (0.047)
Abolition_effect after 4 years	0.035 (0.026)	0.075** (0.030)	0.115** (0.034)
Abolition_effect x Initial exporter after 4 years		-0.093*** (0.036)	
AD_abolition x Initial_distance after 4 years			-0.171*** (0.049)
Year dummies	yes	yes	yes
Firm fixed effects	yes	yes	yes
No. Observations	8292	8292	8292
Overall R^2	0.01	0.001	0.002

Notes: as in table 9

5.3 Discussion

5.3.1 Hypothesis 1

As expected, the abolition of AD protection has a positive effect on within-firm productivity, as firms in the abolished AD cases gain in productivity when the protection expires after 5 years, relatively to firms in extended AD protected cases. The obtained results might be explained by an increase in foreign competitive pressure (Muendler, 2004), as it is likely that firms in the abolished AD cases faced an increase in foreign competitive pressure as a result of eliminated AD tariffs, unlike firms in the extended protected cases. The intensified competition from abroad might force import-competing firms to become more efficient and trim their fat (Pavcnek, 2002). This is in line with the basic intuition of the X-efficiency literature, implying that an exogenous increase in product market competition pushes firms to terminate their X-inefficiency or organisational slack (Liebenstein, 1966).

This outcome is consistent with the theoretical model of Iacovone (2009), which predicts that the threat of entry by foreign firms enhances innovation efforts by domestic firms in the import-competing industry to "escape competition". Hence, the abolition of AD tariff reduces the barriers for foreign competition to enter the domestic market (i.e. only for firms from countries that were accused of dumping), which enhances the incentives of the domestic producer to invest in efficiency improvements to retain its market. This outcome corresponds to a strand of literature on domestic liberalization (Pavcnek, 2002; Muendler, 2004; Schor, 2004; Fernandes, 2007; Amiti and Konings, 2007; Raff and Wagner, 2010; Dovis and Milgram-Baleix, 2009), which have shown that reduced import tariffs increases the within productivity of domestic firms. Fernandes (2007) hypothesized that efficiency improvements as a result of reduced import tariffs might stem from an increase in: (i) machinery investments (ii) skilled labor (iii) foreign intermediate inputs. However, this study is not able to investigate these channels.

Although Konings and Vandenbussche (2008) found that AD protection increases firm-level productivity relative to firms not protected by AD protection[36], the results of this analysis does not seem to contradict them. Hence, Konings and Vandenbussche (2008) found evidence that a temporary protection period of 5 years allow firms to restructure and increase their productivity, while the outcome of this study seems to suggest that the abolition of AD

[36] Without regarding the heterogeneous response of firms, Konings and Vandenbussche (2008) found an on average positive effect of AD protection on within firm productivity.

protection has a positive effect on the productivity of firms that received a temporary protection, as compared to firms that received protection for an additional period. Where the latter are not likely to face an increase in competitive pressure, as a results of continuing AD tariffs.

5.3.2. Hypothesis 2*a*

From the empirical results described in Table 12, it can be concluded that firms respond heterogeneously to the abolition of AD protection depending on their initial distance to the productivity frontier. The results imply that the abolition of AD protection has a greater positive effect on the productivity of more inefficient firms, as compared to more efficient firms. This result is in line with recent findings on the effect of domestic liberalization on productivity by Schor (2004), Dimova (2008), Dovis and Milgram-Baleix (2009), on Brazil, Bulgaria and Spain, respectively. Moreover, the results imply that inefficient firms are catching up with the domestic technology frontier and the productivity dispersion between firms decreases. This could be explained by the increased shutdown probability of inefficient firms under an increased competition (Bernard et al., 2006b). The higher shutdown probabilities under an increase in foreign competitive pressure might give laggard firms a higher incentive to work hard and fast to improve their efficiency, as compared to relatively more efficient firms (Muendler, 2004). In addition, an alternative mechanism could be at work simultaneously, which could explain the observed small negative impact of AD protection on productivity of firms at the domestic productivity frontier. Dumping countries often tend to be low income countries (see Table 1). It can be expected that firms from these countries are more likely to be able to use intermediate inputs of labor and material at a lower cost than firms from EU countries (Maggioni, 2010). The abolition of AD protection could restore the flow of low price imports (although to a lesser extent than before the AD protection) from these low income countries and discourage domestic firms to invest in innovation, since they are not able to use intermediate inputs at the same cost as firms from dumping countries. Thus, firms may decide to stop innovating and investing and this would reduce their productivity. Since, innovation is a relatively more important channel to enhance productivity for firms closer to the domestic frontier (Acemoglu et al. 2006), it is likely that these firms are more affected by the abolishment of AD protection, than inefficient firm, which improve their productivity relatively more through imitation. This suggestion corresponds to recent findings by Maggioni (2010), which argues that import competition with firms from low income countries reduces the productivity dispersion in an industry.

The results seem to contradict the predictions of the theoretical models developed by Aghion et al. (2004) and Iacovone (2009), since the most efficient firms are not able to improve relatively more than inefficient firms. However, the relaxation that laggard firms are able to improve their productivity in the model of Iacovone (2009), contrary to Aghion and Griffith (2005), seems to fit the outcome.

