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Trade & Factor Mobility

A study of the nexus between trade gains and labor market regulation

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Abstract

This study considers the nexus between trade, productivity and misallocation. Drawing on the influential model by Melitz (2003) in which firm heterogeneity is exploited to derive aggregate productivity gains from trade liberalizations, the intermediating role of dismissal regulation in producing these gains are examined. The source of the post-liberalization increase in aggregate productivity is a selection effect whereby less efficient firms are forced to exit or relinquish market shares to the benefit of more efficient firms. To increase market shares and serve foreign export markets firms need to acquire productive resources, an activity that is crucially contingent on frictionless factor markets. This assumption has been largely neglected in previous research despite its central role in the realization of the selection effect. This study represents a first tentative step at examining how disturbances to factor markets impact productivity in the wake of a trade liberalization. Using the EMU as a liberalization-shock, the effect of dismissal regulation will be studied in a fixed-effects panel data model on a sample of the EU from 1996 to 2016. The results indicate support both for positive productivity effects of trade but more importantly for the interaction between trade and dismissal regulation. These findings lay the groundwork for more rigorous theoretical treatment on imperfect factor markets, heterogeneous firms and trade gains.

Key words: Firm Heterogeneity, Panel Data, Trade, Labor Market Regulation
Words: 9953

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1 Introduction

“We're going to fix [trade deals]. You know, last year [2015] we lost almost $800 billion in trade deficits. We have trade deficit with other nations of almost $800 billion.”/Donald Trump (Politifact, 2016)

The quote above is hardly unique to even the most casual observer of the American chief executive but it is indicative of how protectionism still lingers as viable policy in the world’s largest economy. The quote is arguably an expression of mercantilism where trade is considered a zero-sum game oriented only toward export expansion. This perspective has been forcefully rebuked throughout the history of economics by thinkers by the likes of Adam Smith and David Ricardo and later Heckscher and Ohlin. They emphasized how trade could be mutually beneficial by adjusting production patterns, conforming to a narrower set of products and reaping the gains of specialization. The kind of trade that these workhorse-models of international trade studies, as well as the kind referred to in the quote above, is that which results from trade between countries with access to significantly different production technologies and factor endowments. This “inter-industry trade” was long the predominant conception of trade espoused by both researchers and the public. However, trade between countries with similar technology and endowments constitute a significant share of trading patterns, a fact recognized by Paul Krugman in the early 1980’s. His model was perhaps the first to approach trade issues from a firm-perspective and imagined how trade would generate more efficient firms and a larger selection of products available to consumers since firms were able to specialize in one uniquely differentiated product and harness economies of scale instead of having to produce a larger amount at a higher cost (Krugman 1980). While pioneering, Krugman’s approach was restricted by the unrealistic restriction that firms are equally productive. The shortfall of Krugman’s model prompted theory of how heterogeneous firm productivity and trade fit together.

A gainful approach to study firm productivity was concocted by Marc Melitz in 2003 article where a framework of heterogenous firms and imperfect competition is constructed. The implication of his model is that trade triggers a selection effect which raises aggregate productivity by the exit of less productive firms and the subsequent seizing of production factors and larger market shares by more efficient firms. The central mechanism responsible for the selection effect is the process by which more efficient firms demand more production factors in order to expand production and thus bid up factor returns. Only firms with a productivity level in excess of an endogenously determined threshold level will export and see increased profit flows due to trade.

The productivity gains from trade rely on a number of assumptions. One crucial assumption is perfectly competitive labor and product markets. Consequently, a source of disturbance could be domestic regulation. Aghion & Howitt (2009) and Nicoletti & Scarpetta (2003) consider how entry regulations vary with productivity growth and find a largely negative relationship while the effect of product-market regulation (PMR) on trade liberalization is studied by Ben Yahmed & Dougherty (2017). This study, however, will be geared toward another potential disturbance to the productivity gains of trade, namely, labor market regulations. For the selection effect to be realized in the Melitz-model, factor markets need to be sufficiently frictionless to allow for less efficient firms to shed production factors and for more efficient firms to be able to absorb those factors to expand its output and meet the increased foreign demand. Indeed, Melitz himself concedes that his model "clearly indicates that policies that hinder the reallocation process or otherwise interfere with the flexibility of the factor markets may delay or even prevent a country from reaping the full benefits from trade." (Melitz, 2003, p. 1719), thus hinting at the importance of perfectly competitive factor markets for the selection effect to come to fruition. Several studies have been conducted connecting productivity with labor market regulations. Hopenhayn & Rogerson (1993) analyze the effects of a firing tax (or a tax on job destruction) and find sizable productivity and welfare losses in its wake. Employment protection legislation in the form of dismissal regulation is found to be correlated negatively with productivity growth by Bassanini et al. (2009) while DeFreitas & Marshall (1998) find less unambiguous results for trade union-variables. Furthermore, Poschke (2009) shows how hiring and firing costs can be incorporated into the profit maximization problem of the firm and how to solve for an equilibrium solution where productivity growth varies negatively with firing costs. Glaringly absent, however, is any comprehensive study of trade and labor market regulations. This study attempts to remedy that by examining the relationship between employment protection legislation, trade and firm productivity in the EU. This will be done on a sample of 20 industries at the ISIC Rev. 4 level in 16 countries from 1996-2014. Fortunately, this period features an exogenous event ideally suited for a natural liberalization experiment, namely the formation of the European currency union in 2000. Indeed, as found by Micco et al (2003), the EMU increased bilateral trade within the EMU by 4-10% and boosted member exports by up to 50% (Glick & Rose 2016).

If the link between labor market regulation and trade can be better fleshed out, the larger question of how regulation and trade interact but also how misallocations in general affect how trade gains are realized can be answered with more confidence. Better understanding of this link will allow us to understand under which circumstances the selection effect is operative and how immobile factor markets impinge on its effect. Obviously, this knowledge is not trivial since if the understanding of what factors are influential in shaping the beneficial effects of trade integration is improved, domestic legislation and international trade compacts can be designed to better accommodate the interaction between labor market regulation and economic performance. As many studies have showed, governments often respond to increased openness by increasing social expenditure to shield workers from the vagaries of globalization (see for example Burgoon 2001, Cameron 1978), and it is not inconceivable that the same shielding mechanism may result in overly restrictive labor market regulation (dismissal regulation in particular), which makes understanding its implication all the more relevant.

Although no research exists which could provide helpful theory in indicating the exact nature of how labor market regulation impacts productivity, research on the general relationship between productivity and labor market regulation indicates a negative correlation. This result is used to create a testable hypothesis about a negative relationship between productivity and labor market regulation, hence, generating the following hypothesis*:* Labor market regulation depresses average firm productivity.

That the relationship is hypothesized as between labor market regulation and average firm productivity is not semantic. As will be elaborated on later, the selection effect has no bearing on the productivity of an individual firm, only on aggregate or average productivity. Thus, this study considers industry averages. Finally, to focus the study the following research question is generated: How does employment legislation impact average firm productivity?

The study will be structured as follows: The subsequent chapter will delve deeper into the underlying theory of firm heterogeneity, trade and productivity as well as clarifying its connection to labor market regulation. This chapter also features a discussion of empirical specification and details of the liberalization experiment. Chapter 3 will present and discuss the data employed for the study and the selection of variables as well as treat econometric issues while results will be presented and discussed in chapter 4. Finally, chapter 5 concludes the findings and relates back to the overall purpose of the study.

