Exporters' Behavior and Aggregate Implications: Three Contributions

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Ecole Doctorale SESAM - Laboratoire LEM

THÈSE

pour le Doctorat en Sciences Économiques

présentée et soutenue par

Clément NEDONCELLE

le 6 décembre 2016

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Jury

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Hubert Jayet, Professeur, Université de Lille

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Preliminary Remarks

Chapter 1 is co-authored with Léa Marchal.

Chapter 2 is co-authored with Jérôme Héricourt.

Chapter 3 is adapted from the article "Trade Costs and Current Accounts" that is published in *The World Economy*, 2016, 39: 1653-1672. doi:10.1111/twec.12318

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General Introduction

In 2012, Costas Arkolakis, Arnaud Costinot and Andres Rodriguez-Clare published in the American Economic Review an article entitled "New Trade Models, Same Old Gains?" (Arkolakis et al., 2012). Beyond its catchy title, the article raises a crucial question about the importance of micro-foundations in the trade analysis. Focusing on welfare gains from trade, the authors support that new trade models – exhibiting heterogeneous (exporting) firms – fail to deliver new answers to central questions in the field. My thesis proposes to reconsider this conclusion.

Micro-foundations of economic analysis is nothing new in the academic literature. The micro-foundation of macroeconomic analysis is generally considered as a major change in paradigm. This so-called revolution emerged in all fields of economic analysis, and international trade has largely been part of it. This change is of particular importance for at least two reasons. First, the economic analysis that is based upon micro-level optimization behavior makes the analysis immune to the Lucas critique. Then, and relatedly, the predictions and the subsequent public policy decisions derived from these models are also solely based upon agent's decisions and not only upon past observed values.

The measure of such a change has however been bounded by the limited contributions of these micro-level analyses to translate into non-trivial aggregate implications. Schematically, as long as aggregate models have homogeneous-agent micro-foundations, the link between micro and macro analysis is straightforward. Nevertheless, a potential contribution of these micro-founded models is to account for heterogeneity that may in turn shape the aggregate outcomes in a non-neutral way. To put it differently, micro-founded analyses open the door for new results with respect to existing studies potentially flawed by aggregation bias. Measuring the potential contribution of this literature can be deduced from the results in Gabaix (2011). My thesis can be included in this voluminous, but recent research program.

In the last two decades, international trade stepped into that direction by documenting how observed trade flows were in fact made of heterogeneous exporting firms, that differ from each other along many dimensions. Yet, accounting for this heterogeneity is just a first step in this agenda. In this thesis, and to put it simply, I provide additional evidence supporting exporters heterogeneity along many dimensions, allowing me then to derive non-neutral aggregate implications, of particular importance for both academics and policymakers.

A New Trade Models and Aggregate Implications

The last two decades have witnessed an active research analyzing firms exporting activity (see Melitz and Redding (2014) for an overview). Thanks to the simultaneous access to new micro data sources and to the parallel development of theoretical models, trade economists have shed light on an extensive number of micro-level questions: What determines export success and failures? How large are exporting firms? How many destinations do they serve? We now know much more the features of firm-level trade and how it may be affected by the firm environment.

Empirical findings support firm and exporter heterogeneity along a large set of dimensions. Bernard and Jensen (1997); Bernard et al. (2007) document that exporting firms are on average different from non-exporting firms, within an industry: exporters are more productive, more capital-intensive, larger in employment and assets, than domestic-only firms. Empirical evidence also emphasizes the importance of compositional effects across firms. Evidence is that firm entry, exit, participation, job creation, job destructions are important enough to shape aggregate outcomes, and in particular average productivity and trade patterns. The main conclusion of this strand of the literature is the following: firm entry and exit, and the subsequent reallocations of resources and production explain the larger aggregate trade flows much more than a standard scaling up of trade at the micro-level (Bernard et al., 2011).

These empirical results motivated theoretical research, highlighting these heterogeneous features of firm activity. Following the seminal work of Melitz (2003), theoretical research was able to rationalize the within-industry reallocation of resources, crucially affecting aggregate productivity, and improved our understanding of trade consequences on the whole economy.

However, as mentioned by Melitz and Redding (2014), the link between micro-level mechanisms and aggregate implications is not straightforward once accounting for firm heterogeneity. Focusing on welfare too, and thus replying to Arkolakis et al. (2012), Melitz and Redding (2015) show that heterogeneous and homogeneous firm models have different distributional implications, that coincide only under some "strong conditions". This result opens the door towards a disconnection between the two levels of the analysis. Heterogeneity at the micro-level may be crucial to determine aggregate outcomes, and macroeconomics. Yet, up to now, this strand of research is at its early stage.

Providing an exhaustive review of all works regarding non-trivial aggregation bias that may flaw existing studies is beyond the scope of this introduction. I however focus on a small set of results that directly motivate my work in this thesis. Imbs and Mejean (2015) support that estimates of trade elasticities are smaller at the aggregate level than at sector level. Berman et al. (2012) estimate that the aggregate trade elasticity to exchange-rate volatility is flawed by an aggregation bias. How micro-level heterogeneity shapes aggregate fluctuations has more generally be seen investigated in di Giovanni et al. (2014, 2016).

My thesis follows this path by providing additional evidence of exporters heterogeneity, allowing me then to derive non-neutral aggregate implications.

B Thesis questions, conclusions and contributions

I present the main questions raised in this thesis and the conclusions that can be drawn from this work. I then develop three dimensions along which my thesis contributes to the existing literature.

Main questions There are three main questions in this thesis.

1. A recent strand of literature has provided evidence of strong correlations between trade and migration flows. These links have mainly been investigated at the aggregate, macroeconomic level, which raises serious concerns about the identification of causal links. On top of that, very little is known about the channel through which migrants favor trade at

the micro-level. In chapter 1, we explore whether and how migrants favor trade in their employing firm.

2. While exchange-rate volatility is documented to be a strong trade-deterring determinant at the firm level, existing evidence based upon aggregate data however is hardly consistent with this fact. Most empirical studies using aggregate data estimate, at most, a very small negative effect of exchange rate volatility on trade. In chapter 2, we investigate how firms cope with exchange rate volatility. In particular, we estimate how much export reallocation possibilities helps to bridge the gap between these two views.

3. An extensive literature has investigated the key forces driving current account dynamics. The empirical literature has listed many potential candidates including openness, financial integration, and demographic trends, among others. Surprisingly, the role of trade liberalization has received less attention. In chapter 3, I ask whether trade cost reductions are a plausible explanation for growing global current account imbalances.

Main conclusions

1. In chapter 1, we estimate the pro-trade effect of foreign-born workers at the firm level using French firm-level data. We test whether foreign workers allow for efficiency gains within their firm and convey valuable information to their employer on their origin countries. We find that foreign-born workers, and especially skilled individuals, foster exports at both margins through a productivity and a trade-cost channel. We estimate that a substantial share of the pro-trade effect comes from the productivity channel.

2. In chapter 2, we find that large firms cope with exchange-rate volatility by reallocating their exports away from destinations characterised by a high exchange-rate risk. Efficient diversification of destinations served appear therefore as another way to handle exchange rate risks, and provides an explanation to the small aggregate trade response to RER volatility: if big multi-destination firms, who account for the bulk of aggregate exports, can react to an adverse shock of RER volatility somewhere by transferring trade to other and less volatile destinations, this leaves exports mainly unchanged at the macro level.

3. In chapter 3, I find that trade liberalisation affects the current accounts through changes in the national production structures and in turn national savings and investment. Using aggregate data for the OECD countries, I provide evidence that the response of current accounts to changes in trade costs depends on the capital intensity of production and on the depth of regional agreements on trade and factor mobility.

The first contribution of the thesis is to provide additional insights on exporters behavior. In the last two decades, the analysis of trade has mainly been conducted at the micro-level. In particular, a bunch of papers investigate what makes exporters successful. This type of question is particularly relevant insofar as micro-level heterogeneity is documented to have substantial and non-neutral aggregate implications. In this respect, chapters 1 and 2 are fully contributive to these research lines.

In chapter 1, when studying the pro-trade effect of migrants, we investigate whether employing migrants tends to favor the export performance of the firms, along all trade margins. We contribute to the literature since we provide evidence that firms that employ migrants export more than firms that do not. Doing so, we contribute to opening the black box of what makes exporters successful.

In chapter 2, we also provide evidence that multi-destinations exporters have additional margins to handle exchange-rate risks compared to small firms that only serves a small set of destinations. Results in this chapter suggests that the destination margin is an additional margin upon which large firms have a premium.

Results from chapter 2 also have substantial aggregate implications. Apart from solving the micro-macro puzzle about the trade elasticity to exchange rate volatility, our results emphasize that heterogenity in exporters behavior is key to understand how the aggregate elasticity of trade to exchange rate volatility is shaped.

The second contribution of the paper is to propose a new methodology to estimate the pro-trade effect of migrants. Even if this contribution solely relies on chapter 1, I believe it is one important contribution of the thesis insofar as we overcome a major limit faced by the existing literature. Existing studies investigating the pro-trade effect of migrants either focus on macro-level data, or do not overcome endogenity concerns. In this respect, we use in chapter 1 a method that allows to overcome this problem. We estimate the pro-trade effect of migrants by estimating differences in export outcomes across firms, explicitly accounting for differences in the probability to employ migrants across firms. Estimating a treatment effect of migrants at the firm-level allows us to take full advantage of the micro-level information and this method – which remains quite un-used in international economics– does not require any instrumental variables strategy to overcome endogeneity.

The third contribution of the thesis is to contribute to the debate on current policy questions. Chapter 1 first has important implications for migration policy. Our results show that foreign-born workers have a positive impact on trade flows and that the effect is not restricted to skilled workers. Our results suggest a number of policy recommendations to favour French exports. Pro-active immigration policies could create a favourable environment for exporting activities. In that respect, a simplification of labour regulations, especially for skilled immigrants, could create foreign-employment incentives for French firms. This would, in turn, create favourable conditions within the employing firm to start exporting or to expand its export activities. Policy makers should also bear in mind that any change in the French migration policy could impact French exports. For instance, a change in the selection of immigrants by region of birth, could lead to trade creation and/or trade diversion effects. This is due to the fact that immigrants not only impact their firm's productivity, but also their firm's export costs towards their origin regions.

Results presented in chapter 2 also have policy implications. A small aggregate trade elasticity to exchange rate volatility hides non-linearities and aggregate bias that are not trivial to public policy. Understanding and apprehending large firm's behavior with respect to country-specific risks is crucial precisely because these firms account for a disproportional share of exports. In turn, country-wide specialization patterns, revenues and other aggregate outcomes may be affected by these firms' behavior.

The theoretical background and the evidence provided in chapter 3 echo general concerns about global imbalances and their corrections. A common view about current accounts has emerged over the past few years: imbalances must be corrected and adjustments must be implemented (Obstfeld, 2012). Our results however suggest that socially-desirable trade reforms can produce these imbalances. One may therefore wonder whether correcting them is legitimate.

C A detailed view of the thesis

C.1 How Migrants Favor Exports

Context International migration flows are a vivid issue for both policymakers and academics. Economists not only pay attention on the causes of migrations but also focus on the consequences of migration flows, in particular for the developed countries. To mention few, Peri and Sparber (2009) and Ottaviano et al. (2013) focus on the consequences of immigration on the labor market outcomes.

In parallel, an extensive literature investigates the firm-level determinants of trade performance in foreign markets. Empirical regularities suggest that among other explanations, firm-level trade outcomes are determined by (i) the idiosyncratic firm characteristics and (ii) the capacity of the firm to overcome large country-specific trade costs. Bernard et al. (2012) provide evidence that successful exporters are more productive, larger in terms of employment, capital-intensity and financial capabilities as compared to non-successful exporters or domestic-only firms. On the other hand, informational barriers which are usually proxied by the geographic and cultural distance between countries, are known to deter export outcomes (Disdier and Head, 2008).

Migrant workers impact both aforementioned trade determinants. A number of papers show that employing migrant workers generates a productivity-enhancing task specialization within the firm Peri and Sparber (2009); Ottaviano and Peri (2012); Mitaritonna et al. (2014). This literature echoes another strand of results supporting the productivity-enhancing effect of cultural and ethnic diversity among skilled workers Goldin et al. (2011). Some macro-level studies also provide evidence that migrants convey valuable information on their origin countries which decreases *ad valorem* and fixed costs faced by exporters.

Research questions The research question is twofold. First, we are interested in the estimation of the pro-trade effect of foreign-born workers at the firm-level. Second, we are particularly interested in the identification of the mechanisms through which migrants favor trade of their employing firm.

Data We use micro-level data on French manufacturing firms over the 1997-2008 period. We identify foreign-born workers in a comprehensive matched employer-employee dataset (from firms' annual employee declarations, DADS) in which we recover the birth geographical zone of each worker. We then combine this data with balance-sheet data (from the French tax authority) and trade data (from the French customs) at the firm-product-destination level.

Method We are perfectly aware of the endogeneity bias that may flaw the standard regression of trade outcome on migration stocks at the firm level. We cannot exclude either of mis-measurement of foreign-born workers at the micro level, nor can we ignore the reverse causality – foreign workers' hiring potentially generated by firm-level trade performance. We settle two strategies to identify the pro-trade effect of migrants despite endogeneity. First, we estimate a treatment effect associated to the employment of foreign-born workers. We identify two groups of firms: a group of firms that employ migrant workers and a group that does not. We compute for each firm the probability to employ foreign-born workers, and we then match a treated firm with a non-treated one. Identification of the pro-trade effect comes from variations in export outcomes between these two firms. We thus compare two firms that, based upon observables, have similar probability to hire foreign-born workers.

Then, we estimate the two channels through which migrants may affect firm exports. The first channel is what we call a productivity channel: migrants bring multiculturality, tasks specialization and productivity gains to their employing firm. This productivity gain tends to favor exports across all destinations. The second channel is the informational channel in which migrants bring information about their origin country to their firm. This information channels is thus destination-specific. We exploit cross-country variations in exports to identify the relative strength of the two channels. We purge firm-destination trade flows from firm-year shocks that are by nature invariant across destinations. We estimate the effect of different treatments on the residual export flows that crucially varies across destinations. We adopt this strategy since we do not have information about the exact origin country of the foreign worker. We thus fully exploit the destination dimension in the trade data to purge variations in exports that are common across destinations. We then compare the estimated effect of migrants on both the residual trade at the firm-destination level and on the the total trade.

Results We estimate a positive trade effect of migrant workers. All trade margins are positively affected by the employment of foreign-born workers, *ceteris paribus*, even accounting for the different probabilities to employ migrant workers across firms. Using variations of exports across destinations, we also find that the main effect comes through the productivity channel. Employing a migrant worker not only favors trade towards its origin country , but also tends to favor exports to all destinations.

C.2 How Multi-Destination Firms Shape the Effect of Exchange Rate Volatility on Trade

Context The increasing volatility of real exchange rates (RER) after the fall of Bretton-Woods agreements has been a source of concern for both policymakers and academics. Exchange-rate volatility has been considered as an adverse effect of floating exchange rate regimes. Assessing the consequences of exchange-rate volatility is thus of particular importance in this respect.

With respect to trade, exchange rate risk increases trade costs and reduces the gains from international trade (Ethier, 1973). Surprisingly, macroeconomic evidence on the effect of exchange rate volatility on trade has however been quite mixed, yielding either small or insignificant effect on aggregate outcomes (see Greenaway and Kneller, 2007 and Byrne et al., 2008 for a survey). Common explanations for this missing evidence refer to the existence of hedging instruments for exchange rate risks, which are precisely designed to dampen the effect of exchange rate volatility on trade. At the micro (firm) level, a couple of papers provided evidence of a trade-deterring effect of real exchange rate volatility (see Cheung and Sengupta (2013) on a sample of a few thousand Indian non-financial sector firms, and Héricourt and Poncet (2015) on the population of Chinese exporters).

Research question Why does not the documented microeconomic trade-deterring effect of exchange rate volatility translate into elastic aggregate trade outcomes? The present paper aims at assessing whether reallocation of exports across destinations rationalises the gap between the two types of evidence.

Data We investigate this hypothesis using a French yearly firm-level dataset containing country- and product-specific trade data from the French Customs and balance-sheet information over the period 1995-2009.

Methodology In a standard firm-level gravity-style model known to be compatible with most of the existing theoretical frameworks, we start by assessing the impact of standard bilateral RER volatility on several definitions of export performance at the firm level, for both the intensive and extensive margins. We use firm-year fixed effects in the estimations: identification comes from variation in exports for a given firm across destinations characterised by different exchange rate volatilities.

Crucially, we then investigate whether this decision is affected by the possibility for the firm to export to another destination. Intuitively, we try to provide evidence that the baseline negative elasticity of firm-destination trade flows to RER volatility is conditional upon the possibility for firms to reallocate exports away from destinations with high volatility. We focus on how the number of destinations served by the firm and the RER volatilities in other destinations shape firm-destination trade flows.

In particular, for this purpose, we build a so-called multilateral RER volatility, which is a weighted average of the RER volatilities in other countries. This variable measures the aggregate RER volatility of the potential countries the firm could serve. We thus investigate how much the reallocation behavior of the firm depends upon both the bilateral and multilateral RER volatility, the latter acting as a dis-opportunity cost.

We finally assess the aggregate consequences of this heterogeneity. We estimate how the trade-deterring effect of bilateral RER volatility is shaped by concentration of exports at the sector level. We check that sectors for which exports are very concentrated on a few high performing firms (exporting to many destinations) are those for which total sector exports are the least sensitive to RER volatility.

Results Our results confirm that multi-destination firms have a specific behavior regarding volatility. All our results point toward the heterogeneous response of trade flows to RER depending upon the possibility for firms to reallocate exports.

First, the number of destinations magnifies the trade-deterring effect of RER volatility on firm-destination exports. Firm-destination trade flows are all the more negatively affected by RER volatility that the firm serves a large set of destinations. We infer from this result that reallocation possibilities may be key to understand this results.

Second, multi-destination firms tend to reallocate exports away from destinations with unfavorable dynamics in terms of RER volatility, i.e., bilateral relatively to multilateral RER volatility. This may be interpreted as an efficient diversification behavior, using the different destinations as an additional way for large firms to cover against market-specific risks.

Third, this heterogeneous behavior of firms depending upon the effective possibility to reallocate their exports across destinations has substantial aggregate implications. Since the bulk of exports is made by firms that are able to reallocate exports across destinations, exports are mainly unchanged at the aggregate level.

C.3 Trade Costs and Current Accounts

Context An extensive literature has investigated the key forces driving current account dynamics. The empirical literature has listed many potential candidates including openness, financial integration, and demographic trends, among others. Chinn and Prasad (2003) provide a survey of the empirically-relevant determinants of current account balance variations across countries and over time. Surprisingly, the role of trade liberalization has received less attention.

Research question Current accounts are around four times more dispersed in 2010 than in 1990, implying diverging current account balances. Over the same time period, trade costs have decreased allowing larger trade flows, at both the intensive and the extensive margin (Arvis et al., 2013). Chapter 3 asks whether these trade cost reductions are a plausible determinant of these increasing current imbalances. In particular, I investigate the changes in aggregate capital demand that in turn affect aggregate investment.

Methodology The main mechanism I rationalize in the theoretical model is the following: changes in trade costs affect the foreign asset position by affecting the industrial structure and the aggregate capital intensity of production. Empirical assessment of this prediction goes through the estimation of the joint impact of changes in trade costs and in the capital content of exports.

In a second step, I estimate how much this result is shaped by institutional integration. If the mechanism relies on capital demand changes, factor mobility should exacerbate the response of current accounts to changes in trade costs, conditionally on variations in factor demand.

The endogenous determination of the capital content of exports is corrected for by implementing an instrumental variable strategy. The World Governance Indicators from Kaufmann et al. (2010)'s data on institutional quality are used as instruments for the capital intensity of production at the country level. Following Acemoglu et al. (2001, 2005), institutional quality is a strong determinant of growth, and a significant part of the effect is channeled through investment.

Data I use aggregate data for the OECD countries between 1988 and 2005. I estimate country-year specific capital content of export using sectoral trade data that I merge with sectoral factor content data. My main measure of trade costs is from Arvis et al. (2013) in which trade costs are estimated using the inverted gravity method (Novy, 2013).

Results I find that regional integration affects current accounts through changes in specialization patterns and in investment needs. I estimate a positive joint effect of capital intensity and trade costs on current accounts: ceteris paribus, when trade costs decrease, countries where production is oriented towards capital-intensive activities have larger current account deficits, consistently with the existence of a higher demand for capital in these countries. This result is exacerbated by depth of regional agreements, suggesting that factor –crucially capital– is key to determine the effect of trade liberalization on current accounts.

Chapter 1

How Migrant Workers Foster Exports

1.1 Introduction

In this chapter, we estimate and decompose the pro-trade effect of foreign-born workers at the firm level. An extensive literature investigates the firm-level determinants of trade performance on foreign markets. Empirical regularities suggest that firm-level trade outcomes are mainly determined by (i) the idiosyncratic firm characteristics and (ii) the capacity of the firm to overcome large country-specific trade costs. Bernard et al. (2012) provide evidence that successful exporters are more productive and larger in terms of employment, capital-intensity and financial capabilities as compared to non-successful exporters or domestic-only firms. This within-industry selection of exporting firms through productivity has been rationalised by the seminal model of Melitz (2003). On the other hand, informational barriers which are usually approximated by the geographic and cultural distance between countries, are known to deter export outcomes Disdier and Head (2008).

Foreign workers impact both aforementioned trade determinants. First, some papers show that employing migrant workers generates a productivity-enhancing task specialisation within the firm Peri and Sparber (2009); Ottaviano and Peri (2012); Mitaritonna et al. (2014). No bridge has however been proposed between these results and the trade-migration literature so far . Second, a number of macro-level studies provide evidence that migrants convey valuable information on their origin countries which decreases *ad valorem* and fixed costs faced by exporters. Thus, they foster trade between their origin and host countries at the extensive margin Gould (1994); Rauch (2001) and at the intensive margin Felbermayr and Toubal (2012).

The impact of the firm's workforce on its export outcomes has attracted little attention until now. To the best of our knowledge, Hiller (2013) published the only firm-level study on the topic. The author shows that firms, in order to access the knowledge embedded in the foreign population of their country, should indeed employ foreign workers.

In this chapter, we investigate the different channels through which foreign workers impact firm-level exports at both trade margins. To this end, we develop a theoretical framework with heterogeneous firms in monopolistic competition resting upon the model of Melitz (2003). We assume that foreign workers allow their firm to be more efficient, and convey valuable information to their employer on their origin countries. Our model predicts that foreign-born workers should foster exports at both margins towards any destination country. This pro-trade effect can be decomposed in a productivity effect (to which any foreign worker contributes) and a trade-cost effect (to which only foreign workers who were born in the export destination contribute). Doing so, we show that export cutoffs are destination- and firm-specific and depend on both their exogenous productivity and their employment of foreign workers.

We test these predictions using a dataset on French manufacturing firms over the 1997-2008 period. We identify foreign-born workers in a comprehensive matched employer-employee dataset (from firms' annual employee declarations) that we combine with balance sheet data (from the French tax authority) and trade data (from the French customs) at the firm-product-destination level. Aware of the reverse causality bias – foreign workers employment is potentially generated by firm-level trade performance – we take full advantage of the firm-level data by estimating the trade-induced effect of foreign-born workers using a propensity score matching (PSM) approach. We find that both trade margins positively react to the employment of foreign-born workers, *ceteris paribus*. The effect is all the more present when foreign workers are skilled. Our results are robust to alternative matching procedures, alternative sub-samples and alternative treatments. Finally, we are able to disentangle the two channels through which foreign-born workers impact the export outcomes of their firm. Using variations in the export performance of the firm across destinations, we find that foreign-born workers, and especially skilled individuals, foster exports at both margins through a productivity and a trade-cost channel. We estimate that the productivity channel represents a substantial share of the total pro-trade effect of foreign-born workers. Depending on the treatment we study, we find that most of the pro-trade effect of migrants operates through this productivity effect.

The contributions of the chapter are the following. First, we propose a theoretical model of heterogeneous firms rationalising the pro-trade effect of foreign workers. To the best of our knowledge, the only attempt to provide a theoretical framework to show how migrants foster exports has been made by Felbermayr and Toubal (2012). We depart from this article by providing a heterogeneous-firm approach to this research question.

Second, we depart from existing empirical studies on the trade-migration nexus by proposing a firm-level analysis. The advantage of using firm-level migration data in this context is twofold. We are very much more confident in the quality of firm-level data, than in aggregate migrant stock data from census or surveys. On top of that, micro-level data also allows us to identify micro-level mechanisms, that cannot be captured using aggregate data, in which the causal direction may be flawed. Both reasons point towards a better identification of the pro-trade effect of migrants. Then, we depart from the few existing firm-level studies by proposing an alternative estimation strategy. While most papers tend to overcome reverse causality using regional-level variables to instrument the firm's foreign employment, we estimate the trade-induced effect of employing foreign workers thanks to a PSM approach. This method allows us to take full advantage of the firm-level data, and not rely on any aggregate migration data.

Closer to our paper is the work of Hiller (2013), from which we depart both by proposing a theoretically-funded approach, and by empirically disentangling the different channels through which foreign workers foster exports.

Finally, we provide additional insights to the black-box of export success and failure. Despite recent contributions, what makes an exporter successful is still not fully rationalised. Our analysis offers one explanation to the incomplete connection between export success and firm-level observable characteristics.

The rest of the chapter is organised as follows. In the next section we present the related literature on the export-migration nexus. In Section 1.3, we present the French firm-level dataset and a set of stylised facts. In Section 1.4, we develop a theoretical framework rationalising the pro-trade effect of foreign workers. In Section 1.5, we present a first set of results supporting the pro-trade effect of foreign-born workers derived from a PSM approach. We disentangle the productivity from the trade-cost effect in Section 1.6. Section 1.7 concludes.

1.2 Exports and migration

The trade-cost effect

Migrants, and especially skilled individuals, convey valuable information between their origin and host countries which fosters exports towards their origin countries. At the firm level, foreign workers advise their employers on their foreign activities thanks to their knowledge of international markets. They lower cultural and linguistic barriers, promote trust and reduce risk which allows for better contracts' enforcement. Doing so, they lower *ad valorem* and fixed export costs and thus enhance exports.

Theoretically, Felbermayr and Toubal (2012) use a partial equilibrium gravity equation to show that immigrants foster exports by reducing *ad valorem* export-costs. In this model, trade-costs depend on the share of foreign population that were born in the export destination country. Empirically, they find that immigrants do reduce trade-costs, this effect accounting for 37% of the total effect of immigration on bilateral trade.[1] This effect tends to be higher for high skilled individuals. A large set of empirical studies with similar results is available on the topic; see the pioneering work of Gould (1994), Head and Ries (1998) and Rauch (2001) and the work of Hatzigeorgiou (2010), Peri and Requena-Silvente (2010) and Aleksynska and Peri (2014).

At the micro-level, Hiller (2013) shows that immigrants may reduce both *ad valorem* and fixed export costs by relaxing informational barriers thanks to their superior knowledge of foreign-markets. Using employer-employee data on Danish manufacturing firms over 1995-2005, the author shows that foreign employment increases the exported quantities and impacts the composition of exports.

The productivity effect

Migrant workers may also foster exports by increasing the productivity of their firms. Two strands of the literature can be related to this productivity channel. First, the literature initiated by Peri and Sparber (2009) shows that natives and immigrants are imperfect substitutes, and that immigrants push towards a task specialisation (foreign workers specialise in manual tasks while natives specialise in communication intensive tasks) which allows for productivity gains. Based on this approach, using French firm-level data over 1995-2005, Mitaritonna et al. (2014) find that an exogenous increase in the local supply of immigrants fosters firm productivity.

Second, immigrants may either positively or negatively impact the outputs of their firms by increasing the cultural diversity among workers. On the one hand, skilled foreign workers reinforce the efficiency of their firm, because cultural diversity enhances innovation and problem solving which leads, for instance, to more patent filings. Their entrepreneurship capacities and potential to innovate is attested by a number of success stories: the creators of Google, Yahoo, Intel, eBay, Paypal were all immigrants Goldin et al. (2011). In addition, immigrants increase the ability of their firm to compete in global markets. They have an export know-how that can be adapted to any foreign market Parrotta et al. (2016). On the other hand, ethnic diversity may create linguistic and cultural frictions which may lead to communication problems, and weaken trust and social ties between workers. Parrotta et al. (2014) present evidence that cultural diversity negatively impacts productivity. A number of papers in the management literature also present mixed evidence regarding the advantages of multiculturalism Loth (2009); Goodall and Roberts

[1] The remaining 63% are due to the preference channel, that is the demand of immigrants for foreign goods which fosters imports.

(2003).

1.3 Data and stylised facts

1.3.1 Data

We merge three datasets providing us information on French firms over the 1997-2008 period, using a unique administrative French firm identifier (the SIREN number).

First, we use the firms' annual employee declarations (Déclarations Annuelles des Données Sociales, DADS) containing exhaustive information on the employment of firms settled on the French metropolitan territory from 1997 to 2008. This administrative database is made of compulsory reports provided by each employer on the gross earning of his employees. All wage-paying individuals and legal entities established in France are required to file payroll declarations; only individuals employing civil servants are excluded from filing such declarations. The dataset is thus made of information at the firm-employee-year level.

More especially, we have information about the geographical zone of birth of each worker. The *etrang* variable allows us to know whether an employee was born in France or in a foreign country. We assume that when the *etrang* variable is left empty, the worker was born in France. The dataset however does not contain information about the exact country of birth of foreign workers. In the rest of the chapter, we consider foreign workers as foreign-born workers. Note that we cannot identify naturalised individuals who thus are considered as foreigners. We also have information on the socio-professional category of each worker. We combine this information with a classification of categories into white- and blue-collar occupations to identify skilled and unskilled workers, displayed in the Appendix A, in Table A.1 (Bombardini et al., 2015).

We aggregate these employee-level data at the firm-level and count, for each firm, the number of natives and foreign workers for each skill category. After removing obvious outliers and extreme values, DADS data are in line with macro-level evidence. For instance, in 2006 in the *Ile-de-France* region, 13.6% of workers are foreign-born, while the estimated share of migrants in total working-age population is 12.9% in the partial 2006 census. The final sample is made of 21,157,647 observations at the firm-year level, that corresponds to an average of 2,000,000 firms per year. In this sample, foreign-born workers represent 7.49% of all workers, which is close to the estimates proposed by Brücker et al. (2013).

The advantage of using firm-level migration data in our case is threefold. We are more confident in the quality of firm-level data, than in aggregate migrant stock data from surveys. We also rely on firm-level data to solely focus on the immigrant working population. On top of that, micro-level data allow us to identify micro-level mechanisms that cannot be captured using aggregate data, in which the causal direction may be flawed. These reasons point towards a better identification of the pro-trade effect of foreign workers on exports.