5.3.3 Hypothesis 2*b*

The results presented in Section 4.2 indicate that there is a heterogeneous response of exporters to the abolition of AD protection. The abolishment of AD tariffs seem to have a smaller positive effect on the productivity of exporters as compared to non-exporters. This effect might be explained by the fact that exporters are more outward-orientated, as compared to non-exporters, and therefore are less "sensitive" to a possible increase in foreign competitive pressure in the domestic market as a result of abolished AD tariffs. In addition, exporters tend to be more productive and larger than non-exporters (Eaton et al., 2004; Helpman et al., 2004; Mayer and Ottaviano, 2008), which implies that non-exporters have higher shutdown probabilities under an increase in foreign competitive pressure (Bernard et al., 2006b), this might give the non-exporters an higher incentive to work hard and fast to improve their efficiency, as compared to relatively more efficient exporters (Muendler, 2004).

From the reported results in section 4.2, it can be observed that the increase in productivity for exporters is small or even negligible. In a recent study, Konings and Vandenbussche (2009) observed a decrease in exports and productivity for exporters after the imposition of AD protection. Konings and Vandenbussche (2009) argued that the drop in exporters' productivity might be explained by the "learning-by-exporting" literature. They suggested that the reduced ability for exporters to price discriminate on foreign markets, as a result of increased prices on the domestic market, might explain their observed drop in export sales. Theoretically it is likely that the abolishment of AD protection should increase the ability of exporters to price discriminate on foreign markets and raise export sales, due to a plausible drop in domestic prices caused by an increased volume of foreign products (Prusa, 1997). However, from unreported results it can be noted that there is no support for an increase in export sales for initial exporters, which implies no additional learning effects from exporting (De Loecker, 2007; Van Biesebroeck, 2005). This might be an additional explanation for the small and negligible observed productivity improvements of exporters.

6 Conclusion

The aim of this research was to empirically measure the effects of abolishing AD protection on firm-level productivity for domestic firms in the import competing sectors, and to investigate if this effect is the same for all firms. In order to examine this effect, 2076 French firms protected by AD protection were identified. While for some firms the AD protection was abolished after a period of 5 years, for others the AD protection continued. The main findings suggest that the abolition of AD protection is associated with an on average rise in total factor productivity for firms that were cut off from protection, compared to firms protected by a continued protection period. This outcome seems to suggest that restoring product market competition with firms from alleged dumping countries may enhance the efforts of importing competing firms in the domestic country to improve their efficiency. This is in line with recent findings in the empirical literature on trade liberalization.

The observed impact of abolishing AD protection on firm-level productivity in this study is subject to heterogeneous responses of firms. This outcome supports the notion of a growing literature regarding the effects of trade policy on asymmetric firms. It is found that firms respond heterogeneously to the abolition of AD protection depending on their relative distance to the domestic productivity frontier and exporting status. The empirical results indicate that the abolition of AD protection has a greater positive effect on the productivity of more inefficient firms, as compared to more efficient firms. Firms at the domestic productivity frontier might even experience a small negative effect of the abolition of AD protection. Moreover, non-exporters seem to be more positively affected by the abolition of AD protection than exporters. These findings suggest that firms at the lower end of the productivity distribution are catching-up with the domestic frontier, and the TFP dispersion decreases.

To the author's knowledge, this is the first study that attempts to measure the effects of abolishing AD protection on the productivity of domestic import competing manufacturers. The findings of this study implicitly do not raise questions on the desirability of implementing a temporary protection period, but more on the desirability of continuing the temporary protection period. The domestic pressure for protectionism in the aftermath of the global financial might encourage policymakers to maintain AD protection after the initial period of five years, however, findings of this study indicate that restoring product market competition seems to be more effective to enhance efforts on productivity improvements than protecting through an extended period of AD protection.

6.1 Limitations

There are some limitations to this research. First, limitations of the used firm-level data obtained from AMADEUS make it difficult to run an accurate calculation of firm-level exit rates. Second, in the empirical analyses TFP is estimated using revenue based output measures. To account for heterogeneity in products between firms in the same industry, it would have been better to use firm-level product prices to deflate values of output, instead of industry deflators. However, these variables were not present in the data. Third, the used firm-level data does not entail information on firm' product mix. It is likely that there are multiple product firms present in the data, which could respond differently to an increase in foreign competitive pressure on the domestic market. This might have potentially moderated the results.

6.2 Future research

This study specifically aimed to measure the effects of the abolishment of AD protection on TFP. As discussed, the results indicate that firms in the abolished AD cases experienced productivity gains. However, how these improvements have been achieved is not clear. It could be interesting for future research to investigate through which channels firms in the abolished cases have increased their productivity. For example, plants could change their output mix as a response under foreign competitive pressure (Bertrand et al., 2006b). Moreover, it could be interesting to investigate if there are differences between industries in the response of firms to the abolition of AD regarding their protective AD duty level. Firms in more protected industries might respond more "sensitively" to a shock in competitive pressure from abroad. It might also be interesting to investigate if a similar effect can be observed in other (EU) countries.

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