2 Trade & Productivity

2.1 Firm Heterogeneity

The landmark studies of Krugman (1980) and Krugman & Helpman (1985) served to emphasize how trade and homogenous firms interact to produce clearly defined gains of trade between countries not expected from the traditional comparative advantage-based models of Heckscher-Ohlin and Ricardo. While revolutionizing the field of international economics their models fell short by failing to acknowledge the role of firm heterogeneity. In the early 2000's Melitz (2003), Bernard et al (2003) and Yeaple (2005) to name a few, seized on the empirical findings of Pavcnik (2002) and Bernard & Jensen (1999) among others, to develop theoretical models of their own that explored how firm heterogeneity altered previous findings. This "new" new trade theory school conceptualized firm heterogeneity primarily as productivity differences and studied the relationship between trade and productivity, sometimes earning it the label endogenous growth theory. Bertrand et al (2003) uses US firm-data to match productivity and trade data as well as simulating and parameterizing the effects of bilateral trade on productivity. Melitz, on the other hand, uses a fixed markup CES-framework (Constant Elasticity of Substitution) and builds on the dynamic firm entry/exit model of Hopenhayn (1992) to explicitly model how firm selection contributes to aggregate productivity. The Melitz model has the attractive feature of pinning the gains of trade to a single variable, which makes it more tractable than Bernard et al's model. Another virtue of Melitz's model is that productivity gains can be expressed through averaged variables allowing for data that is less disaggregated than firm data which can be hard to come by and be matched by other data when studying multi-country samples.

2.1.1 The Melitz Model

In Melitz's seminal study (2003) he showed how Krugman's model of imperfect competition and intra-industry trade (1980) could be amended to reflect heterogenous productivity differences between firms. His model relies on monopolistically competitive firms producing one variety each in identical nations with a single compound factor (labor). Another important assumption is that consumer utility stems from a CES-utility-function. With a slight modification owing to Feenstra (2015, p. 157) the function is formulated as:

$$U = \left[\int_{\omega\in\Omega} c(\omega)^{\frac{\sigma-1}{\sigma}}\right]^{\sigma/(\sigma-1)}$$

Where σ represents the constant elasticity of demand and ω is a good on the set Ω of continuously differentiable goods. The choice of utility function is not innocuous, in fact, the exact opposite. Although by no means necessary for the model (Melitz & Ottaviano 2008), CES-utility implies fixed firm markups, thus effectively paralyzing the import competition effect operative upon liberalization with an additive utility function (Melitz, 2003, p. 1715) (as in Krugman's model). The benefits of isolating the selection effect will be made more apparent in the discussion of the interaction between labor market regulation and trade liberalization conducted in the subsequent section.
An attractive feature of his model is that the heterogeneity between firms is reflected in a single variable. To express this, the inverse firm supply function is reproduced below (Melitz, 2003, p. 1699):

$$q: L = f + q/\phi$$

Where q is output, L represents amount of labor embodied in production (labor is the compound production factor), while f is the fixed cost of production and ϕ indicates firm-specific productivity, which is the inverse of the marginal cost. Each firm maximizes profit according to the following expression(ibid):

$$\pi(\phi) = \frac{r(\phi)}{\sigma} - f$$

Where r is revenue. The profit expression contains two central takeaways; first that profits are growing in the productivity parameter and second, the significance of the fixed costs of production. The inclusion of fixed costs introduces the dynamics of Melitz's model within which each firm draws a random productivity-level after having invested the fixed entry amount f_e. Unless a firm draws a productivity-level consistent with at least nonnegative profits, it is forced out of production. The profit level at which firms just break even is characterized by a threshold productivity-level, ϕ^*, which is an increasing function of the fixed cost of production since firms need to cover higher fixed costs with lower marginal costs. In each subsequent period, firms are hit by stochastic productivity shocks that may force them to exit.

Upon aggregation, the average profitability of firms coupled with the threshold level combine to create two equilibrium conditions for the open economy. The first indicates the average profitability that prevails at any given threshold level. At this level one firm just breaks even, aptly giving rise to the zero-cutoff-profit condition (ZCP). The equilibrium is also determined by the level at which the expectation of future profits is just enough to offset the sunk investment cost for entrants, referred to as the free entry condition (FE) whose intersection with the

ZCP-curve (illustrated in graph 2.1 below) generates a unique average profitability- and threshold level. The conditions are stated below as (ibid, p. 1703):

$$\pi^{avg} = fk(\phi^*) + p_x n f_x k(\phi_x^*)] \quad \text{(ZCP)}$$

$$\pi^{avg} = \frac{\delta f_e}{1-G(\phi)} \qquad \text{(FE)}$$

$$k = \left[\frac{\tilde{\phi}(\phi^*)}{\phi}\right]^{\sigma-1} - 1$$

Where δ is the stochastic productivity shock (probability of being forced out after entry), $1 - G(\phi)$ is the distribution from which firm productivity is drawn and $\tilde{\phi}$ is the average productivity level. If $\sigma > 1$, average profits are increasing with average productivity and decreasing with the threshold level. The variable p_x represents export probability while n is the amount of trading partners. Note that ϕ_x^* (export threshold-level) is a decreasing function of the variable trade cost τ. The FE condition establishes that, the more prohibitive entry is, both in terms of investment costs and exit risk, the larger the excepted profits will need to be in order to stimulate entry. The effects of a trade liberalization would typically be manifested by a shock to the fixed and variable trade costs. Combined this will trigger a shift upwards of the ZCP curve from ZCP_0 to ZCP_1 in graph 2.1, yielding a higher threshold level for all firms ($\phi_1^* > \phi_0^*$) but a lower export threshold level (not shown in graph). The average profitability of surviving firms increases from π_0^{avg} to π_1^{avg} . Since Melitz's model features no learning gains from exporting, the increased export threshold level fails to impact overall productivity.

The equilibrium conditions also highlight the role served by the average productivity level. Given the fixed export cost only payable upon exporting (f_x) the liberalization of trade restrictions partitions firms into exporters and non-exporters (assuming, as Melitz does, that trade costs are sufficiently large) where more efficient firms react to the added export market by expanding production. Since increased production requires more inputs, demand for production factors increases and factor returns consequently, increase. If production costs increase, firms that previously were just breaking even will be forced out of business since the added cost increases the threshold level. While trade reduces the domestic market share for each firm, the market share for those productive enough to export increases compared to autarky.

More formally the weighted average productivity can be described by the expression (ibid, p. 1710):

$$\widetilde{\phi_t} = [1/M_t \left(M\tilde{\phi}^{\sigma-1} + nM_x\left(\tau^{-1}\tilde{\phi}_x\right)^{\sigma-1}\right)]^{\frac{1}{\sigma}-1}$$

This relationship describes how productivity is a weighted average of incumbent firms (M) and the fraction that exports (M_x), suppressed by $M_t = M + nM_x$. The positive effects of trade liberalization on this expression are evident through the decrease of variable trade costs and by the addition of the export component. Both $\tilde{\phi}$ and $\tilde{\phi}_x$ are positive functions of their respective threshold levels indicating that both thresholds levels enter implicitly in the expression.

Since this paper is concerned primarily with the productivity gains of trade in a heterogenous firm environment, the gains have mainly been conceptualized in terms of aggregate productivity improvement and the selection effect. However, as shown by Melitz and expanded on by Chaney (2008), depending on the chosen distribution for the mass of firms, consumers may also enjoy a wider variety of products owing to increased import competition (although this effect may be mitigated for countries of asymmetric size and consumers with different utility functions (Baldwin & Forslid 2010)).