Then, we use firm-level trade data from the French customs over the 1997-2008 period. This database reports the volume (in tons) and the value (in Euros) of exports for each CN8 product (European Union Combined Nomenclature at 8 digits) and destination, for each firm located on the French metropolitan territory. Some shipments are excluded from this data collection. Inside the EU, firms are required to report their shipments by product and destination country only if their annual export value exceeds the threshold of 150,000 Euros. For exports outside the EU, all flows are recorded unless their value is smaller than 1,000 Euros or one ton. Yet, these thresholds eliminate a very small proportion of the total exports. From this dataset, we only keep merchandise shipments, excluding agricultural and services exports. The trade dataset consists in 26,186,006 observations at the firm-year-destination-product level, that we aggregate into 7,110,894 observations at the firm-year-destination level and into 1,381,500 observations at the firm-year level. Once combined with the DADS data, we obtain a dataset of 21,157,647 firm-year observations over the 1997-2008 period, in which 1,043,790 are exporters (representing 98% of total French exports) and 20,113,857 are non-exporting firms.

We complete the picture using a balance-sheet dataset constructed from reports of French firms to the tax administration over the 1997-2008 period (Bénéfices Réels Normaux, BRN). This dataset provides us with information on the value added, total sales, capital stock, debt structure and other variables at the firm level. Importantly, this dataset is composed of both small and large firms, since no threshold applies on the number of employees for reporting to the tax administration. The BRN dataset contains between 550,000 and 650,000 firms per year (around 50% of the total number of French firms). In total, the dataset is made of 5,850,838 firm-year observations of which 5,425,621 can be merged into the sample of 21,157,647 firm-year observations. Depending on the year, these firms represent between 90% and 95% of French exports contained in the customs data.

Descriptive statistics are reported in Table 1.1. Looking at firms' employment, we observe that non-exporters and exporters employ about 95.5% of natives over their total workforce. Note that about 76.29% of firms do not employ any foreign worker in the sample. We also see that most foreign-born workers hold low-skilled jobs. On average, exporters tend to hire more skilled foreign workers than non-exporters.

Table 1.1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
FIRM CHARACTERISTICS					
Profit (in thousands of Euros)	5,425,621	0.210	16.722	-14,710.550	8,099
Revenue (in thousands of Euros)	5,425,621	6.014	597	0	697,523
Assets (in thousands of Euros)	5,425,621	13.860	1,298	0	1,266,449
Capital intensity	5,425,621	83.210	2,323	0	1,265,299
Age (since creation)	4,787,889	16.050	13.220	0	88
Apparent labour productivity	5,425,621	60.910	6,688	0	1.35E+007
TRADE					
Exported value (in thousands of Euros)	1,043,790	3,218	71,816	0	1.51E+007
Exported quantity	1,043,790	1,762	43,028	0	8,766,293
Export destinations	1,043,790	5.960	10.170	1	174
Exported products	1,043,790	22.400	102.195	1	10,194
Participation dummy	4,603,472	0.049	0.217	0	1
EMPLOYMENT PER TYPE OF FIRM					
Panel A: Exporters					
Share of French workers	748,160	0.958	0.145	0	1
Share of foreign workers	748,160	0.041	0.145	0	1
Panel B: Non-exporting firms					
Share of French workers	4,603,472	0.961	0.136	0	1
Share of foreign workers	4,603,472	0.038	0.018	0	1
SKILLED EMPLOYMENT PER TYPE OF FIRM					
Panel A: Exporters					
Share of French skilled workers	748,160	0.165	0.311	0	1
Share of foreign skilled workers	748,160	0.008	0.071	0	1
Panel B: Non-exporting firms					
Share of French skilled workers	4,603,472	0.077	0.213	0	1
Share of foreign skilled workers	4,603,472	0.004	0.045	0	1

1.3.2 Stylised facts

We now focus on the characteristics of firms that employ foreign-born workers, as compared to firms that do not. We plot the distributions of two firm-level characteristics that are generally associated to trade outcomes for these two groups of firms. Figure 1.1 presents the Kernel distributions of the assets (in log) for both groups. The two distributions are very close. They have the same shape. The distribution of firms employing no foreign worker is slightly on the left with respect to the second distribution. It suggests that firms hiring no foreign worker may be smaller. The same conclusion is reached when representing distributions for the capital intensity shown in Figure 1.2. In this case, the two distributions are hardly distinguishable. Thus, the two groups of firms do not seem to be very different.

Figure 1.1: Distributions of assets by types of firms

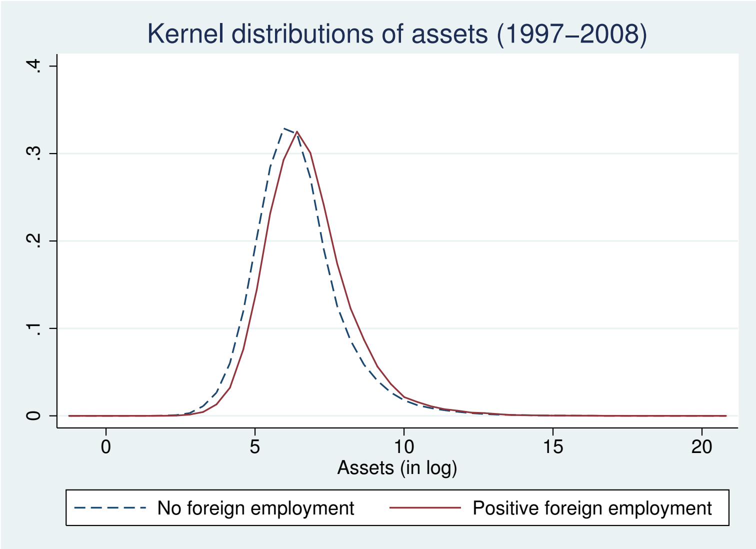


Figure 1.2: Distributions of the capital intensity by types of firms

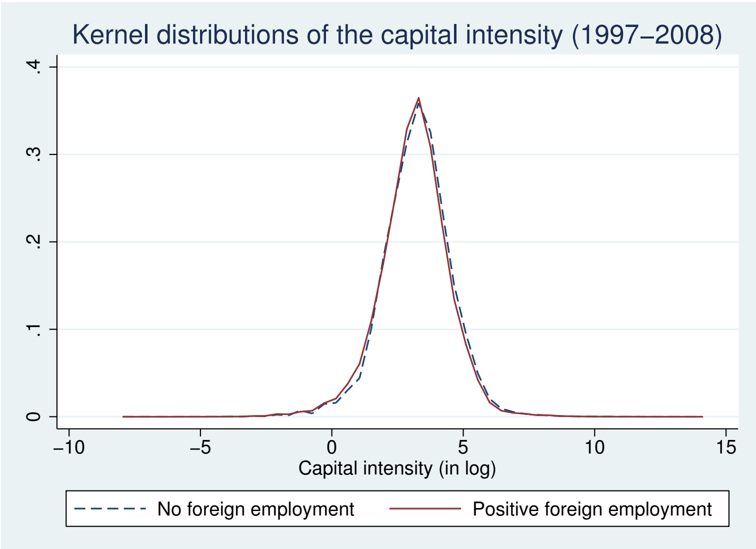
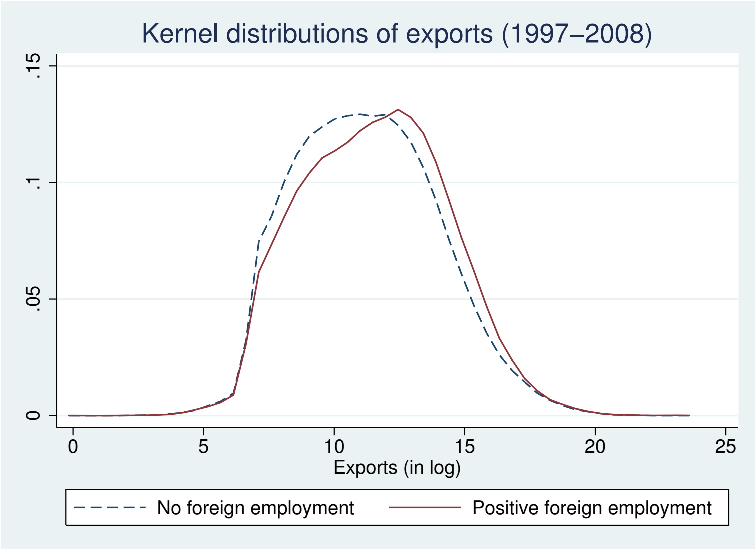


Figure 1.3 shows the distributions of the exports (in log) by firm-year level. Contrarily to previous dimensions, the two distributions seem to be distinct: the first distribution (firms employing no foreign worker) is slightly on the left with respect to the second distribution (firms employing foreign workers). The shapes of the two distributions also seems to be distinct. On average, firms that employ foreign-born workers seem to export substantially more.

Figure 1.3: Distributions of total exports by types of firms



If the two types of firms are not different on average, except in their export outcomes, it gives a rationale to compare two firms that only differ in their foreign employment to identify the effect of foreign workers on exports. In that case, the comparison is less likely to be flawed and biased by firm size or firm performance, which do not seem on average to be correlated with foreign employment. This aggregate information is an additional support for the following theoretical analysis based upon first-order selection effects. It also supports the following empirical strategy, which consists in comparing trade outcomes from firms that only differ in their foreign employment.

1.4 Theoretical framework

In this section, we build a model of heterogeneous firms in monopolistic competition resting upon the model of Melitz (2003). We consider two sources of heterogeneity: firms are not only heterogeneous in their productivity level but also in their employment of foreign workers. Then, we analyse first-order selection effects, in other words we investigate whether employing foreign workers (i) determines the choice of the firm to supply a foreign market, and whether (ii) it allows that firm to produce larger quantities for each foreign market it supplies. Therefore, in our model, export cutoffs are destination- and firm-specific.

1.4.1 Model set-up

Let us consider a world with $n+1$ symmetric countries open to trade: a domestic country denoted d and n foreign countries indexed by x. The domestic country is endowed with a stock of composite labour denoted L. Following Borjas (2003), we assume this composite labour is a CES aggregate made of native and foreign-born workers who are imperfect substitutes:

$$L = \left[\sum_o \theta^o \left(L^o \right)^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} \quad ; \ \forall o = \{d, m\} \tag{1.1}$$

The subscript o denotes the origin of a worker such that $o = \{d, m\}$ where d refers to *domestic-born* and m refers to *foreign-born.* θ^o denotes the origin-specific productivity level of the workers, and δ is a positive constant denoting the elasticity of substitution between the two types of workers.

We further assume that foreign workers, disregarding their birth country, are perfect substitutes:

$$L^m = \sum_{x=1}^{n} L^x \tag{1.2}$$

where L^x denotes the stock of foreign workers who were born in the foreign country x.

Workers are paid at their marginal productivities, and the wage of one unit of labour composite factor equals unity which ensures the factor price equalisation among countries.

1.4.2 Demand

The preferences of a representative consumer are given by the following CES utility function:

$$U = \left[\int_{i \in \Omega} \left(q_i \right)^{\frac{\sigma-1}{\sigma}} \mathrm{d}i \right]^{\frac{\sigma}{\sigma-1}} \tag{1.3}$$

where Ω denotes the set of available varieties, q_i is the demand for variety i and σ denotes the elasticity of substitution between any two goods. The aggregate set of varieties is consumed as an aggregate good ($Q \equiv U$). The associated aggregate price is given by:

$$P = \left[\int_{i \in \Omega} \left(p_i \right)^{1-\sigma} \mathrm{d}i \right]^{\frac{1}{1-\sigma}} \tag{1.4}$$

where p_i is the price of variety i.

Solving the consumer maximisation program gives the demand for variety i: $q_i = Q \left(\frac{p_i}{P} \right)^{-\sigma}$, and the expenditure on variety i: $r_i = R\left(\frac{p_i}{P}\right)^{1-\sigma}$, where R denotes the aggregate revenue spent in the country so that $R = PQ$.

1.4.3 Supply

We consider a continuum of firms operating under monopolistic competition and indexed by i. Thus, the number of firms also equals the number of varieties available in the country.

Firm's characteristics

Any firm i is characterised by an *exogenous* productivity level drawn from a random distribution and denoted ϕ_i, and by an *endogenous* productivity level denoted α_i. Together, ϕ_i and α_i determine the *global* productivity of the firm: $g_i = \phi_i \alpha_i$.

The endogenous productivity level depends on the workforce composition of the firm in term of foreign employment and is given by:

$$\alpha_i = \alpha(\lambda_i^1, ..., \lambda_i^n) \tag{1.5}$$

where λ_i^x denotes the share of workers born in the foreign country x ($\forall x = 1...n$) and employed by firm i.[2] The function α is defined over $[0,1]^n$. It is symmetric and concave in its arguments such that there exists an optimum of the workforce composition that maximises the endogenous productivity of the firm. Let the *productivity channel* denotes the effect through which the workforce composition impacts the productivity of the firm.

Firm i selects the composition of its workforce in order to maximise its global productivity. However, its choice is constrained by the scarcity of foreign workers on the labour market. Thus, its employment of foreign workers is always sub-optimal such that its endogenous productivity increases or remains unchanged when its share of workers born in country x increases:

$$\frac{\partial \alpha_i}{\partial \lambda_i^x} \geq 0 \, \forall \, x = 1...n \tag{1.6}$$

Note that different firms may be constrained differently in their choices of foreign employment. Condition (1.6) makes sense for two reasons. First, if foreign workers had a negative impact on the productivity of their firms, no firm would employ them and there would be no solution to

[2]We consider that $\lambda_i^d + \sum_{x=1}^{n} \lambda_i^x = 1$ where λ_i^d denotes the share of native workers employed by firm i.

the model. Second, the share of immigrants in France is not very large over the studied period (7% according to Brücker et al., 2013), so we can consider them as a scarce resource.

Finally, firm i has no intrinsic preference regarding the origin of its foreign workers. The set of foreign workers it hires depends on a stochastic process. Firms are therefore heterogeneous in their employment of foreign workers born in a specific foreign country.

Domestic production

Firm i produces under increasing returns to scale. Its technology to produce q_i^d units of goods for the domestic market is given by: $c_i^d = \frac{1}{g_i} q_i^d + f^d$, where $\frac{1}{g_i}$ represents its marginal cost and f^d is a positive constant greater than unity denoting a domestic market entry cost.[3]

Firm i's ex-ante profit on the domestic market is given by:

$$\pi_i^d = R \left(\frac{p_i^d}{P} \right)^{1-\sigma} - \frac{1}{g_i} q_i^d - f^d \tag{1.7}$$

After maximisation, we obtain the price of variety i when sold on the domestic market: $p_i^d = \left(\frac{\sigma}{\sigma - 1} \right) \frac{1}{g_i}$. Introducing the price in the demand function, we obtain the quantity produced by firm i for the domestic market: $q_i^d = Q \left[P \left(\frac{\sigma - 1}{\sigma} \right) g_i \right]^{\sigma}$. Finally, introducing these last two equations in equation (1.7), we find the ex-post profit of firm i realised on the domestic market:

$$\pi_i^d = \frac{R}{\sigma} \left[P \left(\frac{\sigma - 1}{\sigma} \right) g_i \right]^{\sigma - 1} - f^d \tag{1.8}$$

Export to market x

The technology of firm i to produce q_i^x units of goods for a foreign market x is given by: $c_i^x = \frac{\tau_i^x}{g_i} q_i^x + f_i^x$, where τ_i^x denotes a variable cost to export the merchandise and f_i^x denotes a positive foreign market entry cost.

The variable cost is greater than unity and firm-specific: $\tau_i^x = T^x + \tau\left(\lambda_i^x\right) \mapsto \mathbb{R}^{+*}$ where T^x denotes a constant greater than unity. Foreign workers born in country x provide their firms with information on their origin countries, which decreases the variable export cost of towards that destination:

$$\frac{\partial \tau\left(\lambda_i^x\right)}{\partial \lambda_i^x} \leq 0 \tag{1.9}$$

[3]Note that because we consider a one time-period model, we make no distinction between fixed and sunk costs.

The fixed cost is positive and firm-specific. It is given by: $f_i^x = f(\lambda_i^x) \mapsto \mathbb{R}^{+*}$ where the function f represents the firm-specific component of the cost. Here again, we assume that foreign workers decrease export cost towards their origin countries such that:

$$\frac{\partial f(\lambda_i^x)}{\partial \lambda_i^x} \leq 0 \tag{1.10}$$

Furthermore, it is more costly to enter a foreign market than to enter the domestic market, so that: $f^d \leq f_i^x \, \forall i \, \forall x \neq d$. In addition, because export costs differ across countries, firm i may not export towards all foreign destinations.

Let the *trade-cost channel* denotes the effect through which foreign workers impact the export costs of their firms.

Firm i's ex-ante profit on market x is given by:

$$\pi_i^x = R\left(\frac{p_i^x}{P}\right)^{1-\sigma} - \frac{\tau_i^x}{g_i} q_i^x - f_i^x \tag{1.11}$$

After maximisation, we find the price charged by firm i on market x: $p_i^x = \left(\frac{\sigma}{\sigma-1}\right)\frac{\tau_i^x}{g_i}$. Introducing the price in the demand function, we obtain the quantity sold on market x: $q_i^x = Q\left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{g_i}{\tau_i^x}\right]^{\sigma}$. Then, introducing these last two equations (price and quantity) in equation (1.11), we find the ex-post profit of firm i on market x:

$$\pi_i^x = \frac{R}{\sigma}\left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{g_i}{\tau_i^x}\right]^{\sigma-1} - f_i^x \tag{1.12}$$

Finally, since $\pi_i^d \geq \pi_i^x \, \forall x \neq d$, when firm i is able to supply market x, it is also able to supply the domestic market. Thus, there is no export-only firm.

1.4.4 First-order selection effects

Assuming that a general equilibrium exists and because the firm's profit is continuous and decreasing in the marginal cost, we are able to study the emergence of first-order selection effects Mrázová and Neary (2013).[4] In other words, we consider that firms are small so their

[4] According to Mrázová and Neary (2013), a number of papers show that an equilibrium exists in any general model of monopolistic competition (Negishi, 1961; Arrow and Hahn, 1971). This is likely to be the case for our model since its structure is similar to the model of Melitz (2003). We depart from this seminal model by considering two sources of heterogeneity: firms are not only heterogeneous in their productivity level but also in their employment of foreign workers. Thus, the only difference is that export cutoffs are destination- and firm-specific.

actions have no impact on the general equilibrium, which allows us to study whether differences in foreign employment induce differences in export behaviours. The theoretical predictions of the model detailed hereafter are summarised in Table 1.2.

Selection into the domestic market

Proposition 1. *The domestic profit of any firm i is an increasing function of its global productivity and is given by:* $\pi_i^d(g_i)$. *Due to the existence of a positive fixed cost to enter the domestic market, then* $\pi_i^d(0) = -f^d < 0\,;\ \forall i$. *Thus, there exists a unique productivity threshold to enter the domestic market,* g^*, *such that* $\pi^d(g^*) = 0$.

Corollary 1.1. *Firms having a productivity below* g^* *would earn a negative profit, thus they do not enter the domestic market.*

Export performance at the extensive margin

Proposition 2. *The profit of any firm i realised on a foreign market x is given by* $\pi_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$. *Due to the existence of a positive entry cost on market x* (f_i^x)*, the zero-profit condition* ($\pi_i^x = 0$) *implicitly defines a firm-specific threshold function for market x given by:* $\psi_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$.

Corollary 2.1. ψ_i^x *denotes the lowest ability firm i should get to supply market x.*

Proposition 3. *The higher firm i's exogenous productivity,* ϕ_i, *the higher its probability to match market x's entry threshold such that:* $\frac{\partial \psi_i^x}{\partial \phi_i} < 0$.

Proof. To enter market x, firm i should get a positive profit: $\pi_i^x \geq 0$. Its probability to serve market x is then given by: $\Pr(\pi_i^x \geq 0)$. We find that the higher firm i's exogenous productivity, the higher its profit on market x:

$$\frac{\partial \pi_i^x}{\partial \phi_i} = \frac{\sigma - 1}{\sigma} R \left[P \left(\frac{\sigma - 1}{\sigma} \right) \frac{\alpha_i}{\tau_i^x} \right]^{\sigma - 1} \phi_i^{\sigma - 2} > 0 \tag{1.13}$$

and hence the higher its probability to serve that market. □

Proposition 4. *The higher firm i's foreign employment, the higher its probability to match market x's entry threshold such that:* $\frac{\partial \psi_i^x}{\partial \lambda_i^x} < 0\, \forall x$.

Proof. Let us look at what happens to the profit on market x, when firm i increases its employment of foreign workers coming from country x:

$$\frac{\partial \pi_i^x}{\partial \lambda_i^x} = \frac{\sigma-1}{\sigma} R\left[P\left(\frac{\sigma-1}{\sigma}\right)\right]^{\sigma-1}\left(\frac{g_i}{\tau_i^x}\right)^{\sigma-2}\left(\frac{\partial g_i}{\partial \lambda_i^x}\tau_i^x - g_i\frac{\partial \tau_i^x}{\partial \lambda_i^x}\right)\frac{1}{(\tau_i^x)^2} - \frac{\partial f_i^x}{\partial \lambda_i^x} > 0 \quad (1.14)$$

On the one hand, for a given exogenous productivity (ϕ_i), a marginal increase in the share of foreign workers coming from country x induces an increase in the firm's global productivity:

$$\frac{\partial g_i}{\partial \lambda_i^x} = \phi_i \frac{\partial \alpha\left(\lambda_i^1, ..., \lambda_i^n\right)}{\partial \lambda_i^x} \geq 0\, \forall x \quad (1.15)$$

On the other hand, a marginal increase in the share of foreign workers coming from country x induces a reduction of firm i's variable and fixed export costs towards market x. Hence, when firm i increases its employment of foreign workers coming from country x, its profit on market x increases, and so its probability to serve that market increases.

Let us now look at what happens when firm i increases its employment of foreign workers coming from another foreign country x' :

$$\frac{\partial \pi_i^x}{\partial \lambda_i^{x'}} = \frac{\sigma-1}{\sigma} R\left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{1}{\tau_i^x}\right]^{\sigma-1}(g_i)^{\sigma-2}\frac{\partial g_i}{\partial \lambda_i^{x'}} > 0\, \forall x' \neq x \quad (1.16)$$

From equation (1.15), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. However, it does not impact its variable and fixed export costs towards market x. We can conclude that firm i's probability to serve market x increases with its employment of foreign workers coming from country x'. □

Corollary 4.1. *For any two firms i and i' only differing in their employment of foreign workers born in country x such that $\lambda_i^x < \lambda_{i'}^x$ then* $\Pr\left(\pi_i^x \geq 0\right) < \Pr\left(\pi_{i'}^x \geq 0\right)$.

Empirically, we should observe that the probability to enter a foreign market depends positively on the firm's employment of foreign workers born in that country. We could then conclude that foreign workers foster exports towards their origin countries at the extensive margin. Yet, this positive effect could corroborate the existence of both (or either one of) the studied channels: foreign workers can increase the productivity of their firms, but they can also decrease the export costs of their firm towards their origin countries.

Corollary 4.2. *For any two firms i and i' only differing in their employment of foreign workers* *born in country x' such that $\lambda_i^{x'} < \lambda_{i'}^{x'}$ then* $\Pr(\pi_i^x \geq 0) < \Pr(\pi_{i'}^x \geq 0)$.

Empirically, we should also observe that the probability to enter a foreign market depends positively on the firm's employment of foreign workers born in any other country than this destination. We could then conclude that foreign workers affect foreign activities by increasing their firm's productivity, and corroborate the existence of the productivity channel.

Export performance at the intensive margin

Proposition 5. *The higher firm i's foreign employment, the higher its exported quantity towards market x.*

Proof. Firm i's exported quantity towards market x is given by: $q_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$. Let us look at what happens to the exports of firm when its employment of foreign workers coming from country x increases:

$$\frac{\partial q_i^x}{\partial \lambda_i^x} = \sigma Q \left[P\left(\frac{\sigma-1}{\sigma}\right)\right]^{\sigma} \left(\frac{g_i}{\tau_i^x}\right)^{\sigma-1} \left(\frac{\partial g_i}{\partial \lambda_i^x}\tau_i^x - g_i \frac{\partial \tau_i^x}{\partial \lambda_i^x}\right)\frac{1}{(\tau_i^x)^2} > 0 \tag{1.17}$$

From equation (1.15), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. In addition, this marginal increase impacts its variable export costs towards market x. Hence, firm i's exported quantity towards market x increases with its employment of foreign workers coming from country x.
Let us now look at what happens when firm i increases its employment of foreign workers coming from another foreign country, x':

$$\frac{\partial q_i^x}{\partial \lambda_i^{x'}} = \sigma Q \left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{1}{\tau_i^x}\right]^{\sigma} (g_i)^{\sigma-1} \frac{\partial g_i}{\partial \lambda_i^{x'}} > 0 \, \forall x' \neq x \tag{1.18}$$

From equation (1.15), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. However, it does not impact its variable export cost towards market x. Hence, firm i's exported quantity towards market x increases with its employment of foreign workers coming from country x'. □

Corollary 5.1. *For any two firms i and i' only differing in their employment of foreign workers from country x such that $\lambda_i^x < \lambda_{i'}^x$ then $q_i^x < q_{i'}^x$.*

Empirically, we should observe that foreign workers born in the export destination foster exports at the intensive margin. However, this could corroborate the existence of both studied channels.

Corollary 5.2. *For any two firms i and i' only differing in their employment of foreign workers from country x' such that $\lambda_i^{x'} < \lambda_{i'}^{x'}$ $\forall x' \neq x$ then $q_i^x < q_{i'}^x$.*

Empirically, we should also observe that employing foreign workers from any other country than the export destination, fosters exports at the intensive margin. This would corroborate the existence of a productivity channel.

Table 1.2: Impacts of foreign workers on their firm's export performance

	Productivity effect	Trade-cost effect	
	global productivity g_i	variable cost τ_i^x	fixed cost f_i^x
Extensive margin			
$\mathrm{d}\Pr\left(\pi_i^x \geq 0\right)/\mathrm{d}\lambda_i^x$	+	+	+
$\mathrm{d}\Pr\left(\pi_i^x \geq 0\right)/\mathrm{d}\lambda_i^{x'}$	+	0	0
Intensive margin			
$\partial q_i^x/\partial\lambda_i^x$	+	+	0
$\partial q_i^x/\partial\lambda_i^{x'}$	+	0	0

1.5 Pro-trade effect of foreign-born workers

We now estimate the export-induced effect of foreign-born workers at the firm level. We first argue that our empirical strategy has to account for endogeneity concerns. We then present the propensity score matching strategy we use. We report the results in the last part of this section.

1.5.1 Endogeneity concerns

When estimating the impact of immigration on trade, an important endogeneity concern relates to the existence of a reverse causality bias. As documented by Hatzigeorgiou and Lodefalk (2014), existing studies adopting instrumental variable techniques show that the causal relation runs from immigration to trade. However, they underline that this result may not be generalised. For instance, it may be the case that immigration depends on the conditions of the host country's labour market, which in turn depend on the importance of trade in that country's economy.

At the micro level, firms' export performance may determine their decisions to employ foreign workers. To the best of our knowledge, only one paper shows a potential reverse causality. Molina and Muendler (2013) find that firms planning to export adapt their workforce by hiring workers from other exporters in order to improve their foreign market access. Even if we provided evidence in section 1.3.2 that firms employing foreign-born workers and firms employing none are not systematically different along assets and capital intensity, we cannot exclude that this reverse causality is not at play. For instance, firms may favour the employment of foreign workers coming from the destinations with which they already have a commercial experience.

To account for this potential endogeneity bias, we use a PSM strategy allowing us to take full advantage of the firm-level data by keeping the whole information on foreign employment at the firm level.

1.5.2 Propensity score matching and treatment effect estimation

We estimate the average treatment effect of employing foreign-born workers on export outcomes. To do so, we use the PSM method (Rosenbaum and Rubin, 1983), extensively used in the estimation of treatment effects. This method allows us to overcome the fact that firms may have different probabilities to employ foreign workers and that these probabilities may be correlated with their export performance. In other words, it allows us to correct for potential endogeneity bias.

Let D_{it} denotes a dummy variable which equals 1 if a firm i is *treated*, *i.e.* if it employs at least one foreign worker at time t. Conversely, $D_{it} = 0$ for *untreated* or *control* firms, **i.e.** firms that do not employ foreign worker.

We also define X_{it}^T as the export outcome of a firm i at time t in the treated group, and X_{it}^C for a firm i in the control group. Summing over firms of each group, we are able to observe the following expected values:

$$E[X_{it}^T \mid D_{it} = 1] \tag{1.19}$$

$$E[X_{it}^C \mid D_{it} = 0] \tag{1.20}$$

Yet, we are interested in the *average treatment effect on the treated* (ATT), which is not observable and can be written as follows:

$$ATT = E\left[X_{it}^T - \left(X_{it}^C \mid D_{it} = 1\right)\right] \tag{1.21}$$

The difference in equations 1.19 and 1.20 is made of the ATT (equation 1.21) and a sampling bias:

$$E[X_{it}^T \mid D_{it} = 1] - E[X_{it}^C \mid D_{it} = 0] = ATT + E\left(X_{it}^C \mid D_{it} = 1\right) - E\left(X_{it}^C \mid D_{it} = 0\right) \tag{1.22}$$

This sampling bias is the difference in outcomes that is attributable to differences in the treated and control groups (such as different firm characteristics) rather than any effect of the treatment itself. Any sampling bias would be straightforward to adjust for if firms differed along a small set of (measurable) dimensions. This is not feasible, however, when comparing firms which vary across a wide number of dimensions.

Propensity-score matching allows to overcome this challenge. This methodology matches treated firms to a subset of untreated firms, based on a set of observable firm characteristics denoted by the vector C_{it} for each firm i at time t. More especially, Rosenbaum and Rubin (1983) show that it is sufficient to match treated and control observations based on a *propensity score*, denoted $p(C_{it})$, which is a scalar variable representing the probability that a firm i receives the treatment at time t (D_{it}). The propensity score is given by:

$$p(C_{it}) = \text{Prob}(D_{it} = 1 \mid C_{it}) \tag{1.23}$$

In our case, the propensity score is the conditional probability of a firm to employ foreign workers given pre-treatment characteristics. In practice, we estimate the following equation:

$$D_{it} = \alpha C_{it} + \gamma_i + \gamma_s + \gamma_r + \gamma_t + \varepsilon_{it} \tag{1.24}$$

which includes firm (γ_i), sector (γ_s), region (γ_r) and year (γ_t) fixed effects.

We include firm fixed effects to control for time-invariant firm characteristics that affect the probability to employ foreign-born workers. For instance, we cannot exclude that multinational firms may behave differently from domestic-only firms about the choice of their labour force, resulting in different probabilities of employing foreign-born workers. Also, we cannot exclude that some executive managers may discriminate between native and foreign workers.

Sector fixed effects are included to account for unobserved heterogeneity in the employment of foreign-born workers which may be favoured in one particular sector, possibly because of skill requirements.

Since the dependent variable in equation (1.24) is a dummy variable, standard practice consists in using a logit estimator. However, insofar as fixed effects are crucial here, we estimate equation (1.24) using an OLS estimator allowing us to add a full set of fixed effects[5]. We check that the predictive values for the score do not depart from the (0,1) support. In all specifications, we

[5] We perform some robustness checks using a logit estimation without fixed effect.

find that the estimated score is out of the (0,1) range for less than 0.05% of the observations, that we then drop out from the sample.

Once the propensity scores are estimated, we match each treated firm with the non-treated firm that has the closest propensity score. We then estimate the average treatment effect (equation 1.21) as follows:

$$ATT = E\left[X_{it}^{T} \mid D_{it} = 1, p\left(C_{it}\right) - X_{it}^{C} \mid D_{it} = 0, p\left(C_{it}\right)\right] \qquad (1.25)$$

Equation 1.25 gives the change in export outcomes due to the employment of foreign workers, after controlling for selection bias in foreign employment. The identification comes from the differences in export outcomes between matched firms, that is between firms having very close probabilities to employ foreign-born workers but which are actually different in their foreign employment. Finally, to assess the quality of the matching method and thereby the quality of the ATT estimate, we check that, on average, treated and control firms have similar characteristics.

One important advantage of the PSM method over a multivariate regression analysis such as the IV-2SLS framework, is that matching allows us to remain agnostic about the relationship between the treatment, covariates and outcomes. Of course, we bear in mind that this approach allows to deal with endogeneity issues only because we assume that we can observe most of the factors driving the potential bias, that is all important variables that affect the probability to be treated. The richness of our dataset allows us to believe that selection on unobservable variables is negligible, and that the PSM approach allows for causal inference. The use of the PSM is all the more supported by the size of the data: we have a large control group which allows us to operate the matching. While this criterion is less likely to be met when dealing with aggregate and macro-level data, we are confident that the present data allows us to overcome this difficulty.

1.5.3 Pro-trade effect of foreign-born workers: results

We estimate the average treatment effect of employing foreign-born workers on four exporting performance measures: the exported value and the exported quantities for the intensive margin, the number of destinations served, and the number of HS6 products exported by the firm for the extensive margin.

We start by estimating the probability to be treated for each firm-year observation. At first, we estimate this probability, following equation (1.24), by regressing the treatment dummy – equal to 1 if the firm employs some migrants– on a set of firm-year variables, using an OLS estimator. Covariates include firm-level hierarchy measures, firm size proxies and and financial characteristics variables. For instance, in the administrative employer-employee dataset, each worker is assigned a CS1 and a CS2 code that respectively are 1-digit and 2-digit socio-professional categories. We compute the firm-level count of 1- and 2-digit categories, and the Herfindahl index of concentration of all workers in these categories. The first-step estimation results are presented in the Appendix B in Table B.1 in column (1). From this estimation, we predict the propensity score.

The main challenge our strategy addresses is reverse causality leading trade performance to determine the firm-level employment of foreign workers. To further ensure that this does not bias the baseline ATT, we estimate the trade ATT associated to employing foreign workers by adding an additional constraint in the matching algorithm. We match treated and non-treated, from the same sector-region, and that also belong to the same pre-treatment export growth quartile. We thus now compare firms that were on the same export growth path before being treated. Baseline results using this matching algorithm are presented in Table 1.3.

Column (1) presents the estimated treatment effect associated to employing a positive number of migrants. We find that both margins of trade positively react to the employment of foreign-born workers. At the intensive margin, the estimated treatment effects are significantly positive. Firms employing foreign workers export larger values and larger quantities. On average, a firm employing foreign-born workers exports 44% $\left(e^{0.374}\right)$ more over all its destinations than another firm having the same probability to employ foreign workers. The same result is true for the exported quantities. At the extensive margin, we estimate that firms employing foreign workers export a larger set of products towards a larger set of destinations. All trade margins are estimated to be positively affected by the employment of foreign-born workers.

To control the quality of the matching method, we check that the post-matching groups have similar average characteristics. In Table 1.4, we present the average values of different variables for the matched treated and non-treated (control) observations group. We also present the relative bias measure, instead of t-test based comparisons (Austin, 2009), to support that the inference about treatment effect made using propensity-score matching is valid. Table 1.4 only focuses on the positive migrant employment treatment and suggests that treated firms are not different, on average, from firms which are not treated. On top of that, this is consistent with aggregate evidence we provided above that suggested that firms employing foreign workers were not different from firms that do not. This set of evidence suggests that comparing firms in this dimension make senses and supports the strategy consisting in attributing differences in export performance to the treatment variable (i.e. employing foreign-born workers). All the results presented in the chapter are based upon comparable post-matching group characteristics that we do not reproduce for sake of space.

We then investigate the effect associated to alternative treatments. In column (2), we find that all trade margins are positively affected by an increase in the share of foreign workers. Consistently with the theoretical predictions, increases in migrants share in total employment are associated to a pro-trade effect, even though estimated elasticities are smaller than in the baseline estimation. In column (2), treated firms are firms that increase the share of their foreign-born workers in their total employment, unconditionally to their previous level of migrant employment. We investigate differences in this previous migrant employment in the next columns.

Column (3) presents the ATT associated to starting employing migrants in t (ie. not employing any migrant in $t-1$), while column (4) presents the estimated ATT of increasing foreign-born workers employment in t conditional upon previous positive employment in $t-1$. When firms start employing foreign workers, all trade margins are positively affected. On the contrary, when firms already employed foreign-born workers, the pro-trade effect is estimated to be smaller, and only the intensive margin seems to be at play. We infer from this set of results that the pro-trade effect of migrant is larger when firms start employing foreign-born workers. On average, the pro-trade effect associated to additional foreign worker is lower than the initial trade effect of the first migrants.

Table 1.3: Average Treatment Effect Estimates - Matching: pre-treatment export growth

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
		Intensive Margin		
Export Values	0.374^a	0.115^a	0.215^a	0.159^a
	(0.017)	(0.020)	(0.032)	(0.029)
Export Quantities	0.412^a	0.061^a	0.139^a	0.170^a
	(0.022)	(0.027)	(0.042)	(0.037)
		Extensive Margin		
# Destinations	0.091^a	0.026^a	0.106^a	0.025^c
	(0.007)	(0.009)	(0.014)	(0.013)
# Products	0.142^a	0.041^a	0.131^a	0.039^a
	(0.010)	(0.012)	(0.019)	(0.017)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score, from the same region-sector and from the same pre-treatment export growth rate quartile. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table 1.4: Matching Quality - Comparing the two groups means

Treatment	$M_{it} > 0$		
Propensity Score Estimator	OLS		
Matching Algorithm	Closest Neighbor		
Additional contraint	Export growth quartile		
	Treated	Control	% bias
Mean Age	3.62	3.62	-2.2
Nb CS1 categories	2.85	2.86	-1.3
CS1 Herf.	0.63	0.64	-1.1
Nb CS2 categories	6.89	6.75	8.9
CS2 Herf.	0.32	0.36	-6.1
Firm Age	2.75	2.74	1.7
Assets	8.12	8.09	1.4
Employment	3.12	3.05	8.3
Capital Intensity	3.47	3.48	-1.2
Short-term Debt	5.09	5.07	1.3
Own Resources	7.21	7.19	1.3
Liabilities	7.34	7.31	2.3

Note: This table provides the observed means for the matched treated and control firms for alternative matching algorithms. Treatment consists in employing a positive number of foreign workers. We compare the two means using a relative bias measures, providing a measure of the quality of the matching procedure. All variables are in logs except "Nb CS1 categories" and "Nb CS2 categories". Each worker is assigned a CS1 and a CS2 code that respectively are 1-digit and 2-digit socio-professional categories in the French administrative system. We compute the firm-level count of 1- and 2-digit categories, and the Herfindahl index of concentration of the workers in these categories. The label "% bias" is the normalised relative bias measure between the two means, see Austin (2009).

Table 1.5: Average Treatment Effect Estimates - Skilled and Unskilled Foreign Workers - Matching: pre-treatment export growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment (D_{it})	$\mathrm{M}_{it}^{S} > 0$	$\mathrm{M}_{it}^{S} > \mathrm{M}_{it-1}^{S}$	$\mathrm{M}_{it}^{S} > \mathrm{M}_{it-1}^{S}$, $\mathrm{M}_{it-1}^{S} = 0$	$\mathrm{M}_{it}^{S} > \mathrm{M}_{it-1}^{S}$, $\mathrm{M}_{it-1}^{S} > 0$	$\mathrm{M}_{it}^{U} > 0$	$\mathrm{M}_{it}^{U} > \mathrm{M}_{it-1}^{U}$	$\mathrm{M}_{it}^{U} > \mathrm{M}_{it-1}^{U}$, $\mathrm{M}_{it-1}^{U} = 0$	$\mathrm{M}_{it}^{U} > \mathrm{M}_{it-1}^{U}$, $\mathrm{M}_{it-1}^{U} > 0$
				Intensive Margin				
Export Values	0.495^{a}	0.381^{a}	0.270^{a}	0.471^{a}	0.133^{a}	0.046^{c}	0.052	0.092^{a}
	(0.034)	(0.047)	(0.065)	(0.064)	(0.020)	(0.024)	(0.040)	(0.029)
Export Quantities	0.300^{a}	0.214^{a}	0.147^{a}	0.317^{a}	0.223^{a}	0.073^{a}	0.060	0.150^{a}
	(0.043)	(0.060)	(0.065)	(0.081)	(0.026)	(0.029)	(0.052)	(0.039)
				Extensive Margin				
# Destinations	0.162^{a}	0.115^{a}	0.107^{a}	0.137^{a}	0.016^{c}	0.006	0.021	0.001
	(0.015)	(0.021)	(0.030)	(0.029)	(0.009)	(0.011)	(0.018)	(0.013)
# Products	0.185^{a}	0.141^{a}	0.145^{a}	0.149^{a}	0.028^{a}	0.005	0.032	0.016
	(0.020)	(0.028)	(0.040)	(0.039)	(0.011)	(0.014)	(0.024)	(0.039)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it}^{S} and M_{it}^{U} respectively denote the share of skilled and unskilled foreign workers in firm i at time t. We match firms using the estimated propensity score and from the same region-sector and from the same pre-treatment export growth rate quartile. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

We then investigate whether the pro-trade effect of foreign-born workers could be driven by skilled workers only. We differentiate skilled from unskilled workers using the classification presented in Table A.1 (Bombardini et al., 2015), that we then aggregate at the firm level. We replicate the same estimations by matching firms per quartile of pre-treatment export growth. Results are presented in Table 1.5.

Columns (1) to (4) suggest that skilled migrants generate a pro-trade effect than seems to be quantitatively larger than for the unskilled workers. Both trade margins are positively affected by the employment and by the increase of foreign-born skilled workers. The pro-trade effect associated to the increase of foreign-born skilled employment does not seem to be particularly at play for the initial skilled foreign workers: coefficients in column (3) are hardly supporting a pro-trade effect, at least for the extensive margin. Increases in foreign skilled employment, conditional on previous skilled employment, nevertheless positively affect both trade margins.

On the contrary, columns (5) to (8) estimate a smaller trade effect associated to employment of unskilled foreign workers. Column (5) displays a positive estimated ATT associated to the unconditional employment of unskilled migrants, even though the coefficient is smaller than for skilled workers. On average, the pro-trade effect of migrants is larger for skilled than for unskilled migrants. Changes in the employment share of unskilled foreign workers is however estimated not to generate any pro-trade effect, contrarily to skilled migrants. All trade margins appear not to be affected by changes in the employment of unskilled migrants, in columns (6) to (8), except the probability of exporting.

We infer from this set of results that skilled workers are mainly driving the average pro-trade effect of migrant employment at the firm level, event though the employment of unskilled workers does generate a small pro-trade effect. This is consistent with previous aggregate evidence supporting the magnified effect of skilled foreign workers on trade flows. We however note that the pro-trade effect for unskilled workers, that are not supposed to bring information to their employing firms, is a contribution of this chapter since we can rationalize this effect through a productivity effect. All existing papers emphasize that the pro-trade effect of migrants only occurs through the informational channel, that is hardly compatible with such pro-trade evidence for unskilled workers. We interpret this result as evidence supporting the existence of a productivity channel.

Robustness checks

We perform a number of robustness checks to address potential bias affecting our estimation of the pro-trade effect of migrants and results are displayed in the Appendix B. We start by using an alternative matching procedure: we match treated and untreated firms within the same-region, independently from their pre-treatment export growth. ATT results based on the whole sample are displayed in Table B.2 and by differentiating the skilled and the unskilled workers in Table B.3. Since we do not match upon previous export growth, we are able to estimate the ATT of foreign migrant on the probability to export (participation dummy). All trade margins are significantly and positively associated to foreign skilled employment and their increases (columns (1) to (4)). Quality of the matching procedure can be inferred from Table 1.4 that suggests comparable post-matching firm characteristics for both groups of firms, but lower matching quality since the relative bias is on average higher than in the baseline evidence. Removing the additional constraint on pre-treatment export growth in the matching process however make our estimates gain to some significance. Higher precision of the estimation is also present when focusing on the unskilled workers, but this does not change the big picture. If unskilled migrants ever affect trade outcome, their contribution is smaller than skilled workers and mainly conditional to previous employment of unskilled migrants.

We then use an alternative matching algorithm by matching each treated firms with its 5 non-treated closest neighbors in propensity scores. ATT results based on the whole sample are displayed in Table B.5 and by differentiating the skilled and the unskilled workers in Table B.6. Using this alternative matching algorithm decreases precision of the estimation. Baseline coefficients are confirmed, but the precision is slightly lower using this matching algorithm relatively to the baseline estimates. This is consistent with the measure of relative bias in the matching procedure that Table B.4 supports. The second set of columns seems to display a higher relative bias than the other matching methods. Results differentiating skilled and unskilled migrants (Table B.6) support that the trade effect is mainly driven by skilled migrants.

We finally test the robustness of our first set of results using an alternative estimator for the propensity score. We estimate the probability to be treated upon the same covariates as previously, but we use a logit estimator and we exclude the fixed effects structure due to computational difficulty resulting from sample size. First step estimation results are presented in Table B.1, column (2). The signs of the coefficients are close in the two estimations, but the estimated coefficients are quite different. The ATT using the logit estimator for the propensity score are presented in Tables B.7 and B.8. The quality of the matching process appears to be lower than for the previous estimations as can be seen from the high relative bias measures displayed in the last set of columns in Table B.4. Despite the lower quality of the matching procedure, we estimate similar patterns for the pro-trade effect of migrants than in the baseline estimation.

1.6 Disentangling the *productivity* from the *trade-cost* effect

We extend our analysis by disentangling the two channels through which foreign-born workers generate an export-enhancing effect. Consistently with our theoretical model, we aim at disentangling the *productivity* and the *trade-cost* channels. The model predicts that foreign workers enhance exports towards all destinations through a productivity channel, while they foster exports only towards their origin countries through a trade-cost channel. To measure the two channels, we thus use variations of exports across destinations as a source of identification. We present the results in the last subsection.

1.6.1 Empirical strategy

To empirically disentangle the two channels through which foreign-born workers impact exports, we use export variations across destinations for a given firm-year observation. If the productivity channel is at play, it should affect all destinations and not only a particular destination. Export variations that are common across destinations are thus used to identify the effect of the productivity channel on firm-year exports. By purging the firm-year-destination exports from the firm-year shocks that is by nature common across destinations, we recover variations in exports that are destination-specific. These residual variations in exports come from idiosyncratic firm-destination shocks and measure the strength of the informational channel.

We now use a firm-year-destination dataset, by recovering the destination dimension from the customs data. We restrict our sample to exporters. In order to purge the firm-year-destination observations of shocks that are common across destinations for a given firm-year, we estimate the following equation with an OLS estimator:

$$X_{ijt} = \gamma_{it} + \gamma_t + \varepsilon_{ijt} \tag{1.26}$$

where X_{ijt} is the exported value by a firm i towards a destination j at time t, γ_{it} represents firm-year fixed effects that capture time-variant firm characteristics, γ_t is a year fixed effect to capture the time trend and ε_{ijt} denotes the error term.

After the regression, we obtain an estimated residual (denoted $\hat{\varepsilon}_{ijt}$) from which common shocks across destinations are excluded. Doing so, we neutralise the productivity effect of foreign-born workers which is supposed to impact exports towards all foreign markets. The estimated residual thus captures firm-destination idiosyncratic shocks.

To ensure the consistency of this strategy, we perform the opposite exercise by estimating the following equation with OLS:

$$X_{ijt} = \gamma_{ij} + \gamma_{jt} + \gamma_j + \gamma_i + \epsilon_{ijt} \tag{1.27}$$

where γ_{ij}, γ_{jt}, γ_j and γ_i respectively denote firm-country, destination-year, destination and firm fixed effects, and where ϵ_{ijt} denotes the error term. We then recover the estimated residual (denoted $\hat{\epsilon}_{ijt}$) that *de facto* only includes all common shocks across destinations.

Then, using the propensity score matching method, we compute the ATT of foreign employment on the firm-year-destination exports (X_{ijt}) and on these two residuals ($\hat{\varepsilon}_{ijt}$ and $\hat{\epsilon}_{ijt}$). Our strategy thus consists in decomposing the impact of foreign employment on exports (X_{ijt}) into a component that approximates the productivity channel ($\hat{\varepsilon}_{ijt}$) and a component that approximates the trade-costs channel ($\hat{\epsilon}_{ijt}$). The relative magnitude of the ATT on the two residuals gives a proxy of the strength of each channel. We expect the ATT on X_{ijt} to be equal to the sum of the ATT on $\hat{\varepsilon}_{ijt}$ and the ATT on $\hat{\epsilon}_{ijt}$.

1.6.2 Results

We estimate the impact of foreign employment on (the log of) the total exported value towards destination j, that we decompose into two components: $\hat{\varepsilon}_{ijt}$ in which common shocks across destinations are excluded and $\hat{\epsilon}_{ijt}$ which only contain the firm-level shocks. By comparing the relative magnitude of the two estimated coefficients, we get a proxy of the strength of the two channels.

We consider the same migration-related treatments as in the previous section, and results are presented in Table 1.6. We match treated and non-treated firms that belong to the same sector-region, and that belong to the same quartile of pre-treatment export growth.

Column (1) considers the ATT of positive migrant employment and suggests that a large share of the total pro-trade effect of migration is made of the productivity effect. By comparing the

Table 1.6: Disentengling the two effects - Matching on pre-treatment export growth

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
X_{ijt}	0.154^a	0.577^a	0.616^a	0.421^a
	(0.005)	(0.007)	(0.009)	(0.009-
$\hat{\varepsilon}_{ijt}$	0.022^a	0.340^a	0.326^a	0.285^a
	(0.004)	(0.005)	(0.007)	(0.007)
$\hat{\epsilon}_{ijt}$	0.132^a	0.237^a	0.290^a	0.136^a
	(0.003)	(0.004)	(0.005)	(0.005)

Note: This table provides the ATT estimates. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score, from the same region-sector and from the same pre-treatment export growth rate quartile. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

two estimated coefficients, we estimate that 85 % of the pro-trade effect comes from our proxy for the productivity effect. Purging export flows from common shocks across destinations, we estimate a large decrease in the pro-trade effect of foreign-born workers. On the contrary, once purged from idiosycratic shocks at the destination-level, export flows are positively affected by the treatment and the effect is close to the total effect. We infer from the comparison of the coefficients in column (1) that the pro-trade of employing migrants is mainly driving the exports towards all destinations together rather than simply on some particular destinations.

Using the same rationale, in column (2), we find that increasing the employment of foreign-born workers is associated to a pro-trade effect that occurs through both channels. The two estimated coefficients are of similar magnitude.

Columns (3) and (4) provide additional insights: the productivity effect of migrants is more at play when firms are starting to hire foreign workers than when they hire additional foreign workers. On the contrary, the informational channel seems to be all the more at play that foreign workers were already employed by the treated firm.

This set of results suggests that foreign employment generates a pro-trade effect that is all the more at play that these foreign workers are newly hired. This suggest that the productivity effect is the first effect to be at play: employing a first migrants generates some within firm changes, associated to higher exports across all destinations. Then, additional migrants generate a pro-trade effect occurring through the informational channel. What is crucial here is that the productivity effect seems to be mainly at play for the first migrants to be employed.

Table 1.7: Disentengling the two effects - Matching on pre-treatment export growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment (D_{it})	$\mathrm{M}_{it}^S > 0$	$\mathrm{M}_{it}^S > \mathrm{M}_{it-1}^S$	$\mathrm{M}_{it}^S > \mathrm{M}_{it-1}^S$	$\mathrm{M}_{it}^S > \mathrm{M}_{it-1}^S$	$\mathrm{M}_{it}^U > 0$	$\mathrm{M}_{it}^U > \mathrm{M}_{it-1}^U$	$\mathrm{M}_{it}^U > \mathrm{M}_{it-1}^U$	$\mathrm{M}_{it}^U > \mathrm{M}_{it-1}^U$
			$\mathrm{M}_{it-1}^S = 0$	$\mathrm{M}_{it-1}^S > 0$			$\mathrm{M}_{it-1}^U = 0$	$\mathrm{M}_{it-1}^U > 0$
X_{ijt}	0.401^a	0.827^a	0.853^a	0.732^a	0.086^a	0.533^a	0.568^a	0.397^a
	(0.007)	(0.010)	(0.013)	(0.015)	(0.005)	(0.007)	(0.010)	(0.009)
$\hat{\varepsilon}_{ijt}$	0.042^a	0.360^a	0.358^a	0.325^a	0.017^a	0.333^a	0.323^a	0.284^a
	(0.006)	(0.008)	(0.010)	(0.012)	(0.004)	(0.006)	(0.008)	(0.008)
$\hat{\epsilon}_{ijt}$	0.359^a	0.467^a	0.495^a	0.406^a	0.069^a	0.201^a	0.244^a	0.113^a
	(0.004)	(0.006)	(0.007)	(0.009)	(0.003)	(0.004)	(0.006)	(0.006)

Note: This table provides the ATT estimates. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score, from the same region-sector and from the same pre-treatment export growth rate quartile. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

The same conclusions are reached when investigating the two channels through which skilled and unskilled workers affect trade, in Table 1.7. We find that skilled migrants tend to favor trade towards all destinations rather than to a particular set of countries.

Robustness checks of this exercise are provided in the Appendix C. In particular, we test the robustness of our results by matching treated firms with the 5 closest non-treated firms in tables C.1 and C.2. The results are quantitatively similar to the baseline evidence. Unconditionally to the matching method, we find that foreign workers tend to favor trade towards all destinations on average. We infer from this evidence that the productivity effect is at play and is substantial compared to the standard informational channel, which is generally the only emphasized channel in trade-migration studies.

1.7 Conclusion

This chapter investigates the pro-trade effect of foreign employment at the firm level. Theoretically, we rationalise the effect of foreign workers on their firm's exports at both the intensive and the extensive trade margins. We show that foreign workers convey valuable information about their home countries which reduces the variable and fixed export costs of their firms towards their origin countries. In addition, we highlight that foreign workers increase their firms' productivity, which in turn, increases exports towards any foreign countries. Our theoretical framework thus predicts that the probability to export and the exported quantities should positively react to the employment of foreign workers.

With a French firm-level dataset over the 1997-2008 period, we use a propensity score matching method to evaluate the effect of foreign employment on export outcomes. We find a positive effect of foreign-born workers on exports, the number of destinations served and the number of exported products. In line with the literature, we find that the pro-trade effect of foreign workers is stronger for skilled foreign workers. We also find that both productivity and trade-cost channels are at play and that the productivity channel effect is substantial. This result supports the the need for more research on the link between foreign employment and productivity.

These results are quite instructive on the link between foreign employment and export outcomes. However, future research could try to further investigate the mechanisms through which foreign workers enhance productivity. One research avenue could be to further study the supply side of the labour market, looking at how foreign and native workers differ in terms of skills and experience, but also in terms of types of contracts. It would help us to fully understand the relation of causality between foreign employment, productivity and firm outcomes.

Finally, our results suggest that foreign employment is either positive or harmless for export outcomes. In that respect, a simplification of labour regulations for foreign workers could create further incentives for French firms to hire these workers. This could, in turn, create favourable conditions within the employing firm to start exporting or to expand its export activities.

In the current context, policy makers should bear that a tightening of immigration policies and labour regulations for immigrants may impact firms' export outcomes. Following our results, one could expect a negative or nil impact on exports. If these restrictions target immigrants from a particular origin country, the effect may be unevenly spread across export destinations, and could even lead to the diversion of existing export flows towards new destinations.

1.8 Additional Material

A Additional Information - Data

Table A.1: Classification of CS into Blue and White collars categories.

CS code	White Collar Jobs
3	Executives and higher intellectual professions
31	Health professionals and lawyers
33	Senior official in public administration
34	Teachers, scientific professions
35	Information, arts and entertainment
37	Administrative and commercial skilled workers
38	Engineers and technical managers
4	Intermediate occupations
42	Teachers and related
43	Intermediate occupations, health and social work
44	Religious
45	Intermediate administrative professions in public administration
46	Intermediate administrative and commercial occupation in enterprises
47	Technicians
48	Foremen, supervisors
CS code	**Blue Collar Jobs**
5	Clericals
52	Civilian employees and officers in public service
53	Protective services
54	Administrative employees
55	Commercial workers
56	Personal services workers
6	Labourers
62	Qualified industrial workers
63	Qualified craft workers
64	Drivers
65	Storage and transport workers
67	Non-qualified industrial workers
68	Non-qualified craft workers
69	Farm workers

Note: Source Bombardini et al. (2015)

B Additional Results: The pro-trade effect of migrants

Table B.1: Propensity score estimation - first step estimation

	(1)	(2)
Dependent variable	$\text{Dummy}_{M_{it}>0}$	
Log Mean Age	0.007^a	0.167^a
	(0.001)	(0.008)
Nb CS 1	0.019^a	0.411^a
	(0.001)	(0.003)
Herf. CS1	0.137^a	0.971^a
	(0.004)	(0.013)
Nb CS2	0.035^a	0.102^a
	(0.001)	(0.001)
Herf. CS2	-0.044^a	-0.797^a
	(0.003)	(0.011)
Log Firm Age	-0.001	-0.075^a
	(0.001)	(0.002)
Log Assets	0.012^a	0.033^a
	(0.001)	(0.007)
Log Effectif	0.023^a	0.254^a
	(0.001)	(0.003)
Log Capital Intensity	0.003^a	-0.032^a
	(0.001)	(0.002)
Log Short-term Debt	-0.001	0.015^a
	(0.001)	(0.001)
Log Own Resources	0.001	-0.012^a
	(0.001)	(0.003)
Log Liabilities	0.001	-0.091^a
	(0.001)	(0.005)
Obs.	3 047 028	3 047 028
Estimator	OLS	Logit
R^2	0.589	0.209

Note: This table provides the first-step estimation results in which the dependent variable is a dummy variable equal to 1 if the firm employs a positive share of migrants and 0 if not. This corresponds to the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. Column (1) uses an OLS estimator and include firm-, year-, sector- and sector-year fixed effects. Column (2) presents the results using a logit estimator. In the administrative employer-employee dataset, each worker is assigned a CS1 and a CS2 code that respectively are 1-digit and 2-digit socio-professional categories. We compute the firm-level count of 1- and 2-digit categories, and the Herfindahl index of concentration of the workers in these categories. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table B.2: Average Treatment Effect Estimates - Alternative matching procedure - No constraint

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
		Intensive Margin		
Exports Values	0.349^a	0.059^a	0.159^a	0.061^a
	(0.017)	(0.020)	(0.031)	(0.028)
Exports Quantities	0.383^a	0.059^a	0.153^a	0.063^b
	(0.023)	(0.025)	(0.039)	(0.036)
		Extensive Margin		
Participation dummy	0.016^a	0.003^a	0.010^a	0.006^a
	(0.001)	(0.001)	(0.002)	(0.001)
# Destinations	0.107^a	0.018^a	0.067^a	0.017
	(0.007)	(0.007)	(0.013)	(0.012)
# Products	0.166^a	0.028^a	0.085^a	0.024
	(0.010)	(0.010)	(0.017)	(0.016)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score and from the same region-sector. We do not match firms belonging to the same quartile of export growth. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table B.3: Average Treatment Effect Estimates - Alternative matching procedure: No constraint - Skilled and Unskilled Migrant Workers

Treatment (D_{it})	(1) $M^S_{it} > 0$	(2) $M^S_{it} > M^S_{it-1}$	(3) $M^S_{it} > M^S_{it-1}$ $M^S_{it-1} = 0$	(4) $M^S_{it} > M^S_{it-1}$ $M^S_{it-1} > 0$	(5) $M^U_{it} > 0$	(6) $M^U_{it} > M^U_{it-1}$	(7) $M^U_{it} > M^U_{it-1}$ $M^U_{it-1} = 0$	(8) $M^U_{it} > M^U_{it-1}$ $M^U_{it-1} > 0$
				Intensive Margin				
Export Values	0.308^a	0.162^a	0.112^a	0.189^a	0.106^a	0.010	0.067	0.036
	(0.038)	(0.048)	(0.064)	(0.067)	(0.022)	(0.024)	(0.045)	(0.029)
Export Quantities	0.268^a	0.138^a	0.106	0.139^c	0.145^a	0.010	0.079	0.069^c
	(0.047)	(0.060)	(0.080)	(0.083)	(0.028)	(0.030)	(0.059)	(0.037)
				Extensive Margin				
Participation dummy	0.010^a	0.007^c	0.005	0.016^a	0.005^a	0.040^a	0.001	0.006^a
	(0.003)	(0.004)	(0.005)	(0.006)	(0.001)	(0.001)	(0.002)	(0.002)
# Destinations	0.099^a	0.051^a	0.026	0.074^a	0.027^a	0.001	0.012	0.011
	(0.016)	(0.021)	(0.028)	(0.029)	(0.009)	(0.010)	(0.016)	(0.012)
# Products	0.135^a	0.079^a	0.051	0.097^a	0.045^a	0.003	0.028	0.021
	(0.022)	(0.028)	(0.037)	(0.038)	(0.012)	(0.013)	(0.032)	(0.016)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M^S_{it} and M^U_{it} respectively denote the share of skilled and unskilled foreign workers in firm i at time t. We match firms using the estimated propensity score and from the same region-sector. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table B.4: Matching Quality - Comparing the two groups means - Robustness

Treatment	$M_{it} > 0$								
Propensity Score Estimator	OLS			OLS			Logit		
Matching Algorithm	Closest Neighbor			5 Closest Neighbors			Closest Neighbor		
Additional contraint				Export growth quartile			Export growth quartile		
	Treated	Control	% bias	Treated	Control	% bias	Treated	Control	% bias
Mean Age	3.61	3.63	1.7	3.61	3.62	-3.7	3.62	3.62	-2.4
Nb CS1 categories	2.85	2.92	6.4	2.85	2.52	33.9	2.85	2.70	15.6
CS1 herf	0.63	0.77	2.2	0.63	0.65	-8.8	0.63	0.64	-4.9
Nb CS2 categories	6.87	6.17	14.3	6.87	5.18	53.2	6.87	5.87	31.2
CS2 herf	0.32	0.32	-2.9	0.32	0.39	-26.5	0.32	0.35	-10.5
Firm Age	2.74	2.71	2.3	2.75	2.72	3.2	2.73	2.69	5.6
Assets	8.12	7.93	10.4	8.13	7.88	15.7	8.12	7.89	14.4
Employment	3.13	3.18	11.9	3.13	2.83	20.8	3.12	2.94	12.9
Capital Intensity	3.47	3.35	1.6	3.48	3.43	4.3	3.47	3.36	9.7
Short-term Debt	5.08	4.99	8.6	5.10	4.87	10.4	5.10	4.88	9.9
Own Resources	7.21	7.01	9.7	7.22	6.95	14.9	7.21	6.96	13.5
Liabilities	7.34	7.18	10.2	7.35	7.11	15.1	7.35	7.12	14.0

Note: This table provides the observed means for the matched treated and control firms for alternative matching algorithms. Treatment consists in employing a positive number of foreign workers. We compare the two means using a relative bias measures, providing a measure of the quality of the matching procedure. All variables are in logs except "Nb CS1 categories" and "Nb CS2 categories". Each worker is assigned a CS1 and a CS2 code that respectively are 1-digit and 2-digit socio-professional categories in the French administrative system. We compute the firm-level count of 1- and 2-digit categories, and the Herfindahl index of concentration of the workers in these categories. The label "% bias" is the normalised relative bias measure between the two means, see Austin (2009).