2.2 Trade, Productivity & Employment Protection

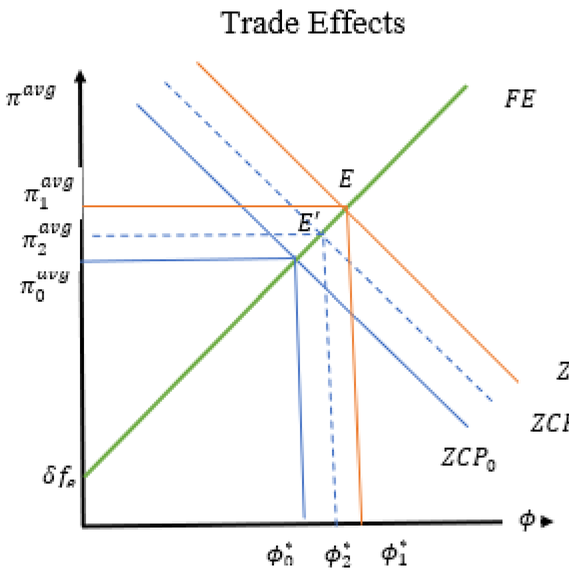
The intersection between productivity and labor market regulation has been studied avidly as an example of a misallocation of productive resources (see Hsieh & Klenow (2009)) and Restuccia & Rogerson (2008)). The first to consider the effects of labor market regulation on productivity and output, however, was perhaps Hugo Hopenhayn. Building on his general equilibrium model with entry/exit dynamics, he and Rogerson (Hopenhayn & Rogerson, 1993) modelled the effects of a firing tax dependent on the previous period's level of employment. Empirical testing found that this inclusion comes to the detriment of 2 percent of average labor productivity, reduces employment by 2.5 percent and consumption possibilities by 2 percent. In later studies, firing costs (such as settlement payments upon dismissal) are shown to be nonlinearly increasing in its adverse effects on total factor productivity-growth (TFP) (Hopenhayn 2009).

The effects of labor market regulation can be understood as creating a wedge between the optimal employment level and the prevailing level (ibid). Whereas optimal resource allocation would dictate that firms respond to productivity shocks by adjusting their employment level upwards or downwards, the presence of firing costs or dismissal regulations make firms hesitant to fire and hire workers to reach this optimal level. Essentially, less efficient firms overemploy labor relative to its more efficient counterparts who underemploy it. Poschke (2009) expanded on Hopenhayn & Rogerson's findings to model explicitly how firing costs depressed not only efficient resource allocation but also the selection effect whereby less efficient firms are forced to exit at the expense of more efficient firms (closely akin to Melitz's selection effect). Furthermore, as suggested by Saint-Paul (2002) and Bartelsman et al (2004), firing costs may increase the risk-aversion of firms and reduce the potential for risky innovation.

Several studies have attempted to test the validity of the misallocation hypothesis using different measures of labor market regulation and samples. Bassanini, Nunziata & Venn (2009) consider how dismissal regulation of permanent and temporary employment affects TFP growth in the OECD from 1982 to 2003 with industry-aggregation at the ISIC Rev. 3 level. Dividing their sample into high-layoff and low-layoff industries, they use a difference-in-differences estimator to find a moderating impact of permanent dismissal regulation on TFP while recording a weak and barely significant effect of regulation on temporary employment on TFP-growth.

The relationship between productivity and employment protection appears robust even for developing countries as shown by De Freitas & Marshall (1999), however, not at the industry or firm level. Their study spans 20 Asian and Latin American countries and estimates how labor productivity varies with the interaction between labor surplus (or underemployment) and both dismissal regulation as well as union density. Considering how the labor surplus conspires with different measures of worker protection is an ingenious method of controlling for swings in the business cycle, particularly relevant in terms of the influence of unions on firms. They find that, consistent with expectation, the labor surplus matters more for the effect of union density on productivity than for dismissal regulation which appears more time invariant.

Hence, it appears that there exists a general dampening effect of employment protection on aggregate productivity. However, the misallocation and macro-studies are silent on how the effect of employment protection interacts with and, is mediated by international trade patterns. That trade (or openness) should interact with regulation to exert an impact on productivity different from the effect of regulation alone is not at all foreign as is shown by Ben Yahmed & Dougherty (2017) for PMR and import competition using the specification from Melitz & Ottaviano (2008) without CES utility. No study, however, has attempted to model how Melitz's selection effect is affected by employment protection. Given the fact that, as recounted earlier, the effect is highly dependent on the proper functioning of factor markets, this ambition appears highly warranted. If strict dismissal regulation prevents or makes potential exporters hesitant to absorb labor from less efficient firms, less efficient firms will not be forced to exit due to prohibitive wage costs. The selection effect is thus hampered by the same patterns predicted by Hopenhayn & Rogerson (1993), Hopenhayn (2009) and Poschke (2009) where more efficient potential exporters are unable to meet the expanded foreign market and thus underemploy labor compared to its productive capacity while less efficient firms overemploy labor where they otherwise would have been forced to exit or at least yield market shares to more efficient firms. The resulting effect of a trade liberalization on aggregate productivity is less pronounced than with no wedge between actual and optimal labor allocation. The wedge is illustrated in graph 2.1 by the horizontal difference between ZCP_2 and ZCP_1 or the difference between the threshold levels ϕ_2^* and ϕ_1^*. Instead of ending up in the



Graph 2.1

undistorted equilibrium at point E, the presence of dismissal regulation causes the economy to reach equilibrium at point E', where the size of the wedge between the points indicate regulatory strictness.

2.3 Empirical Specification

Based on the previous discussion, the following model emerges:

$$\mathrm{A}_{sct} = \alpha_{sct} + D_{ct} + \beta_1 X_{sct} + \beta_2 Z_{ct} + \beta_3 M_{sct} + \beta_4 R_{sct} + \beta_5 C_{sct} + \epsilon_{sct}$$

This specification includes both sector-specific fixed effects (α_{sct}) and time-invariant country-fixed effects (D_{ct}) to control for omitted sector and country-variables such as technological upgrading (Ben Yahmed & Dougherty, 2017, p. 396) but also for the influence of institutional factors unique to individual countries (WTO, 2012, p. 19) as well as unobservable sector-specific characteristics. Furthermore, the variable X_{sct} represents the industry-level effects of openness. Z_{ct} represents strictness of dismissal regulation and A_{sct} is industry-level productivity. In turn, R_{sct} is the interaction between dismissal regulation and trade liberalization and M_{sct} industry interaction between openness and trade liberalization.

Observing the selection effect requires the ability to isolate the effects of a liberalization. This can be achieved by means of experiment. If some countries are subjected to a liberalization while others are not, the outcomes for both groups can be compared. Thus, the experiment consists of comparing the effects of dismissal regulation and openness on a control group with the effects of the liberalization on the interaction between dismissal regulation and openness for the treated group. Comparing the coefficients of X_{sct} and M_{sct} yields the effects of a trade liberalization on productivity since the former relates to the entire sample while the latter concerns only the treated segment. Most importantly, the selection effect is observed in the comparison of R_{sct} and M_{sct}. The experiment also enables the general effects of dismissal regulation on productivity to be disentangled from the effects of how dismissal regulation mediates how trade interacts with productivity by comparing the effects of Z_{ct} with R_{sct}.

Finally, the inputs from the production function are embedded in the variable C_{sct} and are the capital and labor input respectively. The variable ϵ represents the exogenous sector-specific productivity shock.

2.4 Treatment Effects

As mentioned above, the extent to which the selection effect can be observed and measured successfully hinges in large part on the ability to segregate the sample into two groups and apply treatment to one of them. Fortunately, both treatment and the ability to segregate the sample into treatment and control group exists for this sample. The EMU compact of 2000 represents an appropriate treatment since it is exogenous to the member states and since it does not encompass the entire sample. Since the sample spans from 1996-2014, the sample can be divided not only across countries but also over time, creating a pre-treatment segment (1996-2000) of the sample to be compared with a post-treatment segment (2001-2014). By comparing the pre and-post-treatment interaction effects of dismissal regulations and openness for the EMU-members with each other and with the same interaction effects for the untreated section of the sample, the selection effect can be observed and controlled for. To model the interaction between EMU-membership, openness and dismissal regulation is also an essential part of isolating the selection effect from the import-competition effect of Melitz's model absent CES-utility. With a design more akin to Ben Yahmed & Dougherty (2017), Melitz & Ottaviano (2008) and Baldwin & Forslid (2010) the interaction between openness and EMU-membership would do well to capture the composite effects of trade on productivity but not to discriminate between the selection effect and import competition effect. The interaction between dismissal regulation and openness is more apt to sequester the selection effect since no theoretical basis exists for why factor markets are meaningful for how import-competition vary with productivity.