Table B.5: Average Treatment Effect Estimates - Alternative matching algorithm: 5 closest neighbors

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
		Intensive Margin		
Export Values	0.335[a]	0.091[a]	0.183[a]	0.112[a]
	(0.013)	(0.015)	(0.024)	(0.022)
Export Quantities	0.372[a]	0.097[a]	0.160[a]	0.116[a]
	(0.017)	(0.019)	(0.030)	(0.028)
		Extensive Margin		
# Destinations	0.097[a]	0.030[a]	0.081[a]	0.036[a]
	(0.005)	(0.006)	(0.010)	(0.009)
# Products	0.153[a]	0.044[a]	0.100[a]	0.051[a]
	(0.007)	(0.009)	(0.014)	(0.013)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match treated firms to the 5 non-treated neighboring firms in terms of propensity score, from the same region-sector and belonging to the same quartile of pre-treatment export growth. All trade margins measures are in logarithm. Robust standard errors are shown in parentheses. [a], [b] and [c] respectively denote significance at the 1%, 5% and 10% levels.

Table B.6: Average Treatment Effect Estimates - Skilled and Unskilled Migrant Workers - Alternative matching algorithm: 5 closest neighbors

Treatment (D_{it})	(1) $M^S_{it} > 0$	(2) $M^S_{it} > M^S_{it-1}$	(3) $M^S_{it} > M^S_{it-1}$ $M^S_{it-1} = 0$	(4) $M^S_{it} > M^S_{it-1}$ $M^S_{it-1} > 0$	(5) $M^U_{it} > 0$	(6) $M^U_{it} > M^U_{it-1}$	(7) $M^U_{it} > M^U_{it-1}$ $M^U_{it-1} = 0$	(8) $M^U_{it} > M^U_{it-1}$ $M^U_{it-1} > 0$
Intensive Margin								
Export Values	0.469^a	0.296^a	0.202^a	0.366^a	0.156^a	0.049^a	0.049^c	0.077^a
	(0.028)	(0.037)	(0.049)	(0.052)	(0.016)	(0.019)	(0.029)	(0.023)
Export Quantities	0.401^a	0.241^a	0.151^a	0.318^a	0.199^a	0.054^a	0.071^b	0.107^a
	(0.034)	(0.046)	(0.062)	(0.064)	(0.020)	(0.024)	(0.037)	(0.029)
Extensive Margin								
# Destinations	0.158^a	0.096^a	0.066^a	0.133^a	0.043^a	0.017^a	0.009	0.021^a
	(0.012)	(0.016)	(0.021)	(0.022)	(0.006)	(0.008)	(0.012)	(0.007)
# Products	0.215^a	0.137^a	0.102^a	0.176^a	0.065^a	0.023^a	0.026	0.037^a
	(0.006)	(0.021)	(0.029)	(0.029)	(0.009)	(0.010)	(0.017)	(0.013)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match treated firms to the 5 non-treated neighboring firms in terms of propensity score, from the same region-sector and belonging to the same quartile of pre-treatment export growth. All trade margins measures are in logarithm. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table B.7: Average Treatment Effect Estimates - Logit propensity score

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
		Intensive Margin		
Exports Values	0.385^{a}	0.155^{a}	0.139^{a}	0.093^{a}
	(0.017)	(0.021)	(0.029)	(0.027)
Exports Quantities	0.434^{a}	0.126^{a}	0.091^{b}	0.099^{a}
	(0.022)	(0.027)	(0.038)	(0.035)
		Extensive Margin		
# Destinations	0.088^{a}	0.033^{a}	0.059^{a}	-0.017
	(0.008)	(0.009)	(0.013)	(0.012)
# Products	0.139^{a}	0.050^{a}	0.072^{a}	-0.005
	(0.010)	(0.012)	(0.017)	(0.017)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24, without any fixed effects and using a logit estimator. M_{it} denotes the share of foreign workers in firm i at time t. We match firms in terms of propensity score, from the same region-sector and belonging to the same quartile of pre-treatment export growth. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table B.8: Average Treatment Effect Estimates - Skilled and Unskilled Migrant Workers - Logit propensity score

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment (D_{it})	$M^S_{it} > 0$	$M^S_{it} > M^S_{it-1}$	$M^S_{it} > M^S_{it-1}$	$M^S_{it} > M^S_{it-1}$	$M^U_{it} > 0$	$M^U_{it} > M^U_{it-1}$	$M^U_{it} > M^U_{it-1}$	$M^U_{it} > M^U_{it-1}$
			$M^S_{it-1} = 0$	$M^S_{it-1} > 0$			$M^U_{it-1} = 0$	$M^U_{it-1} > 0$
				Intensive Margin				
Exports Values	0.411^a	0.338^a	0.356^a	0.300^a	0.378^a	0.140^a	0.122^a	0.078^b
	(0.030)	(0.039)	(0.049)	(0.062)	(0.017)	(0.021)	(0.030)	(0.028)
Exports Quantities	0.217^a	0.174^a	0.207^a	0.104	0.496^a	0.179^a	0.102^a	0.154^a
	(0.038)	(0.050)	(0.063)	(0.078)	(0.023)	(0.028)	(0.039)	(0.037)
				Extensive Margin				
# Destinations	0.116	0.084^a	0.116^a	0.043	0.086^a	0.021^a	0.045^a	-0.029
	(0.013)	(0.018)	(0.022)	(0.028)	(0.008)	(0.009)	(0.013)	(0.017)
# Products	0.142^a	0.104^a	0.173^a	0.038	0.141^a	0.041^a	0.063^a	-0.019
	(0.018)	(0.023)	(0.029)	(0.036)	(0.010)	(0.013)	(0.018)	(0.017)

Note: This table provides the ATT estimates for the five treated variables on the trade margins. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24,without any fixed effects and using a logit estimator. M^S_{it} and M^U_{it} respectively denote the share of skilled and unskilled foreign workers in firm i at time t. We match firms in terms of propensity score, from the same region-sector and belonging to the same quartile of pre-treatment export growth. All trade margins measures are in logarithm, except the participation dummy. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

C Additional Results: The two channels

Table C.1: Disentengling the two effects - Matching on pre-treatment export growth

Treatment (D_{it})	(1) $M_{it} > 0$	(2) $M_{it} > M_{it-1}$	(3) $M_{it} > M_{it-1}$ $M_{it-1} = 0$	(4) $M_{it} > M_{it-1}$ $M_{it-1} > 0$
X_{ijt}	0.103^a	0.544^a	0.586^a	0.411^a
	(0.004)	(0.005)	(0.007)	(0.007)
$\hat{\varepsilon}_{ijt}$	0.006^b	0.314^a	0.314^a	0.257^a
	(0.003)	(0.004)	(0.005)	(0.005)
$\hat{\epsilon}_{ijt}$	0.097^a	0.230^a	0.272^a	0.154^a
	(0.002)	(0.003)	(0.004)	(0.004)

Note: This table provides the ATT estimates. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score, from the same region-sector and from the same pre-treatment export growth rate quartile. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Table C.2: Disentengling the two effects - Matching on pre-treatment export growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment (D_{it})	$M^S_{it} > 0$	$M^S_{it} > M^S_{it-1}$	$M^S_{it} > M^S_{it-1}$	$M^S_{it} > M^S_{it-1}$	$M^U_{it} > 0$	$M^U_{it} > M^U_{it-1}$	$M^U_{it} > M^U_{it-1}$	$M^U_{it} > M^U_{it-1}$
			$M^S_{it-1} = 0$	$M^S_{it-1} > 0$			$M^U_{it-1} = 0$	$M^U_{it-1} > 0$
X_{ijt}	0.449^a	0.843^a	0.855^a	0.764^a	0.011^a	0.476^a	0.516^a	0.359^a
	(0.005)	(0.007)	(0.010)	(0.011)	(0.004)	(0.005)	(0.007)	(0.007)
$\hat{\varepsilon}_{ijt}$	0.034^a	0.338^a	0.347^a	0.298^a	0.000	0.303^a	0.304^a	0.250^a
	(0.004)	(0.006)	(0.008)	(0.009)	(0.003)	(0.004)	(0.006)	(0.006)
$\hat{\epsilon}_{ijt}$	0.415^a	0.504^a	0.507^a	0.466^a	0.011^a	0.172^a	0.212^a	0.109^a
	(0.003)	(0.006)	(0.005)	(0.006)	(0.002)	(0.003)	(0.004)	(0.004)

Note: This table provides the ATT estimates. Propensity scores upon which the matching is made are computed using predictions from the estimation of equation 1.24. M_{it} denotes the share of foreign workers in firm i at time t. We match firms using the estimated propensity score, from the same region-sector and from the same pre-treatment export growth rate quartile. Robust standard errors are shown in parentheses. ^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10% levels.

Chapter 2

How Multi-Destination Firms Shape the Effect of Exchange Rate Volatility on Trade: Micro Evidence and Aggregate Implications

2.1 Introduction

The increasing volatility of real exchange rates after the fall of Bretton-Woods agreements has been a source of concern for both policymakers and academics. Exchange rate risk increases trade costs and reduces the gains from international trade (Ethier, 1973). Surprisingly, macroeconomic evidence on the effect of exchange rate volatility on trade has however been quite mixed, yielding either small or insignificant effect on aggregate outcomes (see among others Tenreyro, 2007, Greenaway and Kneller, 2007 and Byrne et al., 2008). Common explanations for this missing evidence refer to the existence of hedging instruments for exchange rate risks, which are precisely designed to dampen the effect of exchange rate volatility on trade. At the micro (firm) level, a couple of papers provided evidence of a trade-deterring effect of real exchange rate volatility (see Cheung and Sengupta, 2013 on a sample of a few thousand Indian non-financial sector firms, and Héricourt and Poncet, 2015 on the population of Chinese exporters). The present chapter aims at bridging the gap between the two types of evidence. Why does not the documented microeconomic trade-deterring effect of exchange rate volatility translate into elastic aggregate trade outcomes?

The present chapter investigates the firm-level impact of Real Exchange Rate (RER) volatility[1] shocks on firms bilateral exports and focuses on the export reallocation across destinations that only multi-destination firms are able to. We examine the heterogeneous responses of exporters to RER volatility according to the number of destinations served. Beyond their higher access to financial instruments to hedge against risk, we argue that multi-destination firms are able to reallocate exports across destinations so as to minimise the overall impact of exchange rate volatility on their total exports. In that case, a large (or non-zero) trade-deterring effect of RER volatility in the firm-destination dimension would be consistent with a small (or zero) trade elasticity to RER volatility at the macro level, independently from hedging strategies.

We investigate this hypothesis using a French yearly firm-level dataset containing country- and product-specific trade data from the French Customs and balance-sheet information over the period 1995-2009. In a standard firm-level gravity-style model known to be compatible with most of the existing theoretical frameworks, we start by assessing the impact of standard bilateral RER volatility on several definitions of export performance at the firm level, for both the intensive

[1] Although the volatility of the real exchange rate differs conceptually from that of the nominal exchange rate, as shown by Clark et al. (2004), they do not differ much in reality. Beyond the fact that the literature delivers a strong preference for volatility indicators based on real exchange rates, our study includes Euro zone members with a fixed nominal exchange rate after 1999. Therefore, the choice for RER volatility was straightforward.

and extensive margins.

We provide evidence of a significant trade-deterring effect of bilateral RER volatility. Indeed, we find that a 10% increase in bilateral volatility reduces the value exported by 0.25%, and entry to a given export market by 0.15%, for the average firm. We also document that the number of destinations strongly amplifies this trade-deterring effect of bilateral RER volatility, independently of other firm size measures Ranking flows according to the number of destinations served, our results show that a 10% increase in bilateral volatility decreases bilateral exports at the 90th percentile by 3.6% relatively to 10th percentile. Similar computation for the differential effect between the 99th and the 1st percentile gives a decrease by 6.2%. Qualitatively identical results are found for entry, with respectively net differential impacts equal to -0.4% (90th-10th percentile) and -0.6% (99th-1st). Those effects are robust to various specifications and robustness checks. In particular, the trade-deterring effect is robust to the inclusion of variables related to potential hedging behavior of firms, through imports or proxys of access to financial markets. The effect is also robust to the inclusion of potential omitted variables– such as quality of political governance– capturing country-specific risks.

Since high-performing firms account for a major part of aggregate exports[2], this is all the more at odd with macro evidence mentioned above, concluding to an absence of effect of RER volatility on trade. How can the strong negative impact on exports at the firm-destination level for the firms making up the bulk of aggregate exports translate into an absence of impact at the aggregate level?

We rationalize this result by investigating the possibilities of reallocation across several destinations for firms serving a many countries. We document how observed trade flows depend upon "external" RER volatility, i.e. in other markets. For this purpose, we build a so-called multilateral RER volatility, which is a weighted average of the RER volatility in other countries. This variable measures the aggregate RER volatility of the potential countries the firm could serve conditionally to her sector. We thus investigate how much the reallocation behavior of the firm depends upon both the bilateral and multilateral RER volatility, the latter acting as a dis-opportunity cost. We find that the above-mentioned results are conditional upon relative RER volatility: when bilateral volatility increases relatively to multilateral volatility, exports

[2] In our sample, firms at the top 1% in terms of value exported represent 63% of aggregate exports, and firms at the top 10% represent 91% of aggregate exports - shares are averages over the 1995-2009 period. Those figures are very similar to those found by earlier studies on French firm-level exports, see in particular Mayer and Ottaviano (2007).

towards the considered market are hampered.

Heterogeneity in the possibility to reallocate exports across countries is crucial since it determines noteworthy implications for the trade-deterring effect RER volatility at the aggregate level. In this respect, we find that the trade-deterring effect of RER volatility is all the more dampened that exports are concentrated in multi-destination firms. Our results help to reconcile the small aggregate trade elasticity to RER volatility and the trade-deterring micro effect growing with the number of destinations served: aggregate exports are driven by a small group of large firms that are especially able to reallocate exports across countries, leaving total exports mainly unaffected by bilateral RER volatility.

The first contribution of the chapter is to provide an alternative explanation for the muted response of aggregate trade flows to RER volatility. Existing literature emphasized the hedging strategies large firms tend to implement to cope with RER risk. On the contrary, we document that firm-destination exports flows are very sensitive to changes in RER volatility for large firms and we provide evidence that this result is driven by an efficient diversification through reallocation of exports across destinations. Our results also indicate that the latter seems to coexist with other hedging strategies.

Our second contribution consists in the identification of the reallocation behavior, in particular using measures of relative RER volatility. These composite indicators represent RER volatilities of all other destinations that could be served by the firm, and capture the external conditions upon which firms can reallocate exports. They appear to be determinant for correctly capturing how the trade-deterring effect of RER is shaped at the firm-destination level, which emphasizes that taking into account third-market effects at the firm-level is crucial to understand precisely how cost/demand shocks impact bilateral exports.

Third, the present chapter contributes to the literature investigating how aggregation bias and non-linearities shape aggregate outcomes. Imbs and Mejean (2015) show that the aggregation of heterogenous firms or sectors can result into a bias in the estimation of the elasticity of aggregate outcomes. Also close to our paper are Berman et al. (2012) and Berthou et al. (2016) who focus on the heterogeneous responses of trade at the firm/sector/country-level to changes in RER level and their aggregate implications. The focus on the present chapter is however different, since we focus on the volatility of the RER, and its implication in terms of reallocation of exports between destinations at the firm-level.[3]

[3]Somewhat related to our study is the paper by de Sousa et al. (2016). However, their focus is quite different since they study the impact of the volatility of foreign demand on bilateral exports, and do not study the possible

The chapter is structured as follows. In the next section, we survey the different theoretical mechanisms underlying our approach. Section 2.3 presents the dataset. Section 2.4 analyzes the first set of results of the chapter focusing only on the effect of bilateral RER volatility on both trade margins. We then further investigate the reallocation of exports across markets in Section 2.5. We then assess the aggregate implications of our results in Section 2.6, and provide concluding remarks in Section 2.7.

2.2 Real Exchange Rate Volatility, Firm Heterogeneity and Exports: Theoretical Background

2.2.1 How should the average firm react to bilateral RER volatility?

Several complementary mechanisms lead to expect a negative impact of exchange rate volatility on bilateral trade. First, RER volatility may be seen as a specific form of uncertainty, which was shown to harm real, firm-level variables in several theoretical context. In a firm-level framework with partial irreversibility, Bloom et al. (2007) find that higher uncertainty reduces the responsiveness of investment to a firm-level demand shock. Relying on a heterogenous-firms trade model with risk-averse managers, de Sousa et al. (2016) show that on average, firm-level exports decrease with uncertainty.

Following Ethier (1973), one may also think of exchange rate risk as creating an uncertainty for the exporter's earnings in her own currency, which is similar to an increase in variable costs. In a heterogenous-firms context, Bernard et al. (2011) show that higher variable trade costs (e.g., an increase in RER volatility) lead to a decrease in the share of multi-product firms that export as well as the number of destinations for each product, and the range of products firms export to each market.

Exchange rate volatility may also increase the sunk costs of exports (see Greenaway and Kneller, 2007), which can be seen as a form of investment in intangible capital. When facing a real depreciation of its own currency, the current earnings of a firm rise. The firm may use this additional income to fund the sunk costs of entering new markets. However, in the case of an abrupt subsequent currency appreciation, once these investments are made, it is impossible to back out and recover what they cost. Consequently, firms may be reluctant to take the chance of engaging in exports to markets characterized by highly volatile exchange rates.

interactions with the other markets served at the firm-level.

2.2.2 How should firm performance impact this relationship between bilateral RER volatility and exports?

We want to investigate whether large firms, serving many destinations are affected by RER volatility in a different manner from smaller firms. We believe that differences in firm size generates different behavior with respect to RER volatility.

On the one hand, multi-destination firms are large firms, and crucially have access to hedging instruments. Compared to smaller firms, these major players (Eaton et al., 2004) are particularly able to handle RER risks. The difference between large and small firms in the access to financial instrument to hedge against risk is widely confirmed by survey data. Ito et al. (2015) investigate how firms cope with exchange rate risk using survey data on a sample of a few hundred Japanese firms listed on the Tokyo Stock Exchange. They find that firms extensively use financial and operational hedging (through imports) to reduce the risk associated to exchange rate fluctuations. Based on the results of a survey conducted on a sample of 3,013 exporting firms located in five Euro Area countries (Austria, France, Germany, Italy and Spain), Martin and Mejean (2012) study the joint use of hedging instruments and the choice of invoicing currency. They find that firms using financial hedging are more likely to price in foreign currency, and conclude that the two strategies can be considered as complementary, and both strategies are correlated with the size of the firm: large firms are more likely to invoice exports in local currency and to hedge against exchange rate risk.

However, it appears from Martin and Mejean (2012) study that big firms are more exposed to RER volatility because they choose to do so. The explanation they put forward is that each supplementary destination is associated to increased diversification possibilities. Since RER volatilities in different destinations are not perfectly correlated, the destination margin of trade appears as a diversification possibility: multi-destination firms can react to an adverse shock of RER volatility somewhere by transferring trade to other and less volatile destinations.

The trade-off is thus the following. Multi-destination firms, who account for the bulk of exports (Bernard et al., 2011; Eckel et al., 2011), simultaneously have larger diversification possibilities across uncorrelated RER risks and better access to hedging instruments. If firm size primarily mirrors the ability to hedge, the number of destinations should therefore *dampen* the impact of RER volatility on exporting behavior of these firms on a given market. If these firms are covered against country-specific risks, a shock in RER volatility should affect them to lesser extent compared to smaller firms unable to hedge. On the contrary, if firm size proxies the diversification possibilities, the number of destinations should *magnify* the impact of RER volatility on exporting behavior of these firms on a given market: optimal reallocation across destinations would induce an amplified elasticity of firm-destination export flows to RER volatility.

These two competing mechanisms generate opposite patterns for firm-destination export flows. On the one hand, hedging behavior is consistent with a muted firm-destination effect of RER volatility on export flows with firm size. On the contrary, if firms optimally reallocate their exports across destinations, firm-country exports would be increasingly elastic to RER volatility with firm size. Both mechanisms are however consistent with a muted aggregate trade elasticity to RER volatility. Hedging behavior has been advocated to generate such a small trade elasticity to RER volatility: if firm-destination trade flows are inelastic to RER volatility because large firms are covered against risk, aggregate trade flows are straightforwardly unaffected by RER volatility. We raise an alternative explanation that may also rationalize the small trade elasticity to RER volatility at the aggregate level, but which is based upon a different micro-level mechanism. If firm-destination trade flows are increasingly elastic to RER because of optimal reallocation of exports across destinations, trade diversion across destinations leaves firm exports mainly unchanged.

On the whole, exchange rate volatility generates both an increase in variable and fixed costs of exporting that could be rationalized using the work by Chaney (2008). At the individual firm level, since firm exports depend upon variable trade costs, trade flows are decreased by RER volatility. Relatedly, RER volatility generates a change in the relative cost in serving a specific country compared to other destination the firm is able to serve.

We bring this hypothesis of a strong non-linearity of RER volatility along firms' performance distribution to the data to disentangle between the two mechanisms that are both consistent with the aggregate small export elasticity to RER volatility. Crucially, the reallocation behavior makes the multi-destination firms export flows divert away from high to low RER volatility destinations. If multi-destination firms take advantage of reallocation possibilities, export flows should be affected by RER volatilities in other destinations. On the contrary, if large firms are hedged against RER risks, export flows should neither be affected by RER volatility nor by the RER volatilities in the other destinations. Investigating the effect of external RER volatility on firm-level bilateral exports is thus of importance to disentangle the two opposite mechanisms.

We finally remark that the two mechanisms generate different general equilibrium effects on export markets. If large firms hedge against risk, all market outcomes are hardly affected by RER volatility, precisely because of the muted response of firm export flows to RER volatility. By contrast, if big firms decrease proportionally more their exports to a given market because of RER volatility, significant general equilibrium effects may arise: in a standard Melitz (2003) model, exit from large firms or lower exported quantities may imply reallocation of exporters on a given market. In particular, the lower quantities sold by large firms, because of reallocation possibilities, may benefit to small firms[4].

2.2.3 Key testable relationships

Three testable relationships can be derived from these various theoretical approaches for export performance on both the intensive (export value) and the extensive trade margins (entry).

Testable Relationship 1: Export performance decreases with bilateral exchange rate volatility. We therefore expect the link between bilateral volatility, on the one hand, and the exported value and the entry decision, on the other hand, to be negative.

Testable Relationship 2: Firm performance (size and number of destinations) is expected to magnify the negative impact of bilateral RER volatility, if diversification dominates conventional (natural/financial) hedging behavior.

Testable Relationship 3: Export performance decreases with relative exchange rate volatility. We therefore expect the link between the latter, on the one hand, and the exported value and the entry decision, on the other hand, to be increasingly negative with the number of destinations served.

2.3 Empirics

2.3.1 Data

RER Volatility Indicators. The bilateral real exchange rate volatility towards destination j, $Bil\_volat_{j,t}$, is computed as the yearly standard deviation of monthly log differences in the real exchange rate. Because we rely on an indirect quotation (that is, one unit of foreign currency

[4]Another mechanism associating RER volatility and higher exports for small firms was put forward in De Grauwe (1988). In any case, the aggregate impact of these small firms is negligible compared to the aggregate impact of large firms' behavior.

equals e units of euros), we compute the real exchange rate as follows: $\text{RER}_{j,m,t} = e_{j,m,t} \times \frac{p_{j,t}}{p_{\text{dom},t}}$, where $e_{j,m,t}$ is the nominal exchange rate of the domestic currency with respect to the destination j's currency at the end of month m of year t, $p_{j,t}$ is the CPI of country j in year t and $p_{dom,t}$ is the French CPI in year t. Nominal exchange rate data are monthly averages, and come from the IMF's IFS dataset.

Firm-level data We use firm-level trade data from the French customs over the period 1995-2009. This database reports exports for each firm, by destination and year over our sample period. It reports the volume (in tons) and value (in euros) of exports for each CN8 product (European Union Combined Nomenclature at 8 digits) and destination, for each firm located on the French metropolitan territory. Some shipments are excluded from this data collection. Inside the European Union, firms are required to report their shipments by product and destination country only if their annual trade value exceeds the threshold of 150,000 euros. For exports outside the EU all flows are recorded, unless their value is smaller than 1,000 euros or one ton. Those thresholds only eliminate a very small proportion of total exports. We exclude from our sample intermediate goods using the Broad Economics Categories classification. The underlying intuition is that exports of intermediates should not react to RER volatility in their destination of exports, but to greater RER volatility in destinations' exports of the products for which these imports are used to produce.

We also use firm-level data contained in the dataset called "BRN" ("Bénéfices Réels Normaux"), which provides balance-sheet data i.e. value added, total sales, employment, capital stock and other variables. The period for which we have the data is from 1995 to 2009. The BRN database is constructed from reports of French firms to the tax administration, which are transmitted to INSEE (the French Statistical Institute). The BRN dataset contains between 650,000 and 750,000 firms per year over the period (around 60% of the total number of French firms). Importantly, this dataset is composed of both small and large firms, since no threshold applies on the number of employees. A more detailed description of the database is provided by Eaton et al. (2004, 2011). Depending on the year, these firms represent between 90% and 95% of French exports contained in the customs data. As it is standard in the literature, we restrict the observations to firms belonging to manufacturing which excludes wholesalers. Balance-sheet and customs data can be merged using the firm identifier (SIREN number) and the year. The dataset finally contains between 17,000 and 35,000 exporting firms per year, and between 137 and 151 destinations served per year.

Other macroeconomic variables come from the Penn World Tables and the IMF's International Financial Statistics.

2.3.2 Descriptive Statistics

Summary statistics of key variables are given in Tables 2.1 and 2.2. They are consistent with previous evidence about French firms: exporting firms are highly heterogeneous in their performance and size, implying a large variance in our dataset. The average firm-country exported value is slightly above 520,000 thousand euros, whereas the average number of employees and value of assets are also quite small: the average exporter is a small firm, with modest values of exports. Performance indicators distributions, that are reported in Table 2.2, deliver a similar message: only a small number of highly performing firms, exporting towards a significant number of destinations. Half of the French firms export towards at most 2 destinations, which is consistent with previous studies on the subject (Eaton et al., 2011 or Mayer and Ottaviano, 2007) and supports the representativeness of the sample.

Table 2.1: Summary Statistics of the Key Variables

Variable	Mean	Std. Dev.	Min	Max
Firm-level variables				
Firm Export value (millions of Euros)	14.11	139.62	0.00	11,163.93
Firm-country Export value (millions of Euros)	0.52	11.09	0.00	4,322.94
Start Dummy	0.16	0.37	0	1
Participation Dummy	0.25	0.44	0	1
Assets (Thousands of Euros)	189.75	5403.34	0.00	1,266,499
Employment (# Employees)	332.96	3262.39	0	298,487
Multilateral Volatility (sector-level sh.)	0.01	0.005	0.00	0.023
Multilateral Volatility (macro level sh.)	0.02	0.004	0.006	0.038
Multilateral Volatility (firm-level sh.)	0.01	0.010	0.00	1.318
Macro variables				
Bilateral RER Volatility	0.018	0.023	0.001	1.318
GDP (Billions of US dollars)	1,043.066	2,173.799	0.174	13,122.22
Price Index (Real Effective Exchange Rate)	0.693	0.451	0.000	3.33

Note: The summary statistics are computed on the 2,260,149 firm-country-year observations that make up our final regression sample used in Table 2.3 to study the intensive margin. The only exception are the statistics for the start and participation dummies which are computed, respectively, on the 6,533,922 firm-country-year observations used in Table 2.4, and on 7,695,707 firm-country-year used in Table F.1. Source: authors' computations from BRN, French Customs and IFS data.

Table 2.2: Distribution of Performance Indicators

Sample	Firm-Dest-Year		Firm-Year	
Variable	Productivity	# Dest.	Productivity	# Dest
1%	11.35	1	9.64	1
10%	29.16	3	27	1
50%	55	12	50.25	2
90%	121.93	37	110.24	12
99%	385.29	72	329	36

Note: Productivity = Value Added per employee, in thousands of euros. For the first two columns, the summary statistics are computed on the 2,150,351 firm-country-year observations that make up our final regression sample used in Table 2.3 to study the intensive margin. For the last two columns, the summary statistics are computed on the 425,741 firm-year dyads corresponding to our final regression sample.
Source: authors' computations from BRN and French Customs.

2.3.3 French Firms and RER Volatility: Some Facts

Using these datasets, we start to explore how French firms cope with RER volatility. We report in Figure 2.1 the cumulative distribution of exports with respect to the bilateral RER volatility. We represent on the vertical axis the share of total exports $P(x)$ that was exported subject to a RER volatility lower than x. We restrict our figure to RER volatility that is under .1 since more than 98% of French exports are concentrated under this value. A high share of total exports face a low RER volatility: around 60% of exports are directed towards destinations with a volatility equal or lower than 0.02. This should not be surprising since an important part of French exports are directed towards Euro Area countries, with a structurally close to zero RER volatility. At the other end of the spectrum, 10% of aggregate exports face a bilateral RER volatility equal or above 0.04. On the whole, there is an interesting heterogeneity for our analysis.

Finally, we represent in Figure 2.2 two types of mean RER volatility faced by firms when exporting to many markets. The line represents the simple average RER volatility across all destinations, while the points represent the exports-weighted average RER volatility faced by firms. We thus compare average RER volatility and effective aggregate RER volatility for each type of firm. The higher the number of destinations, the higher the average RER volatility is. Yet, once firm choices are taken into account, we find that the average RER volatility increases but less than if no reallocation choices were made by the firm. This is a first, descriptive evidence that, when firms can allocate their exports across destinations, they face lower aggregate RER volatility.

Figure 2.1: Cumulative Distribution of Exports

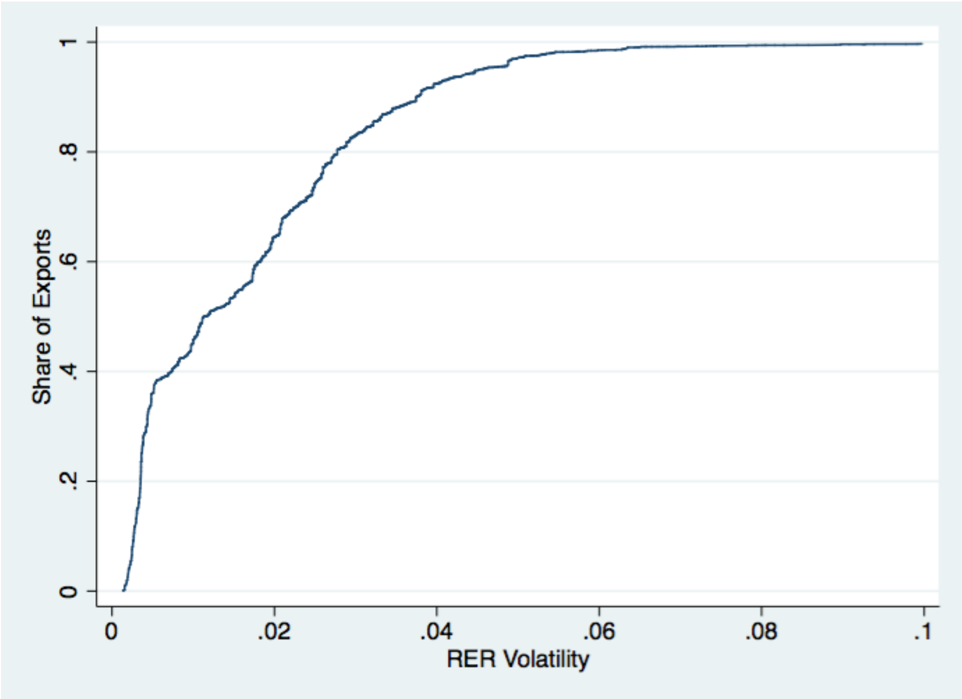
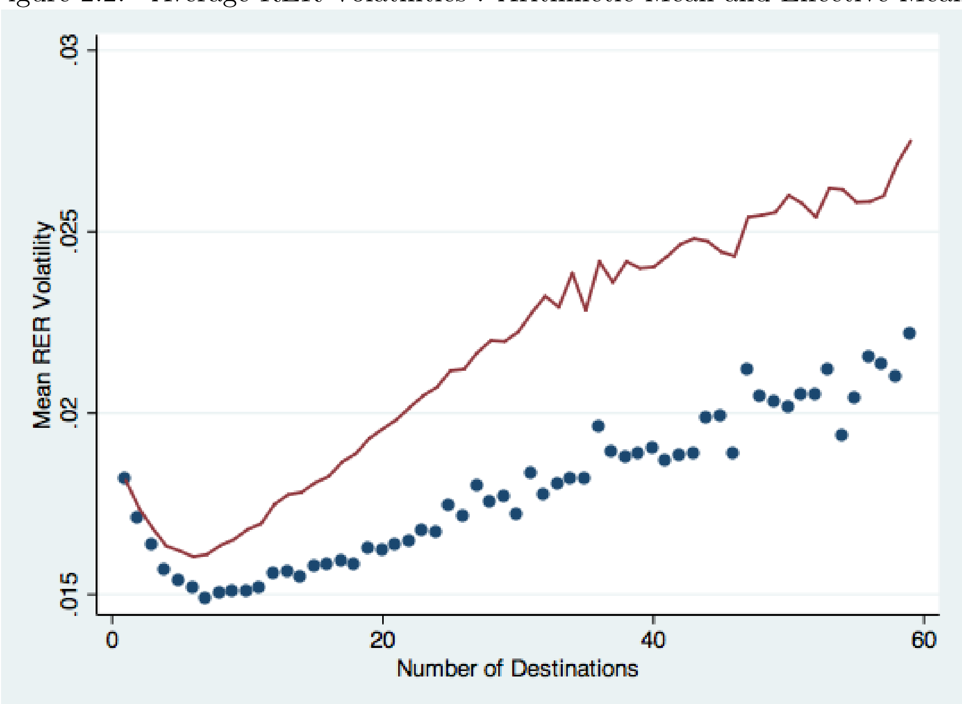


Figure 2.2: Average RER Volatilities : Arithmetic Mean and Effective Mean.



2.4 Export Performance and Bilateral RER Volatility

Empirical strategy We start by estimating the following specification:

$$\begin{aligned} \text{ExportPerf}_{ijt} &= \alpha \text{Bil\_volat}_{jt} + \tau \left(\text{Bil\_volat}_{jt} \times \text{NbDest}_{it-1} \right) \\ &+ \phi \mathbf{Z_{jt}} + \theta_j + \lambda_{it} + \mu_{ij} + \gamma_{jt} + \epsilon_{ijt} \end{aligned} \tag{2.1}$$

where ExportPerf_{ijt} is a measure of the export performance of firm i for export destination j in year t. We consider two alternative measures of export performance: the intensive margin of exports is captured with the log of the free-on-board export sales to country j in year t while the extensive margin is apprehended as entry. The latter is defined as $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$[5]. Bil_volat_{jt} is the standard bilateral RER volatility in destination j. Our empirical strategy presumes the exogeneity of real exchange rate volatility, since it is very unlikely that a firm shock translates into a change in country-level exchange rate variations. This is a very standard assumption in the related empirical literature, made among others by Berman et al. (2012), Cheung and Sengupta (2013) or Héricourt and Poncet (2015).

All our estimations include firm-year fixed effects, λ_{it}, allowing us to examine variations in export allocations across destinations for a given year. We complete this specification by adding a set of country dummies to account for unobserved heterogeneity. In some specifications, we replace this set of dummies by a a set of firm-country fixed effect, μ_{ij}: it allows us to account simultaneously for variations in exports across years, even though it is not the main focus of our investigation.

We include the interactive term between bilateral RER volatility and the (lagged) number of destinations to account for a non-linear effect of RER volatility with firm size. Note that all unconditional firm-year variables, such as the number of served destinations, are by construction subsumed in the firm-year fixed effects. The key parameter of interest is τ (interaction with the number of destinations): its sign and level of significance tells whether the amplifying effect of the number of destinations on trade mentioned in section 2.2 is at play. If firm-destination trade flows of multi-destination firms tend to exhibite a largerake advantage of reallocation possibilities, τ should exhibit a negative sign, like α (see Testable Relationship 2).

[5] In that set of regressions, our sample consists of a firm-country series of zeros followed by a decision to begin exporting. For a given firm-country, we can have several beginnings. For example, the subsequent export statuses 011001 becomes 010001 in our sample.

The conditioning set $\mathbf{Z_{jt}}$ consists of destination-year specific variables. In standard models of international trade, exports depend on the destination country's market size and price index. Therefore, $\mathbf{Z_{jt}}$ includes in our specifications destination j's GDP and effective RER.

We include in some specifications a set of country-year fixed effects (γ_{jt}). However, since it is colinear with the bilateral RER volatility, including this set of fixed effect makes bilateral volatility unidentifiable. We thus introduce this fixed effect in specifications including solely interactive terms.

Finally, all regressions are performed with the linear within estimator for the intensive margin and the linear probability model[6] for the extensive margin. Finally, Moulton (1990) shows that regressions with more aggregate indicators on the right-hand side could induce a downward bias in the estimation of standard errors. All regressions are thus clustered at the destination-year level using the Froot (1989) correction.

2.4.1 Baseline evidence

We study the joint effects of both bilateral RER volatility, firm performance and number of destinations on the two margins of trade separately: the size of export value per firm for the intensive margin, and the decisions to start exporting (entry) for the extensive margin.

Intensive margin of trade

We present baseline estimation results in Table 2.3. We first focus on the unconditional effect of bilateral RER volatility on export performance, i.e., on a benchmark specification with τ restricted to 0. We estimate in columns (1) and (2) a negative effect of bilateral volatility, consistently with Testable Relationship 1. The estimated negative sign is robust to the inclusion of the destination countries' market size and price index in column (2), both displaying the expected positive signs.

This fixed effect structure allows us to investigate whether changes in bilateral RER volatility affect exports across destinations for a given firm-year. As for control variables, our two proxies for the destination countries' market size and price index display the expected positive sign.

A 10% increase in the RER volatility generates lower exports by around 0.3%. While qualitatively consistent with previous firm-level studies, this estimate for the average firm seems

[6]The LPM makes easier the estimation of models with many observations, fixed effects and dummies. In our case, an estimation based on a non-linear estimator, such as the conditional logit proved to be impossible.

Table 2.3: Intensive Margin: Baseline Estimations

Dep. Variable	Ln(X_{ijt})					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.043^a	-0.034^a	0.351^a	0.038^b		
	(0.013)	(0.012)	(0.025)	(0.017)		
Ln Country price index		0.062^b				
		(0.025)				
Ln GDP		1.222^a				
		(0.072)				
Ln. Bil. RER Volatility × Nb. dest			-0.143^a	-0.028^a	-0.028^a	-0.022^a
			(0.008)	(0.006)	(0.004)	(0.005)
Ln. Bil. RER Volatility × Assets						-0.009^a
						(0.003)
Observations	2260149	2260149	2260149	2260149	2260149	2260149
R^2	0.878	0.879	0.533	0.878	0.880	0.880
Firm-year dyads	425741	425741	425741	425741	425741	425741
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

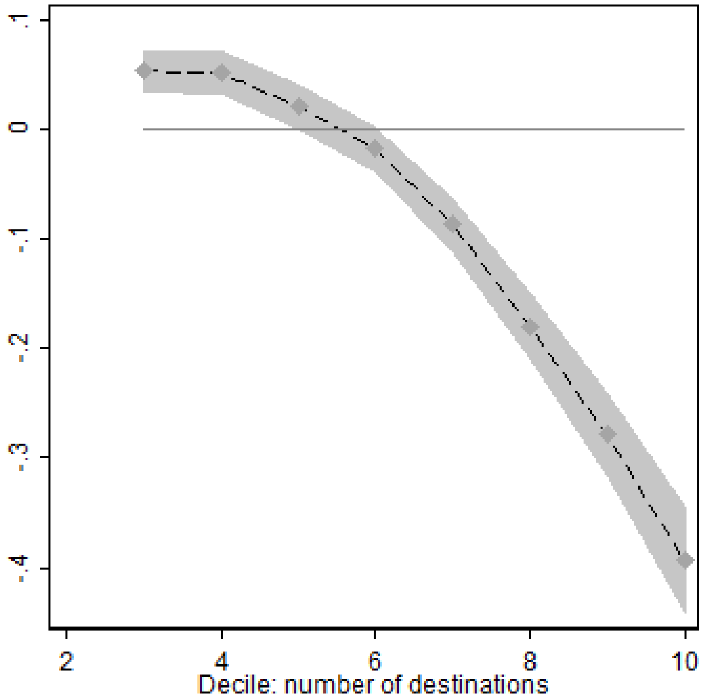
Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and country fixed effects.

quantitatively modest.

This average effect however hides strong heterogeneity across firms. Columns (3) to (6) show that the magnitude of the negative effect of RER volatility on the intensive margin of trade actually depends on the performance of the firm. The number of destinations is estimated to amplify the negative effect of bilateral volatility. In specification (3), the estimated coefficient on the interaction term between RER volatility and the number of destinations the firm serves is negative and significant. Since the unconditional effect of volatility was negative in the first two columns, we interpret this conditional negative coefficient as a magnifying effect of firm size.

To illustrate these results, we can provide quantitative assessments of the differential impact of RER volatility on the export performance for firms at the 10$^{\text{th}}$ and 90$^{\text{th}}$ percentiles of the distribution of the number of destinations served. Table 2.2 above reports summary statistics on the distribution of the number of destinations. Based on coefficients from column (3) in Table 2.3, all things being equal, the effect of a 10% increase in RER volatility on export value is $0.1 \times \alpha + 0.1 \times \tau \times NbDest$. Our results show that a 10% increase in bilateral volatility decreases bilateral exports by -1.6% [0.1× 0.038 + 0.1 × (-0.028) × ln(37)] for firms above the 90$^{\text{th}}$ percentile, but boosts exports for firms at the 10$^{\text{th}}$ percentile by +2% [0.1× 0.361 + 0.1 ×

Figure 2.3: Estimated Elasticities



(-0.143) × ln(3)]. This brings a net impact on the 90th relatively to 10th percentile of - 3.6% [0.1 × (-0.143) × (ln(37)-ln(3))]. Similar computation for the differential effect between the 99th and the 1st percentile gives a decrease by 6.2% [0.1 × (-0.143) × (ln(72)-ln(1))]. Column (3) thus suggest that multi-destination trade flows at the destination level are much more hampered by RER volatility than the single-destination firms.

Another picture of the differential impact of RER volatility is displayed in Figure 2.3. We plot the estimated coefficients associated to unconditional bilateral volatility for each decile of the distribution of the number of destinations. The elasticity of trade flows to RER volatility is decreasing with the number of destinations, suggesting a magnifying effect of RER volatility on trade for multi-destination firms.

The amplifying effect of the number of destinations is robust to the inclusion of firm-country fixed effects in column (4), and to the inclusion of country-year fixed effects in column (5) that make the identification of the unconditional impact of bilateral volatility on trade impossible.

We introduce in column (6) the interactive term between bilateral volatility and the (lagged) assets of the firm, together with the interaction between volatility and the number of destinations

Table 2.4: Extensive Margin, Entry: Baseline Estimations

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.015^{a}	-0.014^{a}	0.024^{a}	-0.008^{c}		
	(0.004)	(0.004)	(0.007)	(0.004)		
Ln Country price index		0.006^{b}				
		(0.003)				
Ln GDP		0.115^{a}				
		(0.014)				
Ln. Bil. RER Volatility × Nb. dest			-0.012^{a}	-0.002^{b}	-0.004^{a}	-0.004^{b}
			(0.001)	(0.001)	(0.001)	(0.002)
Ln. Bil. RER Volatility × Assets						-0.000
						(0.000)
Observations	6996200	6996200	6996200	6996200	6996200	6996200
R^2	0.390	0.390	0.263	0.390	0.396	0.396
Firm-year dyads	1306136	1306136	1306136	1306136	1306136	1306136
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	yes	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and country fixed effects.

in column (7). We find that assets also magnify the negative effect of bilateral RER volatility on the intensive margin of trade, but the amplifying effect associated to the number of destinations is still present in the results and resists to the inclusion of this alternative measure of firm size. As expected from the theoretical discussion supporting Testable Relationship 2, the same bilateral RER volatility shock simultaneously decreases exports from high performing firms and increases those for low-performing firms. The key point is that the differential impact between top and bottom percentiles delivers substantial negative figures, confirming that big multi-destination firms, which account for the bulk of aggregate exports, react both negatively and disproportionately to a RER volatility shock.

Extensive margin of trade

We also assess the joint effect of bilateral RER volatility and indicators of firm performance on the extensive margin of trade at the firm-country level (i.e. how they affect entry decision). The explained variable is now the decision for a firm to start exporting to market j. It is constructed as a change of export status at the firm-country level; it takes the value 1 when a firm exports to country j in year t but did not in year $t-1$.

Table 2.4 replicates for the entry behavior the estimations presented in Table 2.3. Evidence in column (1) suggests that RER volatility has a significant deterring impact on the entry decision. A 10 % increase in RER volatility is associated to a 0.15 % decrease in entry probability. The entry decision is thus less affected by RER volatility than the intensive margin. Similarly to the intensive margin, this average figure however hides heterogeneity across firms. Indeed, columns (3) to (6) investigate the existence of non-linearities of this trade-deterring effect in the number of destinations. The number of destinations seem to amplify the negative response of entry associated to RER volatility, but the elasticity associated to the interaction is very close to zero and lower than for the intensive margin.

As we did previously for the intensive margin, we can compare the differential impact of RER volatility conditioning on the number of destinations served by contrasting effects for firms at the 10^{th} and 90^{th} percentile of the distribution of the number of destinations. Based on coefficients from column (3), this leads that, all things being equal, the net differential effect on the 90^{th} percentile relative to the 10^{th} percentile of an additional 10 percent in RER volatility on the probability of entering is equal to -0.4% [$0.1 \times (-0.012) \times (\ln(72)-\ln(3))$]. For the 99^{th} percentile relative to the 1^{st}, the net differential impact amounts to -0.6% [$0.1 \times (-0.012) \times (\ln(72)-\ln(1))$]. This set of results is thus consistent with our prediction suggesting that RER volatility also deters trade at the extensive margin. The estimated elasticities are however a lot smaller than at the intensive margin. The baseline results suggest that when facing RER volatility, the adjustment mainly occurs at the intensive margin. On average, RER volatility tends to deter disproportionately more exported quantities than the extensive margin. The main trade-deterring effect of RER volatility is thus concentrated at the intensive margin, even though multi-destination firms exhibit larger elasticities for both trade margins.

2.4.2 Robustness analysis

Accounting for hedging behavior and invoicing currency

Hedging strategies have been advocated to be responsible for the muted response of trade flows following RER volatility. Previous results however suggest that RER volatility impacts large firms more than the average firm. In Table 2.5, we check whether the negative (micro-level) effect of RER volatility at the intensive margin resists to the inclusion of variables embodying (or at least, indirectly related to) hedging or invoicing behavior by firms.

In columns (1) and (2) we start by controlling for natural hedging strategy by accounting for firm-country imports. We compute a dummy variable (D_{import}) equal to 1 if the exporting firm i is simultaneously an importer from country j in year t.[7] Since this variable is defined at the firm-country level, the unconditional variable is not subsumed in the firm-year fixed effects. We can then estimate the unconditional impact of being an importer and investigate the conditional impact of RER volatility upon this dimension. The estimated coefficient with respect to the import dummy in column (1) is significantly positive and its conditional effect is slightly positive (column (2)). This is logical consequence from hedging behavior: being naturally covered against country-specific risks generates a fall in the conditional effect of RER volatility. However, our main result remains unharmed: even taking into account imports from the same country, bilateral volatility still exerts a disproportional negative impact on exports for firms serving many destinations.

The inclusion of financial hedging in the picture is less straightforward. Exhaustive information regarding the use of hedging instruments is not available - studies like Martin and Mejean (2012) or Ito et al. (2015) are based on survey data for a few thousand firms. However, we do know that, in a world of imperfect financial markets with information asymmetries, a larger firm will have also easier access to external finance since it has more collateral (see Beck et al., 2005, for cross-country-evidence). Consequence is twofold: bigger firms have simultaneously a better access to external finance and to hedging instruments; they have more finance to fund the use of hedging instruments, like forward contracts or options. Since the latter are mostly short-term contracts, we can presume that they will weigh primarily on firms short-term finance. Therefore, we decide to focus on the effect of two ratios to capture firm-level access to short-term finance and hedging instruments. We first compute a working-capital ratio (WC ratio), defined as working capital requirement over stable resources using BRN dataset. Results are presented in columns (3) and (4). We then compute a short-term debt ratio (STD ratio), equal to short-term debt over total debt. Results are presented in columns (5) and (6). Both firm-level measures dampen the negative effect of RER volatility on trade flows, consistently with the idea these two variables may correctly proxy financial coverage. However, these results coexist with the magnifying effect of the number of destinations on bilateral volatility.

[7] We choose to use a dummy rather the continuous imports variable itself, because of the many zeros it contains. The log transformation would then cause a drastic reduction in sample. Using a dummy allows to spare observations.

Table 2.5: Intensive margin - Hedging

Dep. Variable	Ln(X_{ijt})							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Bilateral RER volatility	-0.034^a		0.053^a		0.056^a		0.063^a	
	(0.012)		(0.020)		(0.021)		(0.019)	
Ln Country price index	0.066^a		0.069^b		0.068^b		0.061^b	
	(0.025)		(0.027)		(0.028)		(0.025)	
Ln GDP	1.218^a		1.300^a		1.282^a		1.244^a	
	(0.072)		(0.083)		(0.091)		(0.073)	
D_{import}	0.235^a	0.280^a						
	(0.036)	(0.026)						
Ln. Bil. RER Volatility × D_{import}	0.008	0.018^a						
	(0.008)	(0.005)						
Ln. Bil. RER Volatility × Nb. dest		-0.026^a	-0.028^a	-0.024^a	-0.029^a	-0.023^a	-0.032^a	-0.027^a
		(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Ln. Bil. RER Volatility × Work. Capital Ratio			0.004	0.003				
			(0.002)	(0.002)				
Ln. Bil. RER Volatility × Short-term debt Ratio					0.005^c	0.004^c		
					(0.003)	(0.003)		
Ln. Bil. RER Volatility × D_{oecd}							-0.005	-0.197
							(0.022)	(11.583)
D_{oecd}							0.050	
							(0.160)	
Observations	2150351	2150351	1749732	1749732	1842556	1842556	2150351	2150351
R^2	0.879	0.881	0.885	0.887	0.886	0.887	0.879	0.880
Firm-year dyads	425741	425741	340893	340893	366998	366998	425741	425741
Country-Year FE	no	yes	no	yes	no	yes	no	yes

Note: D_{Import} stands for the importer dummy. Working Capital Ratio is defined as working-capital requirement to stable resources. Short-term debt ratio is defined as the ratio of short-term debt to total debt, i.e. short- and long-term debt. D_{oecd} takes the value 1 if the destination country belongs to the OECD, 0 otherwise. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Similarly, no exhaustive information on invoice currency used by the exporter is available at the firm-level. The study from Martin and Mejean (2012) on a few thousands firms from several EMU countries (among which, France) highlights that 90% of firms declare using the euro for exports, but this proportion decreases once firms are weighted by their size. On the whole, 70% of the value of EMU aggregate exports are invoiced in euro. This emphasizes that bigger firms are more likely to invoice using the local currency of the destination country to price their exports. We already control extensively for firms size in the above-mentioned estimations, and our main result of magnified impact of bilateral RER volatility for bigger firms is fully consistent with the idea that bigger firms are voluntarily more exposed to exchange rate risk. Interestingly, it also appears that firms mainly exporting to developing countries are expected to price in home currency while exports to the US or other large industrialized countries are more likely to be priced in destination countries. We test directly this idea in columns (7) and (8) of Table 2.5 where a dummy variable is introduced, taking the value 1 if the destination country belongs to the OECD, and its interaction with bilateral volatility. Despite the expectations from the literature on invoicing currency, coefficients are insignificant in the two columns, not affecting our coefficient of interest. We conclude from this set of results that hedging behavior of firms does not affect the negative impact of bilateral volatility which is growing with the number of destinations served.

We perform a similar analysis at the extensive margin. We check in Table 2.6 the robustness of our results to the inclusion of variables possibly related to natural or financial hedging at the firm-level, as well as invoice currency choice. If imports are not associated to higher entry in the considered country (column (1)), they seem to have a small hedging impact on bilateral volatility (column (2)), without compromising our main result in any manner. The same conclusion prevails for the Working Capital Ratio and the short-term debt ratio. Interactions between a dummy variable for destination countries belonging to the OECD and bilateral RER volatility is negative in column (7): the negative impact of RER volatility on entry is magnified for these specific destination markets, which fits well with the idea that exporters tend to price more in destination currencies when they export to developed markets. But once again, this does not change anything to our main result: bilateral RER volatility hits disproportionately more bilateral exports from firms serving many destinations.

Table 2.6: Extensive margin - Hedging

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Bilateral RER volatility	-0.011^a		-0.007		-0.010^c		0.006	
	(0.003)		(0.005)		(0.005)		(0.005)	
Ln Country price index	0.006^b		0.006^b		0.007^b		0.006^c	
	(0.003)		(0.003)		(0.003)		(0.003)	
Ln GDP	0.114^a		0.111^a		0.103^a		0.116^a	
	(0.013)		(0.016)		(0.018)		(0.014)	
D_{import}	0.036	0.094^a						
	(0.022)	(0.007)						
Ln. Bil. RER Volatility × D_{import}	-0.012^c	0.005^a						
	(0.006)	(0.002)						
Ln. Bil. RER Volatility × Nb. dest		-0.004^a	-0.002^c	-0.004^a	-0.002	-0.004^b	-0.004^b	-0.004^a
		(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Ln. Bil. RER Volatility ×Working Cap. Ratio			-0.000	-0.001^a				
			(0.000)	(0.000)				
Ln. Bil. RER Volatility × Short-term Debt					0.001^c	0.001^b		
					(0.000)	(0.000)		
Ln. Bil. RER Volatility × D_oecd							-0.022^b	0.308
							(0.010)	(14.023)
D_{oecd}							-0.062	
							(0.040)	
Observations	6533922	6533922	5328017	5328017	5617994	5617994	6533922	6533922
R^2	0.390	0.395	0.400	0.405	0.403	0.408	0.388	0.393
Firm-year dyads	425741	425741	340893	340893	366998	366998	425741	425741
Country-Year FE	no	yes	no	yes	no	yes	no	yes

Note: D_{Import} stands for the importer dummy. Working Capital Ratio is defined as working-capital requirement to stable resources. Short-term debt ratio is defined as the ratio of short-term debt to total debt, i.e. short- and long-term debt. D_{oecd} takes the value 1 if the destination country belongs to the OECD, 0 otherwise. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Potential omitted factors

In Table 2.7, we check the robustness of our results to the inclusion of potential omitted variables.

Table 2.7: Intensive margin - Omitted Variables

Dep. Variable	Ln(X_{ijt})								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln Bilateral RER volatility	-0.033^b	0.051^b		-0.029^a	0.035^c		-0.033^b	0.069^a	1.196
	(0.015)	(0.025)		(0.011)	(0.018)		(0.015)	(0.026)	(31.929)
Ln Country price index	0.062^b	0.058^b		-0.062^b	-0.066^b		0.063^b	0.054^c	
	(0.029)	(0.029)		(0.030)	(0.030)		(0.028)	(0.029)	
Ln GDP	1.184^a	1.195^a		1.151^a	1.162^a		1.043^a	1.074^a	
	(0.088)	(0.088)		(0.069)	(0.069)		(0.089)	(0.091)	
QoG Pol.	0.042^b	0.010							
	(0.021)	(0.030)							
Ln. Bil. RER Volatility × Nb. dest		-0.029^a	-0.021^a		-0.022^a	-0.018^a		-0.031^a	-0.026^a
		(0.007)	(0.006)		(0.006)	(0.005)		(0.007)	(0.006)
Ln. Bil. RER Volatility × QoG Pol.		0.011	0.021^a						
		(0.008)	(0.007)						
Ln RER level				0.413^a	0.356^a				
				(0.069)	(0.069)				
Ln RER level × Nb. dest					0.017^a	0.020^a			
					(0.003)	(0.002)			
Exporter Experience							0.287^a	0.256^a	0.286^a
							(0.012)	(0.037)	(0.031)
Ln. Bil. RER Volatility × Exp. Experience								-0.007	-0.007
								(0.008)	(0.007)
Observations	1631978	1631978	1631978	2150351	2150351	2150351	1600253	1600253	1600253
R^2	0.891	0.891	0.892	0.879	0.879	0.880	0.892	0.892	0.893
Firm-year dyads	326176	326176	326176	425741	425741	425741	325496	325496	325496
Country-Year FE	no	no	yes	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

We start by checking that the impact of RER volatility on trade does not solely capture country-specific risks. Quality of institutions and governance is a strong determinant of trade at the aggregate level and at the firm level, insofar as trade is negatively associated to political and economic risks. We thus use the "Political Stability Estimate" variable from the Worldwide Governance Indicators dataset on institutional quality to control for country-specific risks in our specification (Kaufmann et al., 2010). This variable is an inverse measure of risks: an increase in the value of political stability is associated with a decrease in the risks associated with export activity in this country, and is therefore expected to positively impact firm-level bilateral exports. Columns (1) to (3) of Table 2.7 display the results. The quality of governance increases the average trade flows, and the effect is magnified for large and multi-destination firms. Both unconditional and conditional effects of quality of governance are thus consistent and perfectly in line with the one on RER volatility. Crucially, these effects do not soak up each other: including quality of governance and conditioning this variable upon firm performance leaves the main results about the trade-deterring effect of RER volatility unchanged. This supports that the effect we are highlighting is truly related to exchange rate volatility, and does not capture an effect related to political instability instead.

Columns (4) to (6) report the result of a similar exercise with the RER level. The measured impact of RER volatility could actually capture variations in the exchange rate level. Including the RER controls explicitly for this trend. Because we rely on an indirect quotation, an increase in the level of the exchange rate, implying a depreciation, is expected to have a positive impact on export performance. This intuition is confirmed: RER volatility and RER level enter with reverse signs. Once again, the inclusion of RER in level does not affect the main message: the trade-deterring effect of RER volatility remains present and is magnified by the number of destinations, event though elasticities are slightly reduced.

We finally control for market-specific experience. We cannot exclude that more experienced firms could have more accurate anticipation of future ER volatility. We compute the number of years of presence in our sample at the destination level to measure market experience and we include this measure in columns (7) to (9). Exporting experience is associated to higher exports, but its joint effect with bilateral volatility does not show any conditional effect. The trade-deterring effect of bilateral volatility does not depend upon exporting experience and our main results is still present.

We perform a similar exercise at the extensive margin in Table 2.8. Since we focus on entry behavior, investigating the conditional impact of exporting experience makes no sense, contrarily to the intensive margin.