Modelling EMU-membership is easily done by first creating a dummy-variable that takes the value 1 if a country is a member of the EMU and 0 otherwise and letting it interact with another dummy-variable that takes the value 1 for the years 2001-2014 and 0 otherwise. The resulting variable is restricted to only be included if a country is an EMU-member and for the years 2001-2014. The dummy-variable alone should impact productivity positively as well as its interaction with openness while, centrally, its interaction with dismissal regulation and openness must be negative for the hypothesis laid out earlier to be supported.

3 Data & Definitions

3.1 Data Sources & Variables

All quantitative data for this study is retrieved from the Structural Analysis Database (STAN) published by the OECD (OECD). STAN offers industry data disaggregated to the level of ISIC Rev 4. To ensure comparability and to conform to data availability, only goods-producing industries will be considered. The list of selected industries is available in the appendix and amount to 20. These industries are situated within a sample of 16 EU countries from 1996-2014. Apart from relatively generous data availability, the EU is selected so as to ensure the greatest similarity in aspects other than those examined. Not all EU-countries are included in the sample, however, but Luxembourg, Malta, Cyprus, Lithuania, Latvia and notably the United Kingdom are excluded due to limited data-availability. Data for Slovakia, Slovenia and Estonia exist at a satisfactory level but since they joined the EMU later than 2000, they are excluded as well. While the selected time period is restricted somewhat by data availability, the crucial feature is that it includes observations before and after the creation of the EMU. Some countries did not join the EU until 2004 (Hungary, Poland and the Czech Republic), however, and to control for the effect of the EU-accession for these countries, the models will feature a dummy-variable capturing this event.

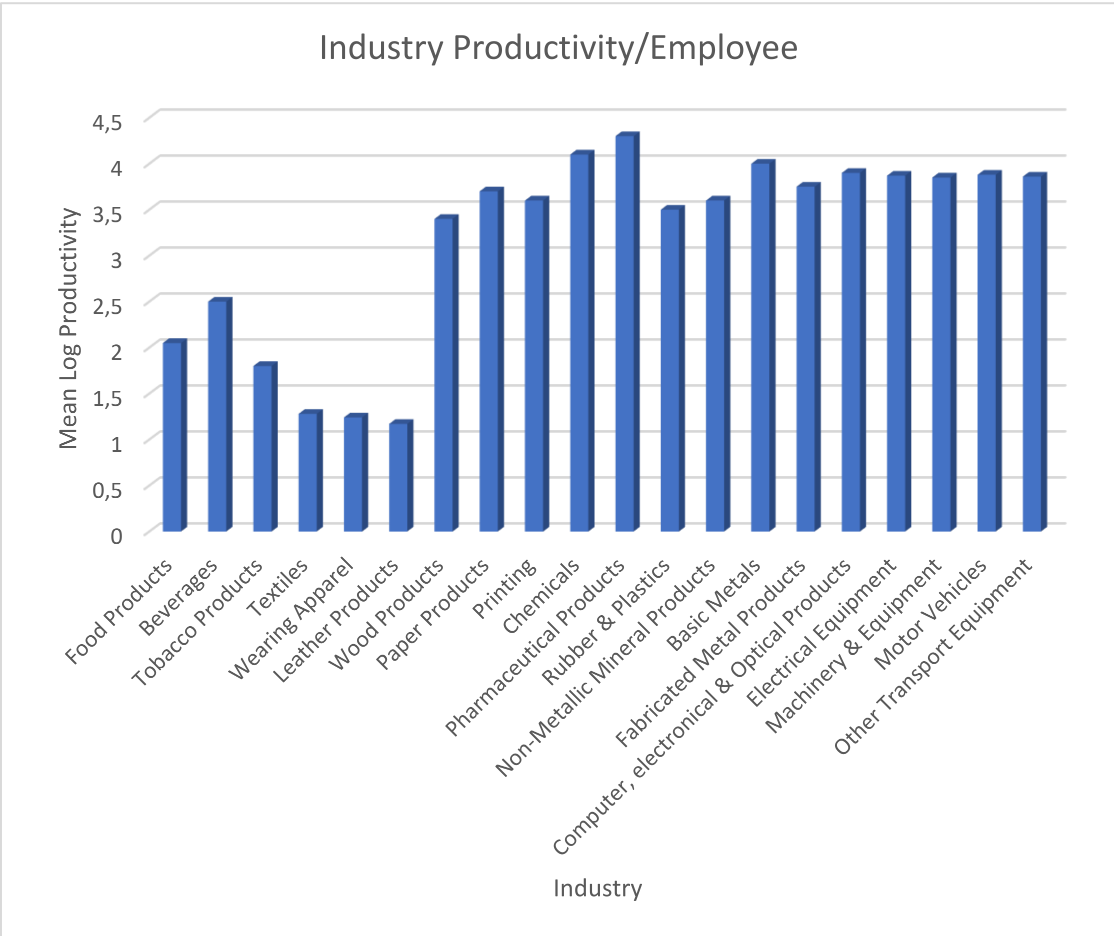
As for the selection of variables a fruitful start is to consider the dependent variable, productivity. A common procedure to compute and estimate productivity is to solve for the productivity residual by decomposing a production function. This procedure is referred to as growth accounting (Aghion & Howitt 2009) and is an ingenious method to extract the otherwise unobservable productivity by exploiting the components of the production function that are observable. Assuming a standard Cobb-Douglas production function for each industry, taking logs and solving for the productivity residual (A) yields:

$$\ln(A_{sct}) = \ln(Y_{sct}) - (1 - \alpha)\ln(L_{sct}) - \alpha(K_{sct})$$

Where Y_{sct}, L_{sct} and K_{sct} are output, labor input and capital input respectively while α is the return to capital. This specification serves as inspiration for the structure of the empirical model to be fitted. The transition from growth accounting to empirical model is not seamless, however, but requires further comment. First, an estimation procedure needs to be selected. Since this study relies on both time and cross-sectional observations the go-to method is to fit a panel data regression.

In addition to exploiting more information than using either cross-sectional or time-series models separately, it turns out that panel data is not only empirically but also theoretically favorable (at least to cross-sectional models). This finding was made in the theoretical work of Baldwin & Robert-Nicoud (2004) who show that when the Melitz model is formulated dynamically, the correlation between productivity appears to hold only over time and not over industries. Another benefit of the panel data regression is the option of including individual-specific intercepts or fixed effects. The fixed effects specification essentially vacuums the error terms for unobservable characteristics and makes them explicit in the aforementioned intercept. Embedding individual intercepts solves any potential endogeneity problems that arise when regressors are correlated with the error term, avoiding creating biased estimates. While helpful in general, this property is particularly fortunate upon estimation of production functions and in the context of trade data. As mentioned by Levinsohn & Petri (2003) inputs in a production function are highly likely to be correlated with unobserved productivity shocks. Although the focal point of their paper is how to proxy the capital stock, they suggest fixed effects as an alternative remedy to the endogeneity problem. Similarly, omitted measures of institutional quality are likely to be correlated with trade flows (WTO, 2012, p. 19), giving rise to the same endogeneity bias as input variables in the production function. Often the choice of the fixed effects is made in contrast to the choice of random effects. Random effects are more appropriate for larger samples and when only the underlying characteristics of the sample are of interest and not the nature of individual observations (Verbeek, 2012, p. 384-385). Moreover, since the random effects model does not correct for the endogeneity bias, the fixed effects model appears more suitable for this study.