Table 2.8: Extensive margin: omitted variables

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.011^b	-0.006		-0.014^a	-0.009^b	
	(0.005)	(0.005)		(0.004)	(0.005)	
Ln Country price index	0.008^b	0.008^b		-0.001	-0.000	
	(0.003)	(0.003)		(0.004)	(0.004)	
Ln GDP	0.088^a	0.088^a		0.108^a	0.109^a	
	(0.016)	(0.016)		(0.015)	(0.015)	
QoG Pol.	0.005	-0.002				
	(0.004)	(0.007)				
Ln. Bil. RER Volatility × Nb. dest		-0.001	-0.003^b		-0.001	-0.004^b
		(0.001)	(0.002)		(0.001)	(0.002)
QoG Pol. × Nb. dest		0.002	0.003			
		(0.002)	(0.002)			
Ln RER				0.027^a	-0.014	
				(0.008)	(0.015)	
Ln RER × Nb. dest					0.012^a	0.012^a
					(0.005)	(0.003)
Observations	4926925	4926925	4926925	6533922	6533922	6533922
R^2	0.422	0.422	0.425	0.388	0.388	0.393
Firm-year dyads	326176	326176	326176	425741	425741	425741
Country-Year FE	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Quality of governance unconditionally does not favor the entry probability once bilateral volatility is already controlled for (column (1)). The parameters on interactive terms with the number of destinations are however insignificant (columns (2) and (3)): firms serving many destinations do not enter disproportionately into markets with good governance. The RER level also enters positively and significantly (column (4)), and its interaction with the number of destinations is positive once the specification include country-year fixed effects. The impact is however quantitatively modest.

Additional Robustness Results

We provide in the appendix additional robustness results regarding our baseline results. We start by checking in section D of the appendix the robustness of the baseline result with respect to our measure of RER volatility. The results reported in Tables D.1, D.2 and D.3 in the appendix confirm that the unconditional impact of exchange rate volatility on the intensive margin is negative and significant (and quantitatively very close to our main definition of volatility) whether we consider 1/the volatility coming from a GARCH model, 2/ the HP (Hodrick and Prescott, 1997) detrended version of our benchmark RER, or 3/ the nominal exchange rate.[8]

Section E of the appendix presents various sensitivity checks regarding the definition of performance at the firm-level. Tables E.1 and E.2 in the appendix reproduce our baseline estimations using alternative measures of firm performance: employment, apparent labor productivity, capital intensity, for both trade margins. All firm size proxies amplify the negative effect of RER volatility but the exacerbating impact of the number of destinations served is not altered even when the latter is included simultaneously with other proxies of firm performance. This supports our initial intuition that multi-destination firms have a specific behavior regarding volatility, that we are going to explore further in the next subsections. Robustness checks based on TFP (Tables E.3 and E.4 in the appendix) deliver almost identical results at the intensive margin, while no effect is observed at the extensive margin.

Section F of the appendix reports the results of robustness checks regarding alternative definitions of the extensive margin. As an alternative to the entry behavior, we estimate the impact of RER volatilities on participation which is defined as the unconditional probability to be exporting to destination j, $Pr(X_{ijt} > 0)$. Taken together, results reported in Table F.1 confirm our previous findings : they are qualitatively identical and quantitatively slightly higher to those found for entry. RER volatility exerts a negative effect on participation, growing with the number of destinations served. Elasticities however remain modest compared to the intensive margin. We also report results of robustness checks using an alternative, more restrictive definition of entry for the extensive margin. We follow Poncet and Mayneris (2013) when defining our dependent variable, now the probability to start exporting to destination j, while not being an exporter to j at $t-1$ and still being an exporter at $t+1$. Formally, this variable is $\Pr(X_{ijt} > 0 \quad | \; X_{ijt-1} = 0, X_{ijt+1} > 0)$. This definition is more conservative than the pre-

[8] In the last case, the sample is restricted to destinations outside the EA. The latter exhibit zero nominal exchange rate volatility after 1999, which may generate a bias in the estimation.

vious one, insofar as it corresponds to a more definitive entry. Results reported in Table F.2 are qualitatively very similar to the ones presented previously. Quantitatively, they are smaller, elasticities decreasing by one third to one half. This constitutes further evidence that bilateral RER volatility does impact the entry decision of firms into a considered market, but to a more limited extent than the intensive margin. It also makes sense to check if RER volatility shocks can represent an incentive to exit from a given export market. Exit is defined as the probability of not exporting to destination j at time t, conditional upon being an exporter to j at time $t-1$: $Pr(X_{ijt} = 0|X_{ijt-1} > 0)$. We regress the corresponding dummy variable on the same variables as above and results are presented in Table F.3. Expected effects are not straightforward: whether we consider volatility as a sunk or variable cost, predictions relate to entering or staying into the export market, but are less clear for exiting. In any case, average effects are nil, and interactions are significant, but elasticities are quite small. All these results regarding alternative definitions of the extensive margin confirm that RER volatility exerts a trade-deterring effect that mainly occurs at the intensive margin; the phenomenon being quantitatively much smaller for the extensive margin.

Section G of the appendix provides additional results regarding other potential omitted variables, such as the quality of economic governance and real market potential (Head and Mayer, 2004) (see Tables G.1 and G.2). Results are not affected by the inclusion of these variables in the baseline estimation: reported results only slightly affect our benchmark result of a negative impact of RER volatility that grows with the number of destinations served at the extensive margin (while being already small in the baseline estimation).

We also tested the robustness of the growing effect of RER volatility with the number of destinations served to various alternative subsamples. Results on these subsamples are presented in section H of the appendix. A very significant part of export flows in our sample is directed towards the Euro Area (EA), for which nominal exchange-rate volatility is zero from 1999. For these observations, the sole source of RER volatility comes from a variation in relative price levels, which is known to be much smaller than the one of the nominal exchange rate. Keeping these observations in the sample may generate a bias. Therefore, another robustness check consists in dropping these observations from our sample. We replicate our baseline estimations for the intensive and the entry margins and results are respectively presented in Tables H.1 and H.2. Results are qualitatively identical to the ones we presented in above: there is still a negative impact of bilateral RER volatility, growing with the number of destinations served.

The marginal effects are however reduced by half, indicating that the extent of reallocation is reduced in this subsample. This should not be surprising: euro area countries are major markets for French firms. Removing these destinations from the sample excludes significant reallocation possibilities.

Other tables in this section check that self-selection into specific markets is not biasing our results. Tables H.3 and H.4 present estimates on the intensive and the extensive margins from regressions we performed only on destinations belonging to the OECD. No coefficient is estimated to be significant on this subsample at the extensive margin. We then check that self-selection into fast-growing markets is not biasing our results, by first excluding BRICS countries (Tables H.5 and H.6), then the top 25 % of GDP growth distribution observations (Tables H.7 and H.8). Finally, Tables H.9 and H.10 check how our results are impacted by the exclusions of firms exporting to a single destination. In all cases, estimates remain very close to the benchmarks presented above.

2.5 Investigating Reallocation Behavior

The previous section documented a robust magnified negative effect of RER volatility for multi-destination firms. We bring to the data three claims supporting that the reallocation behavior of multi-destination firms across destinations explains this result. We provide in this section sets of evidence that support these claims.

2.5.1 Firm-year fixed effects and export shares

To study how firms allocate their exports across destinations, one strategy consists in estimating how bilateral volatility in country j affects the share of destination j in total exports of a given firm, instead of the absolute export values. Our previous estimations nevertheless all included firm-year fixed effects. Previous estimations are thus fully similar to estimating how bilateral volatility in country j affects the share of destination j in total exports of a given firm. This set of estimations then already supports that the share of exports across destinations is dampened by RER volatility, and the elasticity is magnified for multi-destination firms. Firms do not only adjust quantities exported to each market following changes in the RER volatility, but it also affects the share of total exports allocated to each market. Firms export relatively less to a given market because of RER volatility in this market, and this is all the more true that the firm serves many markets. The allocation of exports across destination is effectively determined by RER volatility.

2.5.2 External RER volatility and Reallocation

We further explore the reallocation behavior of multi-destination firms, by investigating the effect of RER volatility on external markets served on bilateral exports towards a considered destination. Previous estimations, including firm-year fixed effects, however also already control for the overall level of ER volatility in all destinations served by the firm. In that case, the effect of external RER volatility on trade cannot be identified simultaneously to the effect of bilateral RER volatility.

Strategy

We depart from this strategy by computing a destination-specific external RER volatility (making it identifiable) and we include this variable in equation 2.1. We start by computing various multilateral RER volatility indicators, which are weighted sums of bilateral RER volatilities. The choice for weights in the computation of the latter is not a trivial issue. We first use sectoral weight structure, based on the share of each country in the Harmonised System (HS) 2-digit sector in which the firm exports:

$$Multi\_volat_{sjt} = \sum_{c \neq j} \omega_{sc} Bil\_volat_{c,t} \tag{2.2}$$

where $Bil\_volat_{c,t}$ is the above defined destination-year specific RER volatility. $Multi\_volat_{sjt}$ is the multilateral volatility associated to country j at time t in HS2 sector s, and the weighting scheme ω_{sc} stands for the share of country c in total exports of sector s over the whole period. Therefore, all destinations with exports from sector s are considered as potential alternative destinations for the firm belonging to the considered sector, even if this firm does not effectively exports towards the current country. This multilateral volatility is likely to be exogenous in the sense that it measures a composite external volatility shock, independently of the actual structure of exports destination of the firm, and consequently, independently of its allocation decision. On top of this, its time-invariance supports its exogeneity with respect to firms decisions.

Alternatively, we use a macro weighting scheme, based on the share of each country in French aggregate exports ω_{ct}, thus defining multilateral volatility at the destination-year level. Therefore,

ω_{ct} stands for the share of country c in total French exports at time t:

$$Multi\_volat_{jt} = \sum_{c \neq j} \omega_{ct} Bil\_volat_{c,t} \tag{2.3}$$

Then, we build two measures of relative RER volatility as follows:

$$Rel\_volat_{xjt} = \frac{Bil\_volat_{j,t}}{Multi\_volat_{xjt}} \tag{2.4}$$

where $Multi\_volat_{xjt}$ is alternatively one of the two multilateral volatilities presented above. We include the relative volatilities in the baseline specification and estimate the following equation:

$$\begin{aligned} \text{ExportPerf}_{ijt} &= \zeta \text{Rel\_volat}_{ijt} + \kappa \left(\text{Rel\_volat}_{ijt} \times \text{Nb\_dest}_{it-1} \right) \\ &+ \phi \mathbf{Z_{jt}} + \lambda_{it} + \mu_{ij} + +\theta_j + \gamma_{jt} + \epsilon_{ijt} \end{aligned} \tag{2.5}$$

where the fixed effect structure is similar to the estimations in the previous section. All regressions include firm-year and firm-country fixed effects that are completed by country-year fixed effects in some specifications. Following Testable Relationship 3, ζ and κ are expected to be negative: bilateral exports towards a considered destination should decrease when the relative RER volatility of this destination rises, and this should be increasingly true when the scope of possible reallocation expands.

Results

Table 2.9 presents estimation results of the intensive margin of trade accounting for relative RER volatility. Columns (1) to (3) are based on multilateral RER volatility with sectoral weights while columns (4) to (6) include macro-based relative volatility.

We estimate that the unconditional effect of RER volatility is negatively associated to the intensive margin of trade: the average firm exports relatively less to country j following an increase in relative volatility in country j with respect to the other countries. This result is consistent with some optimal allocation behavior of exports across destinations. In this table, and contrarily to the previous ones, we explicitly account for external volatility. Results support that external volatility effectively drives the trade-deterring effect of bilateral volatility: volatility

Table 2.9: Intensive margin and relative volatility

Dep. Variable	Ln(X_{ijt})					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Relative volatility (sector weights)	-0.031[a]	0.053[a]	0.055[b]			
	(0.012)	(0.018)	(0.023)			
Ln Country price index	0.064[b]	0.061[b]		0.071[a]	0.068[a]	
	(0.025)	(0.025)		(0.026)	(0.026)	
Ln GDP	1.238[a]	1.245[a]		1.293[a]	1.298[a]	
	(0.073)	(0.072)		(0.079)	(0.079)	
Ln Relative volatility (macro weights)				-0.028[b]	0.058[a]	-2.401
				(0.012)	(0.021)	(67.780)
Ln Relative volatility × Nb. dest		-0.029[a]	-0.024[a]		-0.029[a]	-0.024[a]
		(0.005)	(0.004)		(0.006)	(0.005)
Observations	2150332	2150332	2150332	1709730	1709730	1709730
R^2	0.879	0.879	0.880	0.871	0.871	0.872
Firm-year dyads	425741	425741	425741	231518	231518	231518
Country-Year FE	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

in j compared to volatility in the other destinations is what matters for the exporting firm.

We also estimate in column (3) that the interaction with the number of destinations served (κ parameter in equation 2.5) is negative and significant, as expected, with elasticities around -0.024. RER volatility outside of country j is associated to increased trade flows to country j for firms serving many destinations. This effect is consistent with the idea that multi-destination firms benefit from an additional margin: they can allocate their exports across destinations, only up to the extent they can do so. The resulting trade flows are thus determined by relative volatility as long as they can effectively reallocate across destinations. This set of results supports this behavior: firms allocate their exports away from markets plagued with high RER volatility.

Replicating the same structure, Table 2.10 reports estimations with respect to the entry decision. Results are, as in the above tables, qualitatively similar to those related to the intensive margin but estimated elasticities are a lot smaller.

The coefficients associated to the relative RER volatilities (columns (1) and (4)) are bothnegative and significant. This effect is once again magnified for firms serving many destinations, as shown by the interactions with the relative RER volatility in columns (2) and (3) suggesting that firms will slightly give up entry to a considered market with higher relative RER volatility all the more that they have a large set of alternative markets to export to. We do not find evidence of

Table 2.10: Entry and relative volatility

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Relative volatility (sector weights)	-0.014^a	-0.007^c	-0.020^b			
	(0.004)	(0.004)	(0.008)			
Ln Country price index	0.006^b	0.006^b		0.012^a	0.012^a	
	(0.003)	(0.003)		(0.004)	(0.004)	
Ln GDP	0.115^a	0.114^a		0.138^a	0.138^a	
	(0.014)	(0.014)		(0.019)	(0.019)	
Ln Relative volatility (macro weights)				-0.017^a	-0.024^b	0.224
				(0.005)	(0.012)	(6.931)
Ln Relative volatility × Nb. dest		-0.002^c	-0.004^a		0.002	-0.001
		(0.001)	(0.001)		(0.002)	(0.001)
Observations	6996200	6996200	6996200	3376886	3376886	3376886
R^2	0.390	0.390	0.396	0.379	0.379	0.386
Firm-year dyads	425741	425741	425741	231518	231518	231518
Country-Year FE	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

a significant magnified effect of the number of destinations on the impact of relative volatility computed with macro weights at the extensive margin.

Taken together, results from Tables 2.9 and 2.10 suggest that reallocation and external RER volatility matter when investigating how firms cope with RER volatility. The average firm-destination exports and entry decision negatively react to bilateral RER volatility all the less that external volatility is high, while the effect is magnified for large firms that are able to reach a large set of markets. We report results with an alternative weighting scheme in Table I.1 in the appendix. In this table, we introduce an alternative measure of relative RER volatility, which is computed using the time-varying share of each sector in total French exports over the whole period. Results based on this measure, on both margins, are very close to those presented here.

2.5.3 Selection effects

We provide additional evidence that document the volatility-induced selection effects on export markets, still accounting for heterogeneity across firms.

To do so, we compute the share of each firm in total French exports in country j and estimate how this share is affected by volatility and the firm multi-destination status. Since we rely on French micro-level trade data, we can only measure a market share among French exporters.

Table 2.11: Firm Export Market share

Dep. Variable	Firm Export Market share: X_{ijt}/X_{jt}					
	(1)	(2)	(3)	(4)	(5)	(6)
Nb.dest	0.149^a	-0.381^a		-0.444^a	-0.234^a	
	(0.005)	(0.038)		(0.038)	(0.028)	
Ln. Bil. RER Volatility × Nb. dest		-0.120^a	-0.145^a	-0.121^a	-0.074^a	-0.095^a
		(0.008)	(0.009)	(0.008)	(0.006)	(0.006)
Assets				0.362^a	0.071^a	
				(0.008)	(0.019)	
Ln. Bil. RER Volatility × Assets					-0.065^a	-0.062^a
					(0.004)	(0.004)
Observations	2260149	2260149	2260149	2260149	2260149	2260149
R^2	0.583	0.584	0.652	0.586	0.587	0.653
Firm-year dyads	425741	425741	425741	231518	231518	231518
Firm-Year FE	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include country-year and firm-country fixed effects.

We however denote it "MarketShare" and is defined as the share of the firm in the total exports of French firms in a destination-year, X_{ijt}/X_{jt}. This variable measure the relative presence of a given firm in a destination, relative to the total presence of French firms.

We estimate how this market share is shaped by bilateral RER volatility and the number of destinations. We thus estimate the following equation:

$$\text{MarketShare}_{ijt} = \alpha \text{Bil\_volat}_{jt} + \tau \left(\text{Bil\_volat}_{jt} \times \text{NbDest}_{it-1}\right) \quad (2.6)$$

$$+ \gamma_{jt} + \theta_i + \lambda_{it} + \epsilon_{ijt} \quad (2.7)$$

All specifications include country-year fixed effects: since all French firms all face the same bilateral volatility, we investigate the variations of sales across firms, depending on their heterogeneous characteristics. We also include a set of firm-year fixed effects in some specifications to account for unobserved heterogeneity, but making us unable to identify the unconditional effect of firm size on market share.

Results are presented in Table 2.11. We estimate that the number of destinations positively affects the market share: firms that serve many destinations export relatively more to a given destination. Controlling for variations across destinations, firm size determines the relative size in the export market. Bilateral volatility and the number of destinations however jointly reduce the market share of the firm. We thus estimate that, for a given market where all firms face the same volatility, the relative presence of a firm is dampened by its size, accounting for variations in RER volatility. We claim that the lower quantities sold by large firms - relative to smaller firms- is evidence suggesting that they reallocate their exports across destinations following RER volatility.

This result supports a volatility-induced selection process that is shaped by firm size. When facing RER volatility, we estimate that multi-destination firms account for a lower share of total exports all the more that they are serving many destinations. On the contrary, firms that serve a smaller set of exports do not see their market share go down as for the larger firms. We even estimate that the small firms do benefit from lower quantities sold by larger firms. We interpret as evidence to claim that multi-destination firms reallocate their exports across destinations. By doing so, they reduce their market share – relatively to other French firms –. Note that this result is consistent with the evidence we presented in Figure 2.3: firms that serve a low number of markets tend to increase their export flows following RER volatility. This result can be rationalized using this set of results: lower quantities sold by large firms tend to benefit to smaller firms.

2.5.4 The Product Margin of Trade

Up to now, we studied exports at the firm-destination level, focusing on the potential reallocation behavior of firms between destinations, exclusively. In this subsection, we go another step further by using the variation in exports across products (defined at the HS6 level) within firms. In other words, we now use the information on the exported products by each firm to study if and how the reallocation behavior in terms of destinations we provided evidence for also emerges in this dimension. Reallocation behavior across products and across destinations may coexist, or be substitutes. There are many reasons to believe that the product-mix may be an additional margin for firm exports: many papers, such as Mayer et al. (2014), have investigated the product mix of exports and have for instance emphasized the prominent role of the best-product at the firm-destination level as well as its consequences within the firm boundaries.

Table 2.12: Firm-product results

Dep. Variable	$\text{Ln}(X_{ijpt})$			Ln Exports Best Product			Ln Nb products		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln Bilateral RER volatility	-0.093^a	0.004		-0.209^a	0.030		-0.223^a	-0.013	
	(0.023)	(0.032)		(0.024)	(0.037)		(0.014)	(0.014)	
Ln Country price index	0.004	0.004		0.034^a	0.033^a		0.050^a	0.048^a	
	(0.008)	(0.009)		(0.006)	(0.006)		(0.007)	(0.007)	
Ln GDP	0.320^a	0.324^a		0.343^a	0.346^a		0.181^a	0.181^a	
	(0.010)	(0.011)		(0.008)	(0.008)		(0.005)	(0.005)	
Ln. Bil. RER Volatility × Nb. dest		-0.032^a	-0.046^a		-0.088^a	-0.116^a		-0.070^a	-0.063^a
		(0.012)	(0.009)		(0.012)	(0.011)		(0.006)	(0.006)
Observations	9232481	9232481	9232481	2743294	2262979	2262979	13989682	12112959	12112959
R^2	0.749	0.743	0.757	0.722	0.707	0.725	0.911	0.908	0.918
Firm-year-product triads	3917867	3917867	3917867						
Firm-year-product FE	yes	yes	yes	no	no	no	no	no	no
Country-year FE	no	no	yes	no	no	yes	no	no	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects. Specifications (1) to (3) also include firm-year-product fixed effects. Specifications (3), (6) and (9) also add country-year fixed effects.

We report in Table 2.12 the estimates accounting for the product margin of trade. The intensive margin is now defined as the (log) export value of the firm for a given product-year pair in a country (columns (1) to (3)), or the log export value for the best product at the firm-country-year level (columns (4) to (6)). The extensive margin is now defined as the (log) number of HS6 products for a given product-year pair in a country (columns (7) to (9)). Otherwise identical to Equations 2.1 and 2.5, regressions for the intensive margin include firm-product-year fixed effects, so that coefficients are identified from variation within firm-product-year triplets across countries. Therefore, our estimates consider the way in which firms choose to allocate their exports for a given product and a given year, across countries. For the extensive margin, the usual firm-year and firm-country fixed effects are included, with similar interpretation.

All the baseline results we provided evidence for in the previous sections still hold, even when accounting for the product margin of trade. Reallocation of exports across products cannot explain the whole reallocation behavior. We find that the export sales at the product-level are deterred by RER volatility, all the more that the firm serves a large set of destinations. We also estimate the same result for the best product at the firm-level. The sales of the best product of the firms also exhibit a decrease following exchange-rate volatility, and the effect is amplified for multi-destination firms. This result is particularly suggestive to support the reallocation behavior across destinations for at least one reason: the documented prominence of the best-product at the destination level is such that, if there is one product for which sales should not be affected by the RER volatility, it should be this best product. On the contrary, we do find evidence supporting that sales of the best product are likely to be affected by RER volatility. Since the elasticity of the sales of the best products to RER volatility is mainly explained by reallocation of exports across destinations, this is additional evidence supporting reallocation of exports across markets.

Finally, we estimate that the number of products is affected by RER volatility with the same non-linearity along the number of destinations. Interestingly, the elasticities on interacted terms in columns (3) and (9) tend to show that the effect is twice stronger for the number of products exported compared to the value per product. In other words, when a firm decreases exports towards a given destination following a RER shock, roughly one third of the effect comes from the decrease of the average value exported per product, and two thirds from a cut in the number of exported products.

2.6 Aggregate Implications

We provided evidence that heterogeneity in the number of destinations firms served is associated to heterogeneous trade response following RER volatility shocks. Firm-destination exports are all the more negatively affected by RER volatility that the firm is large, because of reallocation possibilities offered by a higher number of destinations served. We now further investigate the aggregate implications of this heterogeneity.

We start by estimating how aggregated sector-country exports are affected by bilateral RER volatility and how the effect is shaped by the sectoral presence of multi-destination firms. We compute the share of sector-destination exports made by firms serving at least 2 countries, and we use variations across sectors in this variable as a source of identification. We check that sectors exhibiting a large share of exports made by multi-destination firms are those for which total sector exports are the least sensitive to RER volatility.

We estimate the following specification:

$$X_{sjt} = \alpha \text{Bil\_volat}_{jt} + \phi_1 \text{ShareExpMD}_{sjt} + \phi_2(\text{Bil\_volat}_{jt} \times \text{ShareMD}_{sjt}) + \lambda_{jt} + \theta_s + \varepsilon_{sjt} \quad (2.8)$$

where X_{sjt} is the aggregated export value for sector s (defined at the HS2) to destination j in year t and where ShareExpMD_{sjt} is the share of sector-year-country exports made by multi-destination firms. Most specifications includes country-year fixed effects, λ_{jt}: the estimator thus investigates variation across sectors. This fixed effect structure makes the coefficient associated to bilateral RER volatility not identifiable. For exposition sake, we replace in column (1) only the country-year fixed effect by two sets of country and year fixed effects, allowing us to estimate the impact of bilateral RER volatility on sectoral trade. We finally include sector dummies in all estimations to account for unobserved heterogeneity.

Results are presented in Table 2.13. We are more specifically interested in the ϕ_2 coefficient since it captures non-linearities in the trade-deterring effect of bilateral RER volatility.

Table 2.13: Aggregate Implications - HS2 sectoral level

Dep. Variable	Ln X_{sjt}					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bil. Volatility	-0.075^a					
	(0.019)					
Ln Country price index	0.056^b					
	(0.026)					
Ln GDP	1.166^a					
	(0.086)					
ShareExpMD		-0.453^a				
		(0.135)				
Ln Bil. Volatility × ShareExpMD (ϕ_2)		0.566^a				
		(0.035)				
Share Exp MD (above median)			-0.287^b			
			(0.142)			
Ln Bil. Volatility × Share Exp MD (above median) (ϕ_2)			0.524^a			
			(0.037)			
ShareExpMD (above top 10%)				-0.270		
				(0.174)		
Ln Bil. Volatility × ShareExpMD (above top 10%) (ϕ_2)				0.272^a		
				(0.046)		
Share of MD Firms					1.103^b	
					(0.545)	
Ln Bil. Volatility × Share of MD Firms (ϕ_2)					0.570^a	
					(0.110)	
Herfindahl index						-0.179
						(0.155)
Ln Bil. Volatility × Herfindahl index (ϕ_2)						0.214^a
						(0.041)
Observations	76324	76324	76324	76324	76324	76324
R^2	0.681	0.737	0.728	0.703	0.691	0.697

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include country-year fixed effects (except in column (1)) and sector dummies.

Table 2.13 presents results when estimations are conducted at the HS2 sectoral level. Column (1) supports that bilateral RER volatility is deterring trade at the sectoral level, but we estimate a positive coefficient (ϕ_2) associated to the interaction between volatility and the share of exports made by multi-destination firms, in column (2). Columns (3) replicates the results when considering the share of exports made by firms which serve a number of destination strictly larger than 2, which corresponds to the median number of destinations in our sample. Finally, column (4) presents the estimations when considering the share of exports made by firms serving more than 12 destinations, that correspond to the 9th decile of the distribution of destinations in the sample. In column (5), we condition the impact of bilateral volatility upon the share of multi-destination firms in the total number of firms (and not their export value) at the sectoral level. Columns (6) investigates a non-linearity in the effect of bilateral volatility along the Herfindahl sectoral index of exports. This last measure is only some robustness check: the value of the index is only correlated with the presence of multi-destination firms at the sectoral level. All estimated interactions terms are positively associated to sectoral exports, conditionally to an average trade-deterring effect of RER volatility. The presence of multi-destination firms thus dampens the overall effect of RER volatility on sectoral exports. Sectors in which multi-destination firms account for a large share of exports exhibit a lower export-deterring effect of RER volatility.

This set of results confirms that export concentration on big, multi-destination firms tends to dampen the trade-deterring effect of RER volatility, which is consistent with the micro-level reallocation behavior we provided evidence above. This set of results at the aggregate level is additional evidence supporting the existence of reallocation behavior by multi-destination firms. On the one hand, multi-destination firms exhibit amplified trade elasticity to RER volatility at the firm-destination level. On the other hand, these firms are simultaneously exhibiting dampened trade elasticity to the same RER volatility at the aggregate level. The whole set of results of the chapter thus helps rationalizing the muted trade response to RER volatility at the aggregate level.

2.7 Conclusion

Relying on a large French firm-level database combining balance-sheet and export information over the period 1995-2009, this chapter proposes a new, micro-founded explanation to the macro puzzle of the muted reaction of aggregate exports to RER volatility. We start by showing that the number of destinations magnifies the trade-deterring effect of RER volatility on firm-destination exports. We support that this result is driven by reallocation strategies: multi-destination firms reallocate optimally their exports across destinations, generating higher bilateral trade elasticities. To identify this feature in the data, we build a multilateral RER volatility which is a weighted average of RER volatilities of all other destinations that could be served by the firm. The latter captures the external conditions upon which firms can reallocate exports. We show that multi-destination firms tend to reallocate exports away from destinations with unfavorable dynamics in terms of RER volatility, i.e., bilateral relatively to multilateral RER volatility. This may be interpreted as an efficient diversification behavior, as the one suggested by the portfolio theory: firms seek to hold the average risk level of their destinations portfolio constant, and this is easier to do as the scope of possible reallocations expands with the number of destinations served. Our results are robust to various checks, including potential omitted variables that are related to country-specific risks and the possibility that firms set hedging strategies. In any case, the diversification behavior we highlight seems to coexist with the latter.

More destination-diversified firms are therefore better able to handle exchange rate risks, with substantial implications for aggregate exports. If big multi-destination firms, who account for the bulk of aggregate exports, can react to an adverse shock of RER volatility somewhere by transferring trade to other and less volatile destinations, this leaves mainly unchanged exports at the macro level. The small aggregate trade response to RER volatility is thus rationalized by the diversification behavior of multi-destination firms and their prominent share in total exports.

2.8 Additional Tables

D Alternative Definitions of Key Variables

Exchange-Rate Volatility

Table D.1: Alternative Measure of RER volatility - GARCH model

Dep. Variable	Ln Exports Ln(X_{ijt})			Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln bilateral RER volatility	-0.040^a	0.017		-0.005^a	-0.001	
	(0.009)	(0.014)		(0.001)	(0.002)	
Ln bilateral RER volatility × Nb. dest.		-0.019^a	-0.022^a		-0.001^b	-0.001
		(0.005)	(0.004)		(0.001)	(0.001)
Observations	2251636	2251636	2251636	6996200	6996200	6996200
R^2	0.878	0.878	0.880	0.390	0.390	0.396

Note: In this table, RER volatility is the estimated residual variance estimated after a GARCH estimation on the first-difference RER monthly levels. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year fixed effects and country dummies.

Table D.2: Alternative Measure of RER volatility - HP filter

Dep. Variable	Ln Exports Ln(X_{ijt})			Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.039^a	0.040^b		-0.015^a	-0.006	
	(0.014)	(0.018)		(0.005)	(0.005)	
Ln Bilateral RER volatility × Nb. Dest.		-0.027^a	-0.026^a		-0.003^b	-0.004^a
		(0.006)	(0.005)		(0.001)	(0.002)
Observations	2118130	2118130	2118130	6484612	6484612	6484612
R^2	0.880	0.880	0.882	0.399	0.399	0.405
Firm-year dyads	271352	271352	271352	329932	329932	329932

Note: In this table, RER volatility is computed as follows. It is the standard deviation of monthly log deviation of RER levels detrended with a Hodrick-Prescott filter. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year fixed effects and country dummies.

Table D.3: Alternative Measure of Exchange-rate Volatility - Nominal Exchange Rate (NER) Volatility

Dep. Variable	Ln Exports $\text{Ln}(X_{ijt})$			Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral NER volatility	-0.040[b]	0.063[b]		-0.005[b]	0.003	
	(0.017)	(0.024)		(0.002)	(0.006)	
Ln Bilateral RER volatility × Nb. Dest.		-0.034[a]	-0.011		-0.002	-0.001
		(0.009)	(0.007)		(0.002)	(0.001)
Observations	1547807	1547807	1547807	2672139	2672139	2672139
R^2	0.893	0.893	0.895	0.398	0.398	0.402
Firm-year dyads	370522	370522	370522	554350	554350	554350

Note: In this table, exchange-rate volatility is computed as follows. We compute the standard deviation of monthly log deviation of *nominal* exchange rates, instead of the real exchange-rate levels as we did within the paper. We exclude European monetary union observations because they exhibit zero NER volatility after 1999, which may generate a bias in the estimation. Robust standard errors are clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year fixed effects and country dummies.

E Alternative Measures of Firm Performance

Table E.1: Intensive Margin - Alternative Measures of Firm Performance

Dep. Variable					Ln Exports $\text{Ln}(X_{ijt})$				
Sample					whole				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln Bilateral RER volatility	-0.046[a]			-0.026[c]			-0.028		
	(0.014)			(0.015)			(0.021)		
Ln. Bil. RER Volat. × LaborProd	-0.024[a]	-0.017[a]	-0.015[a]						
	(0.005)	(0.004)	(0.004)						
Ln. Bil. RER Volat × Nb. Employees				-0.018[a]	-0.012[a]	-0.008[a]			
				(0.004)	(0.003)	(0.003)			
Ln. Bil. RER Volat × Cap. Intensity							-0.005	-0.004	-0.003
							(0.004)	(0.003)	(0.003)
Ln. Bil. RER Volat × Nb. dest			-0.022[a]			-0.018[a]			-0.023[a]
			(0.005)			(0.005)			(0.005)
Observations	1867694	1867694	1867694	1867694	1867694	1867694	1867694	1867694	1867694
R^2	0.886	0.887	0.887	0.886	0.887	0.887	0.886	0.887	0.887
Firm-year dyads	375177	375177	375177	375177	375177	375177	375177	375177	375177
Country-Year FE	no	no	yes	no	no	yes	no	no	yes

Note: In this table, we introduce additional firm performance measures: apparent labor productivity (value added per employee), total firm-level employment, and capital intensity, measured as the ratio of total fixed assets to employment. All these variables are found in the BRN dataset. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table E.2: Extensive Margin - Alternative Firm Performance Measures

Dep. Variable					Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$				
Sample					whole				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln Bilateral RER volatility	-0.017^a			-0.016^a			-0.016^a		
	(0.005)			(0.005)			(0.006)		
Ln. Bil. RER Volat × LaborProd	-0.002	-0.001^b	-0.001^c						
	(0.002)	(0.001)	(0.001)						
Ln. Bil. RER Volat × Nb. Employees				-0.001^a	-0.001^a	-0.001			
				(0.000)	(0.000)	(0.000)			
Ln. Bil. RER Volat × Cap. Intensity							-0.000	0.001	0.001^c
							(0.001)	(0.000)	(0.000)
Ln. Bil. RER Volat × Nb. dest			-0.004^b			-0.003^c			-0.004^b
			(0.002)			(0.002)			(0.002)
Observations	5723604	5723604	5723604	5723604	5723604	5723604	5723604	5723604	5723604
R^2	0.401	0.407	0.407	0.401	0.407	0.407	0.401	0.407	0.407
Firm-year dyads	1046814	1046814	1046814	1046814	1046814	1046814	1046814	1046814	1046814
Country-Year FE	no	no	yes	no	no	yes	no	no	yes

Note: In this table, we introduce additional firm performance measures: apparent labor productivity (value added per employee), total firm-level employment, and capital intensity, measured as the ratio of total fixed assets to employment. All these variables are found in the BRN dataset. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Total Factor Productivity

Table E.3: Intensive Margin - Alternative Measures of Firm Performance -Total Factor Productivity

Dep. Variable	Ln(Exports) $Ln(X_{ijt})$					
Sample	whole					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.036^{b}	0.057^{c}	-0.034^{b}	0.060^{c}	-0.032^{b}	0.062^{c}
	(0.017)	(0.033)	(0.016)	(0.032)	(0.016)	(0.032)
Ln. Bil. RER Volatility × Nb. dest		-0.030^{a}		-0.030^{a}		-0.031^{a}
		(0.010)		(0.010)		(0.010)
Ln. Bil. RER Volatility × TFP1	-0.007	-0.005				
	(0.006)	(0.006)				
Ln. Bil. RER Volatility × TFP2			-0.006	-0.005		
			(0.006)	(0.006)		
Ln. Bil. RER Volatility × TFP3					-0.005	-0.004
					(0.006)	(0.006)
Observations	744743	744743	744743	744743	744743	744743
R^2	0.908	0.908	0.908	0.908	0.908	0.908
Firm-year dyads	186712	186712	186712	186712	186712	186712
Country-Year FE	no	no	yes	no	no	yes

Note: In this table, we introduce Total Factor Productivity (TFP) as an additional firm performance measure. Using BRN dataset over 1995-2001 period (for which we have all the required information to compute TFP), we estimate TFP at the firm-level total. TFP1 denotes the estimated TFP using OLS in a specification in which the value added is solely determined by employment. TFP2 is the estimated TFP using OLS in a specification in which the value added is determined by employment and total fixed assets. TFP3 is the estimated TFP using OLS in a specification in which the value added is determined by employment and total fixed assets, under the assumption of constant returns to scale. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table E.4: Entry - Alternative Measures of Firm Performance -Total Factor Productivity

Dep. Variable	Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
Sample	whole					
	(1)	(2)	(3)	(4)	(5)	(6)
ln bilateral RER volatility	-0.006[b]	-0.009	-0.007[b]	-0.009[c]	-0.007[b]	-0.010[c]
	(0.003)	(0.006)	(0.003)	(0.006)	(0.003)	(0.005)
Ln. Bil. RER Volatility × Nb. dest		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
Ln. Bil. RER Volatility × TFP1	0.001[c]	0.001				
	(0.001)	(0.001)				
Ln. Bil. RER Volatility × TFP2			0.001[c]	0.001		
			(0.001)	(0.001)		
Ln. Bil. RER Volatility × TFP3					0.001	0.000
					(0.001)	(0.001)
Observations	5499244	5499244	5499244	5499244	5499244	5499244
R^2	0.242	0.242	0.242	0.242	0.242	0.242
Firm-year dyads	186712	186712	186712	186712	186712	186712
Country-Year FE	no	no	yes	no	no	yes

Note: In this table, we introduce Total Factor Productivity (TFP) as an additional firm performance measure. Using BRN dataset over 1995-2001 period (for which we have all the required information to compute TFP), we estimate TFP at the firm-level total. TFP1 denotes the estimated TFP using OLS in a specification in which the value added is solely determined by employment. TFP2 is the estimated TFP using OLS in a specification in which the value added is determined by employment and total fixed assets. TFP3 is the estimated TFP using OLS in a specification in which the value added is determined by employment and total fixed assets, under the assumption of constant returns to scale. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

F Alternative Definitions of the Extensive Margin

Entry 2

Table F.1: Participation: Baseline Estimations

Dep. Variable	Participation - $Pr(X_{ijt} > 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.017^a	-0.016^a	0.030^a	-0.011^c		
	(0.005)	(0.005)	(0.008)	(0.006)		
Ln country price index		0.008^a				
		(0.003)				
Ln GDP		0.147^a				
		(0.015)				
Ln. Bil. RER Volatility × Nb. dest			-0.016^a	-0.002^c	-0.004^a	-0.004^b
			(0.001)	(0.001)	(0.001)	(0.002)
Ln. Bil. RER Volatility × Assets						0.000
						(0.001)
Observations	9364038	9364038	9364038	9364038	9364038	9364038
R^2	0.444	0.445	0.275	0.444	0.450	0.450
Firm-year dyads	1397202	1397202	1397202	1397202	1397202	1397202
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table F.2: Extensive margin - Definitive entry : Entry 2

Dep. Variable	Entry 2 dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0), X_{ijt+1} > 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.008^a	-0.007^a	0.017^a	-0.001		
	(0.002)	(0.002)	(0.004)	(0.002)		
Ln country price index		0.004^b				
		(0.002)				
Ln GDP		0.051^a				
		(0.008)				
Ln. Bil. RER Volatility × Nb. dest			-0.008^a	-0.002^a	-0.004^a	-0.003^a
			(0.001)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						-0.000
						(0.000)
Observations	6996200	6996200	6996200	6996200	6996200	6996200
R^2	0.404	0.405	0.192	0.404	0.409	0.409
Firm-year dyads	1306136	1306136	1306136	1306136	1306136	1306136
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

G Omitted Variables

Intensive Margin

Extensive Margin

H Alternative Samples

Table F.3: Exit: Baseline Estimations

Dep. Variable	Exit: $Pr(X_{ijt} = 0 \vert (X_{ijt-1} > 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.007	-0.006	0.028[a]	-0.010[b]		
	(0.006)	(0.004)	(0.006)	(0.005)		
Ln country price index		0.005				
		(0.003)				
Ln GDP		0.100[a]				
		(0.014)				
Ln. Bil. RER Volatility × Nb. dest			-0.011[a]	0.001	-0.002	-0.001
			(0.001)	(0.001)	(0.001)	(0.002)
Ln. Bil. RER Volatility × Assets						-0.000
						(0.000)
Observations	7012880	7012880	7012880	7012880	7012880	7012880
R^2	0.397	0.397	0.272	0.397	0.402	0.402
Firm-year dyads	1311832	1311832	1311832	1311832	1311832	1311832
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table G.1: Intensive margin: omitted factors - quality of economic governance and Real Market Potential

Dep. Variable	Entry					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.027^b	0.050^a		-0.031^b	0.021	-1.860
	(0.012)	(0.019)		(0.015)	(0.024)	(96.448)
Ln country price index	0.060^b	0.055^b		0.039	0.036	
	(0.025)	(0.025)		(0.036)	(0.037)	
Ln GDP	1.189^a	1.202^a		1.521^a	1.519^a	
	(0.074)	(0.074)		(0.150)	(0.150)	
QoG Eco.	0.588^a	0.121				
	(0.133)	(0.164)				
Ln. Bil. RER Volatility × Nb. dest		-0.027^a	-0.019^a		-0.018^b	-0.013^b
		(0.006)	(0.005)		(0.008)	(0.006)
QoG Eco. × Nb dest		0.158^a	0.154^a			
		(0.037)	(0.036)			
QoG Eco × Assets			0.259^a			
			(0.028)			
ln RMP (HM04)				0.141^a	0.128^a	
				(0.049)	(0.048)	
ln RMP (HM04) × Nb. dest					0.004	0.018^a
					(0.006)	(0.004)
Observations	2098385	2098385	2098385	1241028	1241028	1241028
R^2	0.880	0.880	0.881	0.905	0.905	0.906
Firm-year dyads	422966	422966	422966	255553	255553	255553
Country-Year FE	no	no	yes	no	no	yes

Note: Note: In this table, we first add economic governance quality to control for country-specific risks, and the estimated Real Market Potential (*RMP (HM04)*) from Head and Mayer (2004) to control for country-specific export opportunities. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table G.2: Extensive margin: omitted factors - quality of economic governance and RMP

Dep. Variable	Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0))$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.013^a	-0.008^c		-0.018^a	-0.016^b	0.619
	(0.005)	(0.005)		(0.006)	(0.007)	(44.894)
Ln Country price index	0.007^b	0.007^b		0.001	0.001	
	(0.003)	(0.003)		(0.005)	(0.005)	
Ln GDP	0.104^a	0.104^a		0.071^b	0.071^b	
	(0.014)	(0.014)		(0.030)	(0.030)	
QoG. Eco	0.098^a	-0.086^c				
	(0.026)	(0.046)				
Ln. Bil. RER Volatility × Nb. dest		-0.002	-0.004^b		-0.000	-0.005^b
		(0.001)	(0.002)		(0.002)	(0.002)
QoG. Eco × Nb. dest		0.058^a	0.026^c			
		(0.012)	(0.014)			
QoG. Eco × Assets			0.005			
			(0.004)			
ln RMP (HM04)				0.051^a	0.022	
				(0.017)	(0.023)	
ln RMP (HM04) × Nb. dest					0.010	0.010^c
					(0.006)	(0.006)
Observations	6341180	6341180	6341180	3853675	3853675	3853675
R^2	0.392	0.392	0.397	0.458	0.458	0.465
Firm-year dyads	1182038	1182038	1182038	704897	704897	704897
Country-Year FE	no	no	yes	no	no	yes

Note: In this table, we introduce additional controls. We first add economic governance quality to control for country-specific risks, and the estimated Real Market Potential (*RMP (HM04)*) from Head and Mayer (2004) to control for country-specific export opportunities. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.1: Intensive Margin: Non-Euro Sample

Dep. Variable	Ln(X_{ijt})					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.061^a	-0.041^a	0.170^a	0.024		
	(0.015)	(0.012)	(0.034)	(0.021)		
Ln Country price index		0.056^b				
		(0.027)				
Ln GDP		1.256^a				
		(0.078)				
Ln. Bil. RER Volatility × Nb. dest			-0.077^a	-0.029^a	-0.018^a	-0.014^b
			(0.012)	(0.008)	(0.006)	(0.007)
Ln. Bil. RER Volatility × Assets						-0.004
						(0.003)
Observations	1687415	1687415	1687415	1687415	1687415	1687415
R^2	0.889	0.890	0.545	0.889	0.891	0.891
Firm-year dyads	404238	404238	404238	404238	404238	404238
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and country fixed effects.

Table H.2: Extensive Margin- Entry: Non-Euro Sample

Dep. Variable	Entry					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.013[a]	-0.010[a]	0.017[a]	-0.007[c]		
	(0.002)	(0.002)	(0.004)	(0.004)		
Ln Country price index		0.005[c]				
		(0.003)				
Ln GDP		0.126[a]				
		(0.012)				
Ln. Bil. RER Volatility × Nb. dest			-0.009[a]	-0.002[c]	-0.002[c]	-0.002[c]
			(0.001)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						0.000
						(0.000)
Observations	5795594	5795594	5795594	5795594	5795594	5795594
R^2	0.418	0.418	0.279	0.418	0.421	0.421
Firm-year dyads	1222757	1222757	1222757	1222757	1222757	1222757
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and country fixed effects.

Table H.3: Alternative Sample: OECD only - Intensive Margin

Dep. Variable	Ln(X_{ijt})					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.023	-0.020	0.266^{a}	0.023		
	(0.019)	(0.018)	(0.033)	(0.024)		
Ln Country price index		0.211^{a}				
		(0.054)				
Ln GDP		1.419^{a}				
		(0.163)				
Ln. Bil. RER Volatility × Nb. dest			-0.108^{a}	-0.017^{b}	-0.019^{a}	-0.015^{b}
			(0.011)	(0.008)	(0.006)	(0.006)
Ln. Bil. RER Volatility × Assets						-0.007^{c}
						(0.004)
Observations	1296553	1296553	1296553	1296553	1296553	1296553
R^2	0.894	0.895	0.611	0.894	0.895	0.895
Firm-year dyads	359534	359534	359534	359534	359534	359534
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: The sample is composed of firm-year observations exporting toward OECD countries solely. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.4: Alternative Sample: OECD only - Extensive Margin, Entry

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.006	-0.006	-0.002	-0.004		
	(0.004)	(0.004)	(0.006)	(0.006)		
Ln country price index		0.016^c				
		(0.008)				
Ln GDP		0.041				
		(0.030)				
Ln. Bil. RER Volatility × Nb. dest			-0.001	-0.001	-0.001	-0.001
			(0.001)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						-0.000
						(0.000)
Observations	4578303	4578303	4578303	4578303	4578303	4578303
R^2	0.299	0.299	0.252	0.299	0.305	0.305
Firm-year dyads	989165	989165	989165	989165	989165	989165
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: The sample is composed of firm-year observations exporting toward OECD countries solely. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.5: Alternative Sample: BRICS Countries Excluded - Intensive Margin

Dep. Variable	$Ln(X_{ijt})$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.040^a	-0.032^a	0.367^a	0.045^b		
	(0.013)	(0.012)	(0.026)	(0.018)		
Ln Country price index		0.063^a				
		(0.021)				
Ln GDP		1.084^a				
		(0.073)				
Ln. Bil. RER Volatility × Nb. dest			-0.148^a	-0.029^a	-0.028^a	-0.021^a
			(0.009)	(0.006)	(0.005)	(0.005)
Ln. Bil. RER Volatility × Assets						-0.009^a
						(0.003)
Observations	2168293	2168293	2168293	2168293	2168293	2168293
R^2	0.880	0.880	0.537	0.880	0.881	0.881
Firm-year dyads	450672	450672	450672	450672	450672	450672
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: In this sample, we exclude (Brazil, Russia, India, China and South Africa) countries with respect to the baseline sample. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.6: Alternative Sample: BRICS Countries Excluded - Extensive Margin, Entry

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.007^{a}	-0.007^{a}	0.001	-0.007^{c}		
	(0.002)	(0.002)	(0.004)	(0.004)		
Ln Country price index		0.001				
		(0.002)				
Ln GDP		0.070^{a}				
		(0.010)				
Ln. Bil. RER Volatility × Nb. dest			-0.003^{a}	-0.000	-0.000	-0.001
			(0.001)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						0.001^{a}
						(0.000)
Observations	8917048	8917048	8917048	8917048	8917048	8917048
R^2	0.237	0.237	0.187	0.237	0.241	0.241
Firm-year dyads	1384905	1384905	1384905	1384905	1384905	1384905
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: In this sample, we exclude (Brazil, Russia, India, China and South Africa) countries with respect to the baseline sample. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects..

Table H.7: Alternative Sample: Top 25% in GDP growth excluded - Intensive Margin

Dep. Variable	Ln(X_{ijt})					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.040^b	-0.033^b	0.312^a	0.051^b		
	(0.016)	(0.015)	(0.031)	(0.023)		
Ln Country price index		0.067^b				
		(0.032)				
Ln GDP		1.435^a				
		(0.114)				
Ln. Bil. RER Volatility × Nb. dest			-0.127^a	-0.031^a	-0.026^a	-0.021^a
			(0.011)	(0.008)	(0.006)	(0.006)
Ln. Bil. RER Volatility × Assets						-0.007^b
						(0.003)
Observations	1723569	1723569	1723569	1723569	1723569	1723569
R^2	0.888	0.888	0.555	0.888	0.890	0.890
Firm-year dyads	411939	411939	411939	411939	411939	411939
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: We exclude from our sample countries that are in the first quartile of annual GDP growth, providing robustness of our result with respect to self-selection of firms into fast-growing markets. Robust standard errors clustered by destination-year in parentheses with ^{a}, ^{b} and ^{c} respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.8: Alternative Sample: Top 25% in GDP growth excluded - Extensive Margin, Entry

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.004[a]	-0.004[a]	0.004[a]	-0.000		
	(0.001)	(0.001)	(0.002)	(0.002)		
Ln Country price index		0.002				
		(0.002)				
Ln GDP		0.085[a]				
		(0.006)				
Ln. Bil. RER Volatility × Nb. dest			-0.003[a]	-0.001[b]	-0.000	-0.001[c]
			(0.000)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						0.001[a]
						(0.000)
Observations	7128031	7128031	7128031	7128031	7128031	7128031
R^2	0.273	0.273	0.207	0.273	0.274	0.274
Firm-year dyads	1281353	1281353	1281353	1281353	1281353	1281353
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: We exclude from our sample countries that are in the first quartile of annual GDP growth, providing robustness of our result with respect to self-selection of firms into fast-growing markets. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.9: Alternative Sample: Single Destination Exporters excluded - Intensive Margin

Dep. Variable	$\text{Ln}(X_{ijt})$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.061[a]	-0.041[a]	0.068[c]	0.024		
	(0.014)	(0.011)	(0.040)	(0.021)		
Ln Country price index		0.056[b]				
		(0.026)				
Ln GDP		1.256[a]				
		(0.077)				
Ln. Bil. RER Volatility × Nb. dest			-0.060[a]	-0.029[a]	-0.018[a]	-0.014[b]
			(0.014)	(0.008)	(0.006)	(0.006)
Ln. Bil. RER Volatility × Assets						-0.004
						(0.003)
Observations	1612121	1612121	1612121	1612121	1612121	1612121
R^2	0.885	0.886	0.453	0.885	0.887	0.887
Firm-year dyads	328944	328944	328944	328944	328944	328944
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: In this sample, we exclude firms that export to one destination only at time t. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Table H.10: Alternative Sample: Single Destination Exporters excluded - Extensive Margin, Entry

Dep. Variable	$Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Bilateral RER volatility	-0.013[a]	-0.010[a]	0.007[b]	-0.007[c]		
	(0.002)	(0.002)	(0.003)	(0.003)		
Ln Country price index		0.005[c]				
		(0.002)				
Ln GDP		0.126[a]				
		(0.012)				
Ln. Bil. RER Volatility × Nb. dest			-0.008[a]	-0.002[c]	-0.002[c]	-0.002[c]
			(0.001)	(0.001)	(0.001)	(0.001)
Ln. Bil. RER Volatility × Assets						0.000
						(0.000)
Observations	5406043	5406043	5406043	5406043	5406043	5406043
R^2	0.383	0.383	0.224	0.383	0.386	0.386
Firm-year dyads	833206	833206	833206	833206	833206	833206
Firm-country FE	yes	yes	no	yes	yes	yes
Country-Year FE	no	no	no	no	yes	yes

Note: In this sample, we exclude firms that export to one destination only at time t. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

I Additional results on reallocation

Alternative Weighting Scheme for Multilateral RER volatility

Table I.1: Alternative Weighting Scheme for Multilateral RER volatility

Dep. Variable	Ln Exports $\text{Ln}(X_{ijt})$			Entry Dummy $Pr(X_{ijt} > 0 \mid X_{ijt-1} = 0)$		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Relative volatility	-0.029[b]	0.055[a]	0.093[a]	-0.013[a]	-0.005	0.022[b]
	(0.012)	(0.018)	(0.023)	(0.004)	(0.004)	(0.009)
Ln country price index	0.065[b]	0.062[b]		0.006[b]	0.006[b]	
	(0.025)	(0.025)		(0.003)	(0.003)	
Ln GDP	1.239[a]	1.246[a]		0.115[a]	0.115[a]	
	(0.073)	(0.073)		(0.014)	(0.014)	
Ln Relative volatility × Nb. Dest.		-0.029[a]	-0.024[a]		-0.003[b]	-0.004[a]
		(0.005)	(0.004)		(0.001)	(0.001)
Observations	2150330	2150330	2150330	6994265	6994265	6994265
R^2	0.879	0.879	0.880	0.390	0.390	0.396
Firm-year dyads	425741	425741	425741	1305944	1305944	1305944
Country-Year FE	no	no	yes	no	no	yes

Note: In this table, we introduce one alternative measure of relative RER volatility. Multilateral RER volatility is computed using the time-varying share of each sector in total French exports over the whole period, and so is the relative volatility. Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels. All specifications include firm-year and firm-country fixed effects.

Chapter 3

Trade Costs and Current Accounts

Figure 3.1: Yearly Standard Deviation of the Current Accounts

3.1 Introduction

The main issue tackled in this chapter is whether global current account imbalances are a consequence of trade liberalization. These growing imbalances as displayed in Figure 3.1, have become a subject of interest and concern as recalled in Obstfeld (2012). Figure 3.1 draws the yearly cross-country standard deviation of the current account to GDP ratio for the OECD members. Current accounts are around four times more dispersed in 2010 than they were in 1990, which implies diverging current account balances. Over the same time period, trade costs have decreased allowing larger trade flows, at both the intensive and the extensive margin (Arvis et al., 2013). The present chapter asks whether these trade cost reductions are a plausible determinant of these increasing current imbalances.

An extensive literature has investigated the key forces driving current account dynamics. The empirical literature has listed many potential candidates including openness, financial integration, and demographic trends, among others. Chinn and Prasad (2003) provide a survey of the empirically-relevant determinants of current account balance variations across countries and over time. Surprisingly, the role of trade liberalization has received less attention. How much of the current account imbalances is linked to regional integration? This chapter provides an explanation for these growing imbalances which relies on the nature of the regional integration process. More specifically, it supports the idea that national industrial structures are affected by the changing trade costs faced by firms when they export goods or services. Trade cost variations affect national trade structures, the level of trade and its nature in terms of factor service. They are likely to affect current account balances insofar as these changes in the industrial structure translate into changes in the national investment level.

I build on the recent approach by Jin (2012) by emphasizing the role of trade costs in shaping industrial structures and the current account balance. Two predictions are derived from the model and brought to the data. The model predicts (i) that trade cost variations interact with changes in the industrial structure to determine the effects of regional integration on current accounts, and (ii) that the depth of regional agreements shape the response of current accounts to changes in trade costs and in specialization patterns: the joint effect of trade costs and of the national capital intensity of production on current accounts is exacerbated for countries with highly integrated institutions.

The current account ratio to GDP is regressed on the capital content of exports, its interaction with trade costs for the 1988-2005 period. A full set of factors is included in the specifications, factors which could potentially influence current account balances by controlling for savings, openness and other country-specific variables. The endogenous determination of the capital content of exports is corrected for by implementing an instrumental variable strategy. The World Governance Indicators from Kaufmann et al. (2010) data on institutional quality are used as instruments for the capital intensity of production at the country level. Following Acemoglu et al. (2001, 2005), institutional quality is a strong determinant of growth, and a significant part of the effect is channeled through investment.

The estimates report a positive joint effect of capital intensity and trade costs on current accounts: ceteris paribus, when trade costs decrease, countries where production is oriented towards capital-intensive activities have larger current account deficits, consistently with the existence of a higher demand for capital in these countries. Estimations controlling for endogeneity confirm this result. The results are confirmed by robustness checks which deal with unobserved heterogeneity and potential lagged effects.

I infer from these results that, aside from the direct effect generally put forward in standard macro analysis, changes in production patterns may be an additional channel of impact of trade liberalization on current accounts.

The remainder of the chapter is composed of five sections. The next section provides a literature review. The theoretical model, emphasizing the joint effect of trade costs and changes on the industrial structure on current accounts, is presented in Section 3, where the 2 testable predictions are derived. Section 4 translates the theoretical predictions into an empirical strategy and defines data sources. Section 5 presents empirical evidence of the impact of capital intensity and trade cost variations on current accounts, and investigates how institutional integration may shape the relation between current accounts and capital intensity. Section 6 shows some robustness check results, including an investigation of lagged effects and unobserved heterogeneity. The last section provides concluding comments.

3.2 Literature Review

This chapter contributes to two strands of the literature. First, it is related to the literature that rationalizes the link between regional integration and global imbalances. Focusing on current accounts, Blanchard and Giavazzi (2002) advocate that integration is likely to increase current account imbalances, as borrowing and lending conditions are implicitly relaxed in an integrated area. Borrowers are led to borrow more in an integrated area, implying increasing current accounts. Schmitz and von Hagen (2009) provide evidence of growing financial integration in the euro area as a source of increasing current accounts in member countries, where the single currency plays a substantial part. Interestingly, the introduction of the euro in 1999 is mainly interpreted as deepening financial openness in the Euro Zone, while the Euro may also be a source of a decrease in exchange rate volatility and thus in trade costs (Berthou and Fontagné, 2013). I explicitly focus on this latter hypothesis and provide insights on its magnitude in current account dynamics.

Second, a recent interest in the relationship between trade and capital flows has emerged. While in standard HOS theory trade and capital flows are perfect substitutes, a major recent improvement has been to depart from the standard HOS framework, thus allowing both for trade in goods and in factors. Using Obstfeld and Rogoff (1996)'s terminology, this literature departs from the standard inter-temporal analysis by combining both intra-temporal trade and inter-temporal trade. In this field, Jin (2012) provides a seminal contribution and a tractable theoretical framework which can replicate the empirical features of the direction of capital flows, as mentioned by Gourinchas and Jeanne (2008) who provide evidence that capital tends to flow towards countries with high level of investment and low growth. Jin (2012) provides a theoretical framework that allows for the endogenization of current accounts by trade structure. She shows that the capital intensity of the industrial structure is a quantitatively important determinant of current accounts.

In the present chapter, I focus on the role of trade costs in shaping current account dynamics. Within the trade literature, a consensus has emerged: reducing trade costs affects the industrial structure. Three strands of literature however have distinct predictions about these patterns. First, the Hecksher-Ohlin-Samuelson (HOS) theory supports the factor proportion theory stating that countries will specialize in industries which are intensive in the factors which they are abundantly endowed with. Contributions like Leamer (1980), Trefler (1993, 1995), Davis and Weinstein (2001), or Romalis (2004) have provided solid empirical evidence of the performance of the factor proportion theory. In these papers, comparative advantage is revealed by its effect on the factor content of trade flows or on the specialization pattern. Then, new trade theories show that each country will produce fewer product varieties within an industry to take advantage of increasing returns to scale (Krugman (1979) and Ethier (1982)). And thirdly, new economic geography theories show that vertical linkages between industries will result in the agglomeration of these industries in one location (Krugman and Venables, 1996). Even if empirical studies on industrial patterns in Europe have produced conflicting and opposite results, industrial structures are undoubtedly affected by regional integration.

What sets this chapter apart from existing research is that, to the best of my knowledge, it is the first attempt to rationalize the effect of trade costs on current account dynamics in a trade framework. Regarding the effect of institutional integration on trade, Vicard (2009) provides evidence that while the existence of a regional trade agreement favors trade, the depth of the agreement however has no additional pro-trade effect. This paper finds that the depth of regional agreements matters insofar as it shapes the response of current accounts to changes in trade costs.

3.3 Theory

I provide a partial equilibrium model that is based upon Jin (2012)'s model in which trade costs are introduced, following Markusen and Venables (2007)'s multi-product and multi-country trade structure with trade costs. The baseline setup for firms and consumers is therefore similar to Jin (2012). The world is composed of two countries, A and B. Each country is characterized by an overlapping generation economy made of consumers living for two periods. Each country uses identical technology. I depart from this baseline model by differentiating the two countries by their factor supply differences. I use the same parametrization of preferences and technology as Jin (2012).

Trade Costs The aggregate national production of good j in country i is given by Y^i_{jt} and $b^i_j(w,r)$ represents the constant unit cost of producing j. The comparative advantage is expressed with the value of b_j: a high b_j means a comparative *disadvantage* in the production of good j. The export price of good j is p_j/τ, while the import price for the same good is $p_j\tau$. τ is assumed such that, for a particular j:

$$p_j\tau \geq b_j(w,r) \geq p_j/\tau$$

This equation states that trade costs affect the level and the sectoral composition of the trade structure. The same inequalities are true for the other country. Γ_{Ajt} is defined as the share of the world production of good j that takes place in country A at time t:

$$\Gamma_{Ajt} = \left(\frac{Y_{Ajt}}{Y^A_{jt} + Y^B_{jt}}\right) \tag{3.1}$$

Classical trade theory implies that for each sector the relative production level is the result of the interaction of comparative advantage and trade costs. Here, the following functional form for this relationship is assumed:

$$\Gamma_{Ajt} = c\left((b^B_{jt} - b^A_{jt})(\tau^{\max} - \tau)\right) \tag{3.2}$$

with $c > 0$ a scale parameter. This functional form has convenient properties which are consistent with standard comparative-advantage-based trade theories. By differentiating this equation with respect to τ:

$$\frac{\partial \Gamma_{Ajt}}{\partial \tau} = -c(b^B_{jt} - b^A_{jt}) \tag{3.3}$$

Therefore, a reduction in trade cost implies an expansion in country A's production of j, relative to the world production only if country A has a comparative advantage in the production of good j.