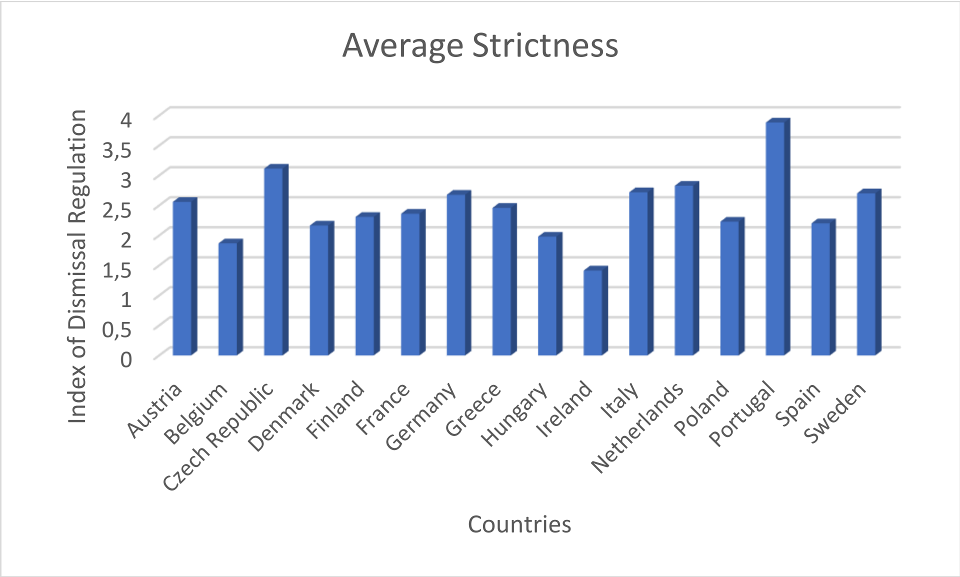
Proxying firm productivity is not unproblematic and the literature appears not to have reached a decided consensus on an appropriate measure. The first and perhaps most intuitive option is to use firm TFP or TFP-growth as a productivity proxy, an approach followed by Dougherty & Ben Yahmed (2017), Hu & Tan (2016) and Bassanini, Nunziata & Venn (2009). Ben Yahmed & Dougherty use a "revenue-based TFP" (Ben Yahmed & Dougherty, 2017, p. 391) while Hu & Tan borrow from the widely used methodologies of Olley & Pakes (1996) and Levinsohn & Petri (2003) in using investment and intermediate inputs as productivity proxies. Another viable alternative is to extract productivity from actual production by using the value added in production. Conceiving of firm productivity in terms of value added is done by Melitz & Trefler (2004), Hsieh & Klenow (2009) and De Freitas & Marshall (1999). An advantage of harnessing the value added in production is that it can be easily be transformed to mimic labor productivity by deflating by the number of employees (in fact this is exactly how Melitz & Trefler define labor productivity). Obviously, opting for either of these measures as proxies comes with both advantages and disadvantages. An argument in favor of TFP is that aligns more closely with how growth literature treats productivity and the Solow-residual and would ease comparability with their findings. However, using TFP does not come without problems. TFP is notoriously difficult to measure accurately and requires detailed data which, particularly, at the firm or sectoral level is unlikely to be available (at least publicly) to the extent required for panel data models. Value added in production on the other hand is more generously available both over time and across industries and countries. Consequently, this study will proxy industry productivity by the value added in production by each employee in each industry. Adhering to the advice by De Freitas and Marshall (1999) of using real value added in production, the data enters as volumes with 2010 as a reference year. Inspection of the value added in production from graph 3.1 below shows some dispersion but that most industries cluster around the mean given in table 3.1 as 3.42. It is not unlikely, however, that the dividing line in the sample can be drawn according to factor intensity. Since what is measured is approximate to labor productivity, it may not come as a surprise that labor-intensive industries are less productive than more capital-intensive industries. While categorizing industries according to factor intensity is thorny without exact measurements, it is likely that the textile and food-production industries are more labor-intensive than chemicals, machinery or mineral products.



Graph 3.1

Another important issue is how to operationalize labor market regulation. Labor market regulation can be understood to encompass both legislation governing work safety and environment but also employment protection or dismissal regulation. It seems quite natural to consider dismissal regulation if the selection effect is contingent on the ability of labor to flow seamlessly between firms. It is not obvious that employment protection is only the result of legislation since trade unions may also be influential in regulating dismissals. Fortunately, the OECD publishes data on both the strictness of dismissal regulation and trade union density and collective bargaining averages. However, trade union density or membership may be less an indicator of the strength of union dismissal rules than an indicator of union influence in general. Coupled with the weak results reported by DeFreitas and Marshall (1999), this study will, consequently, exclude any measure related to trade unions and focus on dismissal regulations. The strictness of dismissal regulations is available for both temporary and permanent contracts as indices ranging from 0 to 6 where larger values indicate more strictly regulated labor markets. Dismissal regulation includes rules governing how and when workers can be laid off and the consequences of both fair and unfair dismissal (Bassanini et al, 2009, p. 353), (OECD). There are reasons to suspect that restrictions on workers with both temporary and permanent contracts will impact the selection effect, albeit, somewhat differently. Bassanini et al (2009) explore the variegated effects of temporary and permanent contracts and argue that the relationship between temporary contracts and may be less clear-cut than for permanent contracts. They argue that temporary contracts may allow firms more flexibility in adjusting employment levels while simultaneously discouraging work effort (Bassanini et al, 2009, p. 387). Upon empirical examination, they find weak or no support for the effect of temporary contracts on productivity. Given the lack of theoretical underpinnings and empirical support, dismissal regulation in this study will be understood as only affecting permanent contracts. The average strictness of dismissal regulation is displayed in graph 3.1. Even though the index ranges from 0 to 6, no country climbs past 3.88 or descends below 1.4 and does not exceed 2.55 on average. As graph 3.1 shows, the values for the non-averaged sample track somewhat its average and the minimum and maximum values range from 1.34 to 4.6 and a mean of 2.53.

To accommodate the variables of the production function labor and capital input serve as control variables. Labor input can be credibly proxied by the return to labor, wages, (Ben Yahmed & Dougherty, 2017, p. 389) and capital input is closely related to the gross fixed capital formation (see for example Candida Ferreira (2013)) which is also deflated by the number of employees in each sector.



Graph 3.2

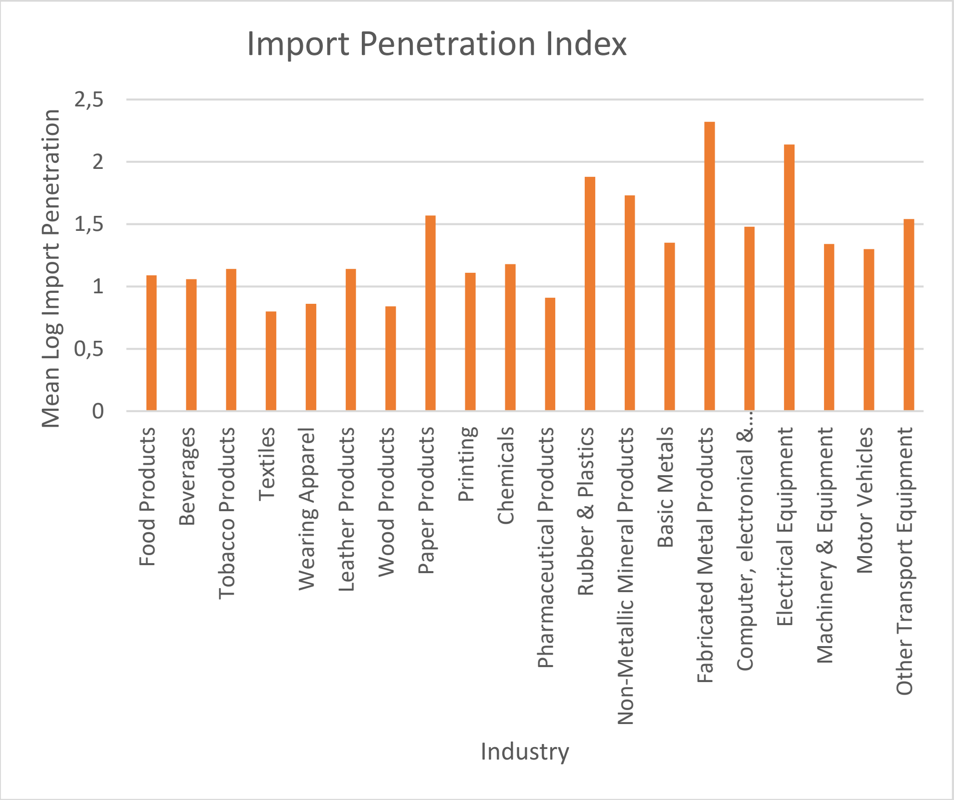
Since the selection effect is only observable in connection with trade, to say anything meaningful about requires the ability to construct a telling trade measure. A method proposed by among others Ben Yahmed & Dougherty (2017) and Weche (2018) measures the degree of openness in an economy. The measure is referred to as the import penetration index and treats the exposure of the economy to foreign imports as a proxy for openness. More specifically, the import penetration index measures the share of total demand that is met by imports. The index is formulated below:

$$\frac{M_{sct}}{M_{sct} + Q_{sct} - X_{sct}}$$

Where s indicates sector (industry), c country, t is the time subscript. In the formula, Q represents production, M imports and X exports. Like value added data, these data are recorded in volumes, although in the thousands. Since value added is recorded in millions of euro, the trade data is converted into millions. It is clear from graph 3.3 that not all industries engage equally in trade. In fact, although not as starkly, the graph is similarly skewed to the right as for productivity in graph 3.1. Notably, as revealed in table 3.1, the discrepancy between the mean and the maximum value suggests large within-industry dispersion of openness, which is less surprising given the EMU-reform.

Variables	Productivity	Import Penetration	Dismissal Index
Mean	3.42	1.4	2.53
Standard Deviation	2.55	1.12	0.58
Min	0.0023	0.0022	1.34
Max	10.12	8.463	4.6

Table 3.1



Graph 3.3

3.2 Econometric Issues

When analyzing economic data (and time-series in particular) it is important not only to let the choice of model rely on theory but also to base it on how the underlying data is structured. For example, it is often the case that as some data-series evolve over time, they do so not randomly but based on previous realizations of the same variable. This phenomenon is called persistence. A common procedure to examine what structure governs the evolution of a given data series over time is to consult the autocorrelation function (ACF) and the partial autocorrelation function (PACF) (Enders, 2015, p. 60). These functions track how current realizations correlate with past realizations of a value. Turning to the data series employed in this sample, the variables that may run the risk of being persistent is value added in production, both trade flows, production data and the control variables for capital and labor input. Upon inspection of the ACF and PACF for these variables (available in the appendix), they all remarkably follow an autoregressive process of order one with a geometrically decaying ACF and a single spike at lag one for the PACF (ibid, p. 61). Consequently, the true form for these data series is to be modelled as being lagged once in addition to the contemporary realization.

A slightly less rigorous method of detecting persistence is to follow the Box-Jenkins-procedure (ibid, p. 72) by starting at relatively long lag lengths and successively paring them down by significance tests. For this sample, the Box-Jenkins procedure appears to suggest including only the lagged dependent variable other than the contemporary realizations of the other variables (results available in the appendix). In panel models, however, there is reason to exercise more caution when including lagged dependent variables since they are likely to be correlated with the individually-specific fixed effects and render the FE-estimator unbiased and inconsistent, particularly for fixed T (Enders, 2012, pp. 397-98). Owing to this risk the benchmark model will not include a lagged dependent variable, which will instead be part of the model as a sensitivity check. Finally, a third method is using information criteria such as the Akaike information criterion (AIC) or the Schwartz-Bayesian criterion (BIC) (ibid, pp. 69-70) to discriminate between the different specifications. As revealed by table 6.13 in the appendix, both the AIC and BIC favor the benchmark model. Another reason to consider a model devoid of contemporary realizations is to correct for any simultaneity bias, since it is unlikely that contemporary variables affect lagged variables. Simultaneity is not a non-issue for productivity estimations in general nor for trade flows and productivity in particular. As Ben Yahmed & Dougherty (2017) note, more productive firms or industries are likely to attract larger trade flows. The problems associated with simultaneous regressors are the same as for other endogeneity biases, namely, biased and inconsistent estimation (Verbeek, 2012, p 147).

Other problems include heteroskedasticity and autocorrelation. Heteroskedasticity arises when the variance of the error term is not independent of the regressors, which is likely given the disparities of country-size in the sample. Since heteroskedasticity invalidates the assumption of a homogenous variance operative in estimation, it should not be left unredressed. Autocorrelation is a common feature of time series where the error term systematically depends on past error-terms. This dependence is problematic since it generates inefficient estimates and erroneously computed standard errors. Formally testing for autocorrelation cannot reject the existence of first-order autocorrelation (Wooldridge panel-data autocorrelation test). However, inspection of the ACF/PACF for the residuals obtained from the benchmark model seems to be consistent with white-noise structure, lending the suspicion of autocorrelation less credibility. Nonetheless, to correct for both heteroskedasticity and the possibility of autocorrelation, the models considered will be fitted with HAC-robust standard errors (Heteroskedasticity-Autocorrelation Consistent).

Finally, another assumption to be tried is that of normally distributed errors. Normality is commonly tested for (or rather normality of the residuals) by considering the Jarque-Bera values. However, in the context of panel data this assumption is less likely to be violated than the other Gauss-Markov assumptions given the large number of observations (Lumley et al, 2002).

4 Results

4.1 Benchmark Results

The model used in estimation is presented below as:

$$\ln(A_{sct}) = \alpha_{sct} + D_{ct} + \beta_1 \ln(REG_{ct}) + \beta_2 \ln(IP_{sct}) + \beta_3 EMU + \beta_4 \ln(IP_{sct}) * EMU + \beta_5 EMU * \ln(REG_{ct}) * \ln(IP_{sct}) + \epsilon_{sct}$$

In contrast to the model in 2.3, which is a more general representation of productivity, the model above reflects the model that enters the actual estimation. The model is largely the same with X_{sct} corresponding to IP_{sct} reflecting the openness measure discussed in the previous chapter and the EMU-dummy reflecting the liberalization as discussed in section 2.4. The coefficients of both import penetration (IP_{sct}) and the EMU-dummy should be positively correlated with productivity if openness and trade liberalizations affect productivity positively, as hypothesized. Consistency with the theory on trade and productivity would indicate that the coefficient on the interaction between import penetration and EMU-membership would be positive and, conversely, that the coefficient on the interaction between dismissal regulation, EMU-membership and import penetration should be negative.

The models below were fitted without a lagged dependent variable but including a dependent variable does not significantly alter the results (see appendix). The control variables were found not significant for all models and were, consequently, removed. The dummy-variable constructed to control for the effects of the late accession to the EU for some countries was found not significant for any of the models either and was elided as well. The table reveals results that are mostly consistent with theory. The productivity boost from becoming an EMU-member, while not significant at the five-percent level, is positive and amounts to almost 0.3 percent. Similarly, the coefficient for import penetration is highly significant and positively correlated with productivity at the rate of about 0.5 percent. As expected the effect of the liberalization experiment is positive and significant at all conventional levels. The effect of the interaction between EMU-membership and openness on productivity towers over both import-penetration and EMU-membership at slightly above 26-percent. Letting the liberalization interact with the index for dismissal regulation produces an almost equally significant depressing effect on productivity at close to 20-percent.

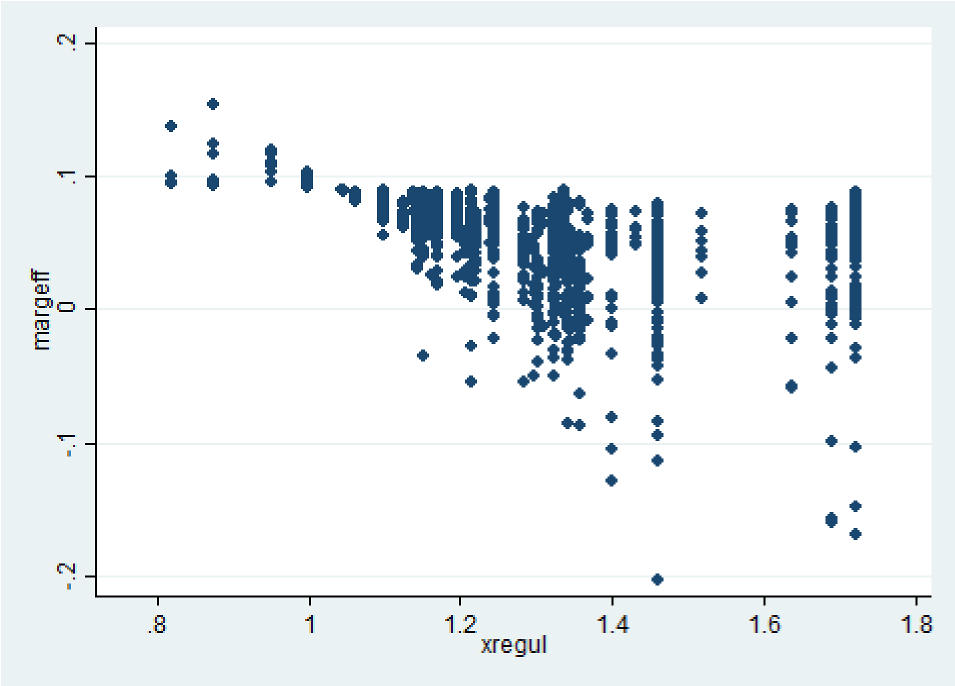
At odds with the a-priori expectations is the effect of dismissal regulation on the entire sample. The coefficient indicates that a one-point increase in the index is responsible for a whopping 40-percent *increase* in productivity. With a p-value far from consistent with rejection of the null at any conventional significance level, this finding is hardly robust but, nonetheless, deserves comment. Apart from defying theory, the unexpected result for the independent effect of dismissal regulation on productivity slightly complicates the experiment. To more precisely gauge the impact of dismissal regulation becomes more difficult since, now, its only reliable manifestation is through the interaction with the liberalization experiment. Comparing the effect of dismissal regulation for the entire sample with its interaction between openness and the treatment would have more overtly isolated the mediating effect of dismissal regulation on the productivity-enhancing effects of trade. Differentiating the model may provide insights able to reconciliate the discrepancy between theory and this finding. Considering graph 4.1 displaying the marginal effect of dismissal regulation on productivity (where xregul is IP) reveals that for values lower than 1.2-3 for the dismissal index, the effect is indeed positive but turns increasingly negative for larger values. It is not inconceivable that firms benefit from the predictability of having a framework for dismissing employees but that this benefit is continually offset as the regulation becomes more prohibitive. On the other hand, the result for the independent effect of dismissal regulation need not be discounted. A possibility is that the studies that found a relationship between dismissal regulation and productivity erred in correctly specifying the causal mechanism. Had they instead amended their models to incorporate trade variables, it is possible their results would more closely resemble those found here.

Comparing how dismissal regulation mediates the effects of the liberalization with openness for the entire sample and the separate effects of the liberalization seems, nonetheless, worthwhile. Common to import penetration and its interaction with EMU-membership is that they both measure the effect of trade on productivity. While import penetration alone indicates how trade flows impact productivity, its interaction with the implementation of the EMU indicates how the relationship reacts to a positive trade shock. The fact that both measures of trade are positively related to industry productivity and that the positive relation is increasingly depressed with the strictness of dismissal regulation indicates that the gains from trade and trade liberalization are not fully realized when labor markets are not perfectly mobile.

VARIABLES	A
EMU	0.0265
	(0.0387)
REG	0.415
	(0.259)
IP	0.0464***
	(0.0141)
IP*EMU	0.261***
	(0.0578)
IP*EMU*REG	-0.206***
	(0.0458)
Observations	1,982
R-squared	0.974

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

Table 4.1



Graph 4.1

4.2 Sensitivity Analysis

Another problem with time-series data is when a data series has the tendency to grow with time, thus not possessing a unique long run expected value or variance. A process with this characteristic is referred to as non-stationary and is likely to result in spurious estimates unrelated to theory. Testing for non-stationarity in panel models commonly involves the computation of two test-statistics. The first is called the Levin, Lin & Chu (LLC) test (Verbeek, 2012, p. 413) and assumes the existence of a common unit-root process for the entire panel under the null that the process is non-stationary. The second was conjured up by Im, Pesaran and Shin (IPS) (2003) and averages the ADF-statistics over all cross-sections. This test differs from the LLC test in that the null hypothesis assumes individual unit root processes for each cross-section instead of a common process for all cross-sections.

Performing both tests for the same series as were tested for persistence yields rather conclusive results. While for levels the LLC test rejects the null for all series the IPS cannot reject the null for any of the series (results available in appendix), this appears most starkly for the trade flows. When performing the test in differences, the tests unanimously indicate stationarity by forcefully rejecting the existence of a unit root. The results for differences seemingly corroborate the suspicion, hinted at by the IPS-test, that the level variables contain unit roots since the act of differencing removes any deterministic time trend in the data. An option, thus, is to fit the model in the first differences. However, there remains the possibility that the inability to reject the existence of a unit root stems from structural breaks in the data, in part from the EMU-reform but also from the Chinese accession to the WTO in 2001, at least for the trade flows since both represent trade shocks (for the trade effects of China's WTO accession, see Blancher & Rumbaugh 2004). Since all series are integrated of order one, another possibility is that they are cointegrated. Hence, while independently non-stationary they may generate a linear combination that is stationary (Enders, 2015, p. 344). A straightforward approach to test if they are cointegrated is to test the stationarity of the residuals. Indeed, both the LLC-test and the IPS-test reject the existence of a unit root in the residuals (results available in appendix 2). Had the stationarity of the residuals been ignored and had the model been fitted in the first-differences, it would have suffered from a misspecification error (ibid, p. 355).

Furthermore, as indicated by the correlograms, most variables in the model appear to follow an AR(1) process and to take this into account as well as to correct for potential simultaneity, a model featuring only the lags of these variables is fitted. With the contemporary realization of the import penetration index replaced by its lagged version, the results largely echo those of the benchmark model. The results for the treated interactions closely resemble the first model. For the untreated segment the EMU-dummy is instead negative but of roughly the same size while the coefficient for dismissal regulation continues to defy theory but at a lower rate than for the benchmark model. The coefficients for both interactions are slightly less pronounced than in the benchmark, but whether that is due to a diminishing effect over time or simultaneity bias is less straightforward. In any event, any bias introduced by simultaneity appears negligible given the close results.

VARIABLES	(1) A
EMU	-0.0374
	(0.0421)
REG	0.114
	(0.212)
IP-1	0.0306***
	(0.0118)
IP-1*EMU	0.253***
	(0.0628)
IP-1*EMU*REG	-0.201***
	(0.0465)
Observations	1,961
R-squared	0.987

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

Table 4.2

5 Conclusion

To more successfully meditate on the findings of this study, the research question is reproduced as: How does employment legislation impact average firm productivity? The empirical results indicate that employment legislation impacts average (or industry) productivity negatively. While, greater openness to international trade appear to enhance the productivity with which the average firm in each sector of the economy uses its inputs, this effect is kept from full realization by the difficulty firms face in adjusting employment. This result helps us to say something about how trade interacts with productivity when firm heterogeneity is allowed for but also how the nature of the interaction changes in the presence of misallocations. When resources are not allocated optimally, factor markets play important roles in determining how productivity gains are dispersed across countries involved in a liberalization.

While this study provides evidence suggesting the existence of relationship between dismissal regulation and the selection effect, the exact mechanism is not uncovered here. Theoretical modelling should strive to clarify the nature of how dismissal regulation prevents both optimal downward and upward adjustment of employment. Moreover, while this study has focused on labor, allowing for other or more production factors would, however, direct attention toward frictions in factor markets other than the labor market. Indeed, as suggested by Bernard et al (2007) the productivity gains enjoyed from trade may be larger for sectors producing goods for which a country is comparatively advantageous in. Hence, analyzing frictions in the trade of the factors used intensively in the production of these goods may be particularly interesting. Comparing those findings with the results of this study would shed light on how the mobility of factor markets in general impact productivity and the gains from trade.

As with any study, this study suffers from limitations. By necessity the sample is restricted by data availability. Consequently, the ambition to generalize is compromised somewhat since the countries involved are developed nations. Another limitation concerns the distinction between de facto and de jure dismissal regulation. While the index published by the OECD records the strictness of statutory dismissal regulation, it says less about enforcement. If countries differ in how vigilantly they enforce the regulation, comparing results between countries may be less meaningful. Limited time-variation also serve to caveat the findings. Legislation is less likely to change frequently than other economic data, which may preclude sufficient observations on how dismissal regulation changes over time, particularly in a small-T context.

6 Appendix

6.1 Correlograms

Graph 6.1 Value Added in Production

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.925	0.925	6321.7	0.000
		2	0.848	-0.049	11637.	0.000
		3	0.783	0.041	16172.	0.000
		4	0.723	-0.005	20038.	0.000
		5	0.668	0.002	23335.	0.000
		6	0.612	-0.033	26103.	0.000
		7	0.562	0.014	28439.	0.000
		8	0.523	0.042	30464.	0.000
		9	0.470	-0.118	32099.	0.000
		10	0.413	-0.048	33363.	0.000
		11	0.361	-0.011	34328.	0.000
		12	0.312	-0.024	35047.	0.000

Graph 6.2 Imports

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.946	0.946	9806.1	0.000
		2	0.894	-0.012	18565.	0.000
		3	0.837	-0.075	26242.	0.000
		4	0.778	-0.059	32863.	0.000
		5	0.718	-0.031	38507.	0.000
		6	0.655	-0.063	43207.	0.000
		7	0.598	0.015	47120.	0.000
		8	0.546	0.023	50385.	0.000
		9	0.476	-0.208	52872.	0.000
		10	0.412	-0.012	54731.	0.000
		11	0.353	0.029	56097.	0.000
		12	0.300	0.021	57087.	0.000

Graph 6.3 Exports

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.949	0.949	9838.4	0.000
		2	0.898	-0.021	18650.	0.000
		3	0.841	-0.088	26377.	0.000
		4	0.781	-0.057	33048.	0.000
		5	0.722	-0.020	38757.	0.000
		6	0.661	-0.058	43538.	0.000
		7	0.606	0.026	47560.	0.000
		8	0.556	0.020	50948.	0.000
		9	0.486	-0.246	53533.	0.000
		10	0.420	-0.019	55460.	0.000
		11	0.360	0.058	56881.	0.000
		12	0.306	0.009	57906.	0.000

Graph 6.4 Production

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.927	0.927	5309.3	0.000
		2	0.849	-0.073	9761.3	0.000
		3	0.781	0.038	13537.	0.000
		4	0.724	0.025	16778.	0.000
		5	0.672	0.005	19570.	0.000
		6	0.615	-0.058	21910.	0.000
		7	0.562	0.003	23866.	0.000
		8	0.519	0.035	25535.	0.000
		9	0.454	-0.191	26812.	0.000
		10	0.390	-0.016	27752.	0.000
		11	0.331	-0.012	28432.	0.000
		12	0.279	-0.013	28915.	0.000

Graph 6.5 Residuals

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.026	0.026	1.3051	0.253
		2	0.000	-0.000	1.3052	0.521
		3	0.011	0.011	1.5167	0.678
		4	0.001	0.001	1.5194	0.823
		5	0.001	0.001	1.5202	0.911
		6	-0.035	-0.035	3.8431	0.698
		7	-0.038	-0.036	6.5111	0.481
		8	-0.065	-0.063	14.358	0.073
		9	-0.033	-0.029	16.362	0.060
		10	-0.050	-0.048	20.982	0.021
		11	-0.119	-0.117	47.636	0.000
		12	-0.077	-0.076	58.754	0.000

6.2 Unit-Root Tests

Table 6.6 Unit Root Results

	Level	Level	First-Difference	First-Difference
Variable	**LLC**	**IPS**	**LLC**	**IPS**
Value Added	**-3.1*** **	**3.51**	**-37.67*** **	**-37.25*** **
Imports	**-9.7*** **	**56.3**	**-84.2*** **	**-70.3*** **
Exports	**-5.8*** **	**9.3**	**-82.3*** **	**-68.8*** **
Production	**-33.9*** **	**10*** **	**-57.9*** **	**-46.7*** **
Residuals	**-16.1*** **	**-10.5*** **	**N/A**	**N/A**

6.3 Sample

Table 6.7 Countries

Country
Austria
Belgium
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Netherlands
Poland
Portugal
Spain
Sweden

Table 6.8 Industries

Industry
Food products
Beverages
Tobacco products
Textiles
Wearing apparel
Leather and leather-related products
Wood and paper products of wood and cork, except furniture
Paper and paper products
Printing and reproduction of recorded media
Chemicals and chemical products
Basic pharmaceutical products and pharmaceutical preparations
Rubber and plastics products
Other non-metallic mineral products
Basic metals
Fabricated metal products, except machinery and equipment
Computer, electronic and optical products
Electrical equipment
Motor vehicles, trailers and semi-trailers
Other transport equipment

6.4 Alternative Models

Table 6.9 Benchmark Model with lagged dependent

VARIABLES	(1) A
A-1	0.697***
	(0.104)
EMU	0.0903**
	(0.0396)
REG	0.105
	(0.192)
IP	0.0254***
	(0.00979)
IP*EMU	0.104**
	(0.0404)
IP*EMU*REG	-0.0993***
	(0.0359)
Observations	1,857
R-squared	0.987

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

Table 6.10 Lagged model with lagged dependent

VARIABLES	(1) A
A-1	0.645***
	(0.109)
EMU	-0.0105
	(0.0352)
REG	-0.0488
	(0.194)
IP-1	-0.0343
	(0.0402)
IP-1*EMU	0.173**
	(0.0737)
IP-1*EMU*REG	-0.105**
	(0.0417)

Observations	1,768
R-squared	0.988

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

Table 6.11

VARIABLES	(1) A
EU	-0.0136
	(0.0524)
EMU	0.0412
	(0.0359)
REG	0.455*
	(0.251)
IP	0.0405***
	(0.0132)
IP*EMU	0.269***
	(0.0571)
IP*EMU*REG	-0.221***
	(0.0443)
Observations	1,975
R-squared	0.980

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

Table 6.12

VARIABLES	(1) A
EU	-0.0239
	(0.0531)
EMU	0.0691
	(0.0460)
REG	0.854***
	(0.319)
IP-1	-0.0153
	(0.0161)
IP-1*EMU	0.510***
	(0.101)
IP-1*EMU*REG	-0.380***
	(0.0775)

Observations	1,170
R-squared	0.983

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

Table 6.13 Information Criteria

Model	AIC	BIC
Benchmark Model	-700	-578
Lagged Model	-481	-358

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