Investments and Current Accounts We know from Jin (2012)[1] that the investment in sector j in country i at time t is:

$$I_{ijt} = I_t^W \cdot \rho_j \cdot \Gamma_{ijt} \tag{3.4}$$

where I_t^W is the world investment level, ρ_j is sector-j capital requirements and Γ_{ijt} measures the share of country i in the world production of good j. $\rho_j = \dfrac{\gamma_j \alpha_j}{\sum_j \gamma_j \alpha_j}$ is defined as the measure of the relative capital intensity of sector j.

Finally, country i's share of the world investment, Λ_{it}, is such that $I_{it} = I_{it}^W \Lambda_{it}$ where

$$\Lambda_{it} = \sum_j \frac{\gamma_j \alpha_j}{\sum_j \gamma_j \alpha_j} \Gamma_{ijt}$$

which implies

$$I_{it} = I_t^W \sum_j \frac{\gamma_j \alpha_j}{\sum_j \gamma_j \alpha_j} \Gamma_{ijt}(\tau) \tag{3.5}$$

This equation allows translating changes in trade costs τ into changes in investment through changes in Γ_{ijt}. This mechanism is an analytical contribution of the chapter. Focusing on country A, we get:

$$I_{At} = I_t^W \sum_j \frac{\gamma_j \alpha_j}{\sum_j \gamma_j \alpha_j} c\left((b_{jt}^B - b_{jt}^A)(\tau^{\max} - \tau)\right). \tag{3.6}$$

Derivating over τ, we obtain:

$$\frac{\partial I_{At}}{\partial \tau} = I_t^W \times \sum_j \rho_j \times c\left(b_{jt}^A - b_{jt}^B\right) \tag{3.7}$$

A change in τ leads to an increase in investment in country A if, across all sectors, changes in τ induce changes in the specialization patterns such that aggregate capital requirements increase. Conversely, a decrease in τ leads to higher investment in A if $\sum_j \rho_j b_{jt}^B > \sum_j \rho_j b_{jt}^A$.

Country i's share in the world production of good j increases when Γ_{ijt} increases, which can be a consequence to a change in τ. Aggregating over all goods, and weighting by the relative capital intensity of each sector, an increase in Γ_{ijt} leads to national investment level variations, which are likely to affect current account balances.

[1] See equations (18), (20) and (21) in Jin (2012).

Finally, at time t, the net foreign assets of country A are the value of A's claims on the world minus the world's claims on A:

$$NFA_{it} = S_{it}^{Y} - \underbrace{q_{it}K_{i,t+1}}_{=I_{i,t}^{\text{imp}}} \tag{3.8}$$

where $I_{i,t}^{\text{imp}}$ is the implicit value of investment in country i at time t. Country i's current account balance is the change in the net foreign asset position.

$$CA_{it} = NFA_{it} - NFA_{i,t-1} \tag{3.9}$$

This result is thus consistent with the standard equilibrium condition: $X - M = S - I$, where the trade balance equalizes the current account balance. In other words, I adopt the now standard vision of trade balance as the net factor service incorporated in trade, suggesting that theoretical attention should rather be more focused on trade in the factor services than on the flows of goods and services.

First Testable Prediction To summarize the above framework, a testable prediction is derived from the formal model about current account determinants, taking the effect of the industrial structure into account.

Testable Prediction 1: *The interaction between the capital intensity of production and trade costs should significantly and positively impact the current account-to-GDP ratio.*

A positive coefficient means that increasing trade costs for capital-intensive countries should reduce investment, and lead to a current account surplus. This prediction also implies that regional integration affects the current account balance through changes in the industrial structure resulting from trade cost reductions. I do not focus on the unconditional effect of trade costs on current accounts because my model implies that this relationship is not straightforward. Suppose that we observe two countries that face an exogenous trade cost shock. Suppose also that one country is relatively labor abundant and thus has labor-intensive activities compared to the other country, whose production is thus capital intensive. In my framework, there is no reason for both countries' current accounts to go in the same direction. The relation between trade costs and current accounts crucially depends on specialization patterns. Unconditionally to changes in the capital intensity of production, the relation between trade costs and current accounts has little meaning. Instead, the contribution of the chapter is to focus on the joint effect of capital intensity and trade costs on current accounts.

Institutional Integration and Second Testable Prediction I further investigate the effect of regional integration on current account balances. I believe that institutional integration may affect the relationship between trade costs and current account imbalances. I argue that institutional integration has heterogeneous effects on current accounts depending on its depth. Consistently with the Balassa classification, the underlying mechanism is such that the first stages of institutional integration decrease transaction costs, while deeper trade agreements favor goods and factor mobility. Consider a country which undergoes a trade cost shock, such that its capital demand increases. The response of current accounts to the shock should be stronger when there is high factor mobility. The depth of regional trade agreements should amplify the interactive effect of trade costs and capital intensity on current accounts.

Testable Prediction 2 : *The triple interaction between the capital intensity of production, trade costs and a measure of high institutional integration should significantly and positively impact the current account-to-GDP ratio.*

A positive coefficient means that changes in trade costs associated with variations in the capital intensity of production affect the current account, all the more so as the country is well integrated institutionally. More specifically, the underlying mechanism is that the depth of regional agreements affects goods and factor mobility, beyond trade cost changes. Such mobility may exacerbate the response of current accounts to changes in trade costs, conditionally on variations in factor demand.

3.4 Empirical Strategy

This section presents the econometric strategy to assess both predictions, taking endogeneity problems into account, before presenting the data sources.

3.4.1 Translating the Predictions into Empirics

The model provides predictions about the industrial structure and its link to current account dynamics. The ideal empirical assessment would be based on the industrial structure on the one hand and on current accounts on the other. However, due to a lack of data, I have to focus on trade patterns rather than on production patterns. It is assumed that production patterns can be inferred from export patterns: if a country is mainly specialized in one sector, exports are likely to be high (Romalis, 2004)[2].

3.4.2 Specifications and Econometric Issues

Prediction 1 With respect to Prediction 1, the following equation is estimated:

$$CA_{it} = \beta_0 + \beta_1 \ln(Z_{it}^K) + \beta_2 \ln(GDP_{it}) + \beta_3 \ln \mathrm{TC}_{it} + \beta_4 (\ln(\mathrm{TC}_{it}) \times \ln Z_{it}^K) + \phi C_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (3.10)$$

where CA_{it} is country i's current account-to-GDP ratio at time t, $\ln(Z_{it}^K)$ is the log of the index of country i's capital intensity at time t , $\ln(GDP_{it})$ is the log of country i's current GDP. The variable TC_{it} denotes the trade costs faced by country i at time t. Two measures of trade costs are considered here: trade costs from Arvis et al. (2013) and real exchange rate volatility. The interactive term between trade costs and capital intensity, $\mathrm{T}C_{it} \times Z_{it}^K$, is then introduced. C_{it} includes controls such as population size, savings, stock market capitalization ratio to GDP – to control for financial development. These variables are identified by Chinn and Prasad (2003) as standard drivers of current accounts. The country's capital stock for the previous year is also controlled for, so that the regression captures the aggregate requirements for capital. Country and year fixed effects are included.

The parameters of interest are thus β_1 and β_4. β_1 should be negative, implying a negative relationship between the current account-to-GDP ratio and the capital intensity of the industrial structure. Consistently with the theoretical framework, β_4 should be positive, which signals a positive impact of changes in the industrial structure resulting from trade cost reductions on the current account-to-GDP ratio.

So as to correct the natural trend of integration with countries belonging to the same area and continent, which potentially affects standard errors, this equation is estimated by clustering at the continental level, using the Froot (1989) correction. The White correction for heteroskedasticity is also used. The results are robust to the use of the Newey-West matrix, controlling for autocorrelation.

[2] Romalis (2004) suggests that there is an isomorphism and co-movement between production and bilateral trade.

Prediction 2 To assess the second prediction regarding the effect of the depth of institutional agreements, the following equation is regressed:

$$\begin{aligned} CA_{it} &= \beta_0 + \beta_1 \ln(Z_{it}^K) + \beta_2 \ln(GDP_{it}) + \beta_3 \ln \mathrm{TC}_{it} + \beta_4 (\mathrm{RTA\ HIGH})_{it} \\ &+ \beta_5 (\ln(\mathrm{TC}_{it}) \times \ln(Z_{it}^K)) + \beta_6 (\ln(\mathrm{TC}_{it}) \times (\mathrm{RTA\ HIGH})_{it}) + \beta_7 (\mathrm{RTA\ HIGH})_{it} \times \ln(Z_{it}^K)) \\ &+ \beta_8 (\ln(\mathrm{TC}_{it}) \times \ln(Z_{it}^K) \times (\mathrm{RTA\ HIGH})_{it}) \\ &+ \phi C_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{3.11}$$

Again, two types of trade costs are considered: trade costs from Arvis et al. (2013) and real exchange rate volatility. With respect to previous notations, the RTA HIGH_{it} variable is introduced; it measures the number of countries with which country i has a "Common Market" agreement or a Monetary Union agreement. This variable is used to evaluate the depth of institutional agreements. Crucially, the main interest of disentangling high-level regional agreements and lower-level agreements is the following: the existence of common-market agreements is beneficial to factor mobility, which is not the case with lower-level agreements. In other words, common-market agreements act like a threshold above which factor mobility is favored. Moreover, when countries have a common-currency agreement, the exchange rate risk is lowered so that this type of agreement suppresses the transaction costs associated with capital movements. Both types of agreements are thus beneficial to factor mobility (and especially capital).

The main interest lies in the estimation of coefficient β_8, associated with the triple interaction between trade costs (respectively RER volatility), the measure of institutional integration and the capital intensity of production. This coefficient should be positive, meaning that there is a magnifying effect of the interaction of trade costs and of the capital intensity of production on current accounts for countries with highly integrated institutions.

This equation is estimated with OLS and all regressions are clustered at the continental level. The White correction for heteroskedasticity is also used. The results are robust to the use of the Newey-West matrix, controlling for autocorrelation.

Econometric Issues Due to obvious simultaneity concerns and an omitted variable bias in the estimation, endogeneity is controlled for using instrumental variables (IV) in a two-stage least square estimation (2SLS). It is now widely recognized that institutional quality is a strong determinant of growth, a significant part of the effect is channeled through investment (Acemoglu et al., 2001, 2005). I use the World Governance Indicators from Kaufmann et al. (2010) data on institutional quality as instruments for capital intensity of production. More precisely, I use the estimated world ranks of "rule of law quality" and "corruption level", as well as the first lag of capital intensity, as instruments for the capital intensity of production.

The validity of the instruments is checked using different statistics. Hansens J-test of over-identification is robust to heteroskedasticity and clustering and is unable to reject our set of instruments in all cases. The F-stat form of the Kleibergen-Paap statistic is also reported, as well as the heteroskedastic and clustering robust version of the Cragg-Donald statistic suggested by Stock and Yogo (2005) as a test for weak instruments. All statistics are above the critical values, confirming that the instruments are strong predictors of capital intensity. The next step is to perform the Durbin-Wu-Hausman test for exogeneity of regressors. Statistically, the null hypothesis of exogeneity cannot be rejected in most specifications. In such a case, Pagan (1984) suggests relying on OLS estimates since they are more efficient. However, I decided to report both OLS and 2SLS estimates to check the robustness of the results.

3.4.3 Data Sources and Stylized Facts

Sample Representativeness The sample is composed of observations from 34 OECD member countries, among which 21 are members of the European Union and 15 belonged to the Euro Area in 2013. The empirical analysis relies on yearly data from 1990 to 2010. Current account balances in values are extracted from the OECD Balance of Payments (MEI) Database. Restricting the sample to the OCED countries is driven by data limitation. The sample however covers a broader set of documented facts which are not specific to the

Exports I use yearly export data, at the sector-country level, from 1988 to 2012 from the OECD International Trade by Commodity Statistics Database. I use sectoral export data, consistently with the 1988 Harmonized System classification[3]. I then construct sectoral share patterns, s_{ijt}:

$$s_{ijt} = \frac{X_{ijt}}{\sum_j X_{ijt}}$$

where s_{ijt} is the share of sector j in country i's exports at time t and X_{ijt} measures country i's exports in sector j at time t.

[3] I use the 2-digit level classification, thus exhibiting 97 categories, which all have strictly positive export patterns.

Sectoral Factor Content I also use data containing the sectoral factor content included in the production, which proxies the capital stock in the production of a given sector. The data is taken from the Factor Intensities dataset built by the UNCTAD and is then aggregated by sector, to get a value of the capital stock for each sector in the Harmonized System 1988 2-digit classification. 2007 is the base year in the sample, implicitly assuming that technology is constant over time and is homogeneous across countries, as in Vanek (1968) or Bowen et al. (1987). I assume that the capital stock in one sector remains constant over the sample time period, and that the sectoral capital stock requirement is the same in each country and is similar to the American benchmark.

Capital Intensity of Production The capital intensity of exports is measured at the country-year level: it is a proxy for the "capital content" of a country's exports, in terms of the physical capital that is included in the production process. The index is constructed this way:

$$Z_{it}^{K} = \sum_{j} s_{ijt} K_{jt} \tag{3.12}$$

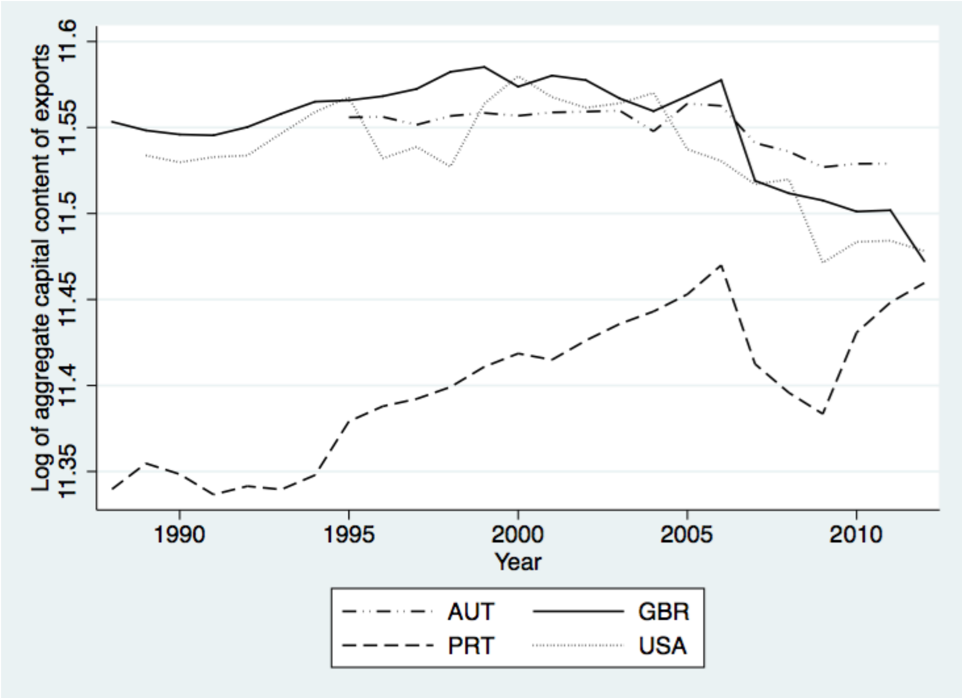
where Z_{it}^{K} measures country i's capital content of exports, s_{ijt} is the previously defined share of sector j in country i's total exports, and K_{jt} is the capital stock included in the production of good j ($\forall i$). The higher the index, the more specialized the country is in capital-intensive activities. I present in Figure 3.2 the computed capital intensity of exports for four countries of my sample. This figures shows that there is variation across countries and across time.

Trade Costs Two types of trade costs are considered: total trade costs and exchange rate volatility. In a first step, I use trade cost data from Arvis et al. (2013), which has recently become available in World Bank datasets[4]. This data results from their paper in which trade costs are inferred from the "inverted gravity" method (Novy, 2013). I thus use data from 1995 to 2010 for the OECD countries.

I then consider effective exchange rate volatility. Monthly effective (trade-weighted) data is from the Bank of International Settlement Dataset. The exchange rate volatility is computed as the yearly standard deviation of the monthly log differences in the real effective exchange rate.

[4]The database is available at http://data.worldbank.org/data-catalog/trade-cost

Figure 3.2: Aggregate capital content of exports



Other Variables Regional agreement data comes from Vicard (2009). Unless otherwise mentioned, other macro variables come from the Penn World Tables. Table 3.1 provides the descriptive statistics for the sample.

Table 3.1: Summary Statistics: Key Variables

Variable	**Mean**	**St.d**	**Min**	**Max**
Current Account-to-GDP ratio	0.004	0.063	-0.379	0.312
Capital Intensity (Z_{it}^{K})	9.925	0.797	6.023	11.795
Trade Costs	70.723	21.572	2.775	122.757
Real Exchange Rate Volatility	2.052	1.754	0.221	16.734

Sources in text.

3.5 Results

The results for the assessment of the two predictions are presented in this section.

3.5.1 Prediction 1: Trade Costs and Current Accounts

I estimate equation (3.10). The OLS and 2SLS estimation results are respectively presented in Tables 3.2 and 3.3. I present the results from the OLS estimation. The results are also robust to the 2SLS estimation. It can be inferred from these results that Prediction 1 is verified.

Table 3.2: Regression of the Current Account-to-GDP Ratio - OLS

	(1)	(2)	(3)	(4)	(5)
Ln GDP	-0.232[a]	-0.120[a]	-0.119[a]	-0.120[a]	-0.083
	(0.011)	(0.042)	(0.042)	(0.042)	(0.058)
Ln Capital Intensity	-0.088[a]	-0.216[b]	-1.055[a]	-0.216[b]	-1.610[a]
	(0.027)	(0.092)	(0.147)	(0.092)	(0.336)
Ln Capital Stock$_{t-1}$	0.045	0.054	0.065	0.054	0.068
	(0.037)	(0.084)	(0.087)	(0.084)	(0.044)
Ln Savings	0.030[a]	0.014[a]	0.014[a]	0.014[a]	0.014[a]
	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)
Ln Population	-0.145	-0.154	-0.159[c]	-0.154	-0.002
	(0.128)	(0.103)	(0.097)	(0.103)	(0.010)
Ln Trade Costs		0.003	-2.256[a]		
		(0.015)	(0.437)		
Ln Capital Intensity × Ln Trade Costs			0.195[a]		
			(0.036)		
RER Volatility				0.001	-0.847[a]
				(0.004)	(0.168)
Ln Capital Intensity × RER volatility					0.073[a]
					(0.015)
Observations	373	373	373	373	366
R^2	0.157	0.202	0.274	0.149	0.230
Country F.E.				yes	
Year F.E.				yes	

Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.
[a], [b] and [c] respectively denote significance at the 1%, 5% and 10%.
Intercept not reported.

Table 3.3: Regression of the Current Account-to-GDP Ratio - 2SLS

	(1)	(2)	(3)	(4)	(5)
Ln Capital Intensity	-0.018	-0.244	-0.270	-0.275	-4.879^b
	(0.132)	(0.179)	(0.181)	(0.185)	(2.350)
Ln GDP	-0.249^a	-0.284^a	-0.280^a	-0.283^a	-0.237^a
	(0.061)	(0.060)	(0.061)	(0.060)	(0.057)
Ln Population	-0.262^a	-0.172	-0.211	-0.256	-0.266
	(0.076)	(0.172)	(0.173)	(0.173)	(0.167)
Ln Capital Stock$_{t-1}$	0.066	0.141^b	0.143^b	0.156^b	0.239^a
	(0.041)	(0.069)	(0.070)	(0.067)	(0.065)
Ln Savings	0.017^c	0.006	0.006	0.006	0.005
	(0.010)	(0.006)	(0.006)	(0.006)	(0.005)
Ln Trade Costs		-0.003	-0.008^b		
		(0.003)	(0.004)		
Ln Capital Intensity × Ln Trade Costs			0.003^b		
			(0.001)		
RER Volatility				0.003	-2.656^b
				(0.003)	(1.310)
Ln Capital Intensity × RER volatility					0.229^b
					(0.113)
Observations	340	282	282	282	282
R^2	0.313	0.265	0.273	0.252	0.156
Country F.E.			yes		
Year F.E.			yes		
Hansen stat.	1.382	4.013	4.607	2.244	3.055
P-value	0.501	0.1345	0.0999	0.3257	0.2171
Kleibergen-Paap stat.	12.794	10.283	10.635	27.756	16.3
Critical value (10%)	9.08	9.08	11.12	9.08	11.12
Durbin-Wu-Hausman	0.664	1.276	0.712	1.439	2.514
P-value	0.4151	0.2586	0.3987	0.2302	0.1128

Heteroskedasticity-consistent (White correction) standard errors in parentheses

^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

Instruments: institutional quality data, first lag of capital intensity

In each table, column 1 is the baseline specification in which the current account-to-GDP ratio is regressed on capital intensity, GDP, controls for openness, savings and financial development. Variables that allow for the empirical validation of the first prediction are then added. The trade costs variables are thus sequentially introduced, in columns 2 and 4, as well as their interactive term with capital intensity, in columns 3 and 5.

The estimates confirm that capital intensity is a current account determinant. The β_1 coefficient is significantly different from 0 and is negative. This means that countries which have a high capital intensity of production also run current account deficits. This is in line with the first prediction. This result is present in other specifications departing from the baseline estimation, although its magnitude varies. The estimated OLS elasticities are around -0.2. The result is robust to the 2SLS estimation, taking the endogeneity of the associated variable of interest into account. In column 1 of Table 3.3, the estimated β_1 is significantly negative. The estimated elasticities are around the same value as the 2SLS estimates.

The negative and significant effect of GDP on current accounts is robust to different specifications and is in line with the standard "convergence" representation of current accounts: countries that grow more also run current account deficits. The results in both tables suggest that both GDP level and capital intensity are current account determinants. The global allocation of capital is thus driven by two interacting, opposite forces: convergence and composition. The direction of capital flows is determined by the relative strength of these two forces.

Regarding the first prediction, in each table, columns 2 and 3 present the results of the estimation when the specification includes trade costs from Arvis et al. (2013). Columns 4 and 5 display the results when the specification takes real exchange rate volatility into account.

The unconditional effect of trade costs on current accounts is null (β_3 is not significantly different from 0). This coefficient can be interpreted as follows: for the average country in the sample, trade costs have no effect on the current account. Instead, the interactive term between trade costs and capital intensity has a positive and significant effect on the current account (β_4 is positive and significant). What can be inferred from this result is that changes in capital intensity which occur through changes in trade costs affect the current account. A country where the industrial structure is oriented towards capital-intensive activities following a fall in trade costs is more likely to run a current account deficit. Conversely, a country that faces lower trade costs and that is labor intensive is more likely to have a current account surplus, insofar as its aggregate capital requirements decrease.

I then investigate the effect of changes in RER volatility – the alternative measure of trade costs – on current account balances. The estimates of the unconditional effect of RER volatility are negative but nonsignificant. Crucially, when the interactive term is added to the regression, the OLS estimate of β_4 in column 5 is significantly positive. This result can be interpreted as evidence of a joint effect of RER volatility changes and production structure evolutions on current accounts, which confirms the second prediction. This positive correlation between the interaction variable and the current account-to-GDP ratio means that decreasing real exchange rate volatility for capital-intensive countries increases investment, and leads to larger current account deficits. Trade liberalization should then reinforce investment in countries where the industrial structure is oriented towards capital-intensive activities, leading to larger current account deficits.

Both unconditional effects of trade costs are found to be null. What can be inferred from this null coefficient is that the average elasticity of current accounts to trade costs is 0. This confirms not only that the relation between trade costs and current accounts is not straightforward, but also that my conditional approach is relevant. Taking specialization patterns into account is necessary to assess the effect of trade costs on current accounts. If these patterns are not taken into account, the effect is only the average (null) one.

3.5.2 Prediction 2: Institutional Integration, Trade Costs and Current Accounts

The effect of regional integration on current accounts is further investigated, taking institutional integration into account. I investigate whether institutional integration and its depth, affect the shape of the relation between trade cost changes and current account imbalances. I estimate equation (3.11). The OLS and 2SLS estimation results are respectively presented in Tables 3.4 and 3.5. Prediction 2 is verified. In each table, columns 1 to 3 present the results of the estimation when the specification includes trade costs from Arvis et al. (2013). Columns 4 to 6 display the results when the specification takes real exchange rate volatility into account as a measure of trade costs.

The noteworthy result from this table is that both triple interactions have a positive and significant effect on current accounts. The joint effect of trade costs and capital intensity on current accounts is magnified by high institutional integration. In other words, countries that have decreasing trade costs and increasing capital demand run larger current account deficits, all the more so as they are well integrated in terms of institutional agreements. This result is present when focusing on trade costs à la Arvis et al. (2013). The 2SLS results confirm this positive coefficient associated with the triple interaction, even if the statistics mean that the 2SLS estimates are less efficient and provide noisier estimates than OLS. What can be inferred from these results is that regional agreements matter in terms of factor mobility insofar as it shapes the response of current accounts to changes in trade costs.

The positive coefficient associated with the triple interaction including RER volatility is however not significantly different from 0 in both estimations. This result is probably driven by the fact that having a high number of agreements generates benefits which are already captured in lower real exchange volatility. Countries which belong to the Euro Area, thus sharing the same currency and low real exchange rate volatility due to zero nominal volatility, are those which have a high number of agreements, with other European partners in particular.

3.6 Robustness

In this section, I test the sensitivity of the above results to several sources of bias and perturbation, namely using first-difference estimators and investigating potential lagged effects of capital intensity and trade costs on current accounts.

3.6.1 Alternative Treatment for Unobserved Individual Heterogeneity

In order to address potential omitted variable bias in the empirical exercise, first-difference estimations have been performed for the two predictions. The following equation is thus regressed:

$$\Delta CA_{it} = \beta_0 + \beta_1 \Delta \ln(Z_{it}^K) + \beta_2 \Delta \ln(GDP_{it}) + \beta_3 \Delta \ln \mathrm{TC}_{it} + \beta_4 (\Delta \ln(\mathrm{TC}_{it}) \times \Delta \ln Z_{it}^K) + \phi \Delta C_{it} + \lambda_t + \varepsilon_{it} \tag{3.13}$$

where $\Delta X_{it} = X_{it} - X_{it-1}$.

Standard errors are clustered by continent, and heteroskedasticity is corrected for using the White correction. The results are presented in Tables 3.6 and 3.7 respectively regarding predictions 1 and 2. The first three columns present the results of the estimation without fixed

Table 3.4: Regression of the Current Account-to-GDP Ratio - OLS

	(1)	(2)	(3)	(4)	(5)	(6)
Ln Capital Intensity	-0.179[a]	-4.572[a]	-9.030[a]	-0.224[a]	-5.182[a]	-10.445[a]
	(0.033)	(1.335)	(2.446)	(0.082)	(1.486)	(2.669)
Ln GDP	-0.209[b]	-0.222[a]	-0.221[a]	-0.192[b]	-0.222[a]	-0.192[a]
	(0.081)	(0.069)	(0.068)	(0.076)	(0.069)	(0.055)
RTA HIGH	-0.011	-3.733[b]	-19.205[a]	-0.003	-3.771[b]	-20.881[a]
	(0.010)	(1.716)	(4.122)	(0.013)	(1.725)	(4.663)
Ln Savings	0.018[a]	0.014[a]	0.014[a]	0.013[a]	0.014[a]	0.013[a]
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Ln Population	-0.241[a]	-0.283[a]	-0.317[a]	-0.181[c]	-0.283[a]	-0.310[a]
	(0.078)	(0.085)	(0.066)	(0.093)	(0.085)	(0.043)
Ln Capital Stock$_{t-1}$	0.064	0.086	0.091	0.083	0.086	0.084
	(0.131)	(0.120)	(0.119)	(0.111)	(0.120)	(0.114)
Ln Trade Costs		-9.609[a]	-21.261[a]			
		(2.420)	(5.307)			
Ln Capital Intensity × Ln Trade Costs		0.815[a]	1.825[a]			
		(0.206)	(0.458)			
Ln Trade Costs × RTA HIGH		0.051[a]	3.588[a]			
		(0.013)	(0.670)			
Ln Capital Intensity × RTA HIGH		0.305[b]	1.646[a]		0.305[b]	1.794[a]
		(0.144)	(0.356)		(0.144)	(0.403)
Ln Capital Intensity × Ln Trade Costs × RTA HIGH			0.307[a]			
			(0.058)			
RER volatility				0.003	-2.402[a]	-5.215[a]
				(0.003)	(0.605)	(1.284)
Ln Capital Intensity × RER volatility					0.204[a]	0.449[a]
					(0.052)	(0.111)
RER volatility × RTA HIGH					0.013[a]	0.813[a]
					(0.003)	(0.186)
Ln Capital Intensity × RER Volatility × RTA HIGH						0.070[a]
						(0.016)
Observations	350	350	350	350	350	350
R^2	0.312	0.378	0.396	0.306	0.304	0.306
Country F.E.			yes			
Year F.E.			yes			

Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.
[a], [b] and [c] respectively denote significance at the 1%, 5% and 10%.
Intercept not reported.

Table 3.5: Regression of the Current Account-to-GDP Ratio - 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)
Ln Capital Intensity	-0.326^c	-2.696	-7.990	-0.278^b	-5.548	-9.032
	(0.187)	(5.988)	(13.267)	(0.133)	(8.976)	(15.310)
Ln GDP	-0.342^a	-0.320^a	-0.317^a	-0.155^a	-0.200^a	-0.317^a
	(0.072)	(0.061)	(0.066)	(0.047)	(0.044)	(0.066)
Capital Stock$_{t-1}$	0.163^b	0.170^b	0.183^b	0.030	0.042	0.183^b
	(0.080)	(0.070)	(0.079)	(0.053)	(0.048)	(0.079)
Ln Savings	0.008	0.008	0.008	0.013^c	0.014^c	0.008
	(0.008)	(0.006)	(0.005)	(0.007)	(0.007)	(0.005)
Ln Population	-0.400^b	-0.274^c	-0.331^c	-0.207^c	-0.253^b	-0.330^c
	(0.203)	(0.140)	(0.175)	(0.109)	(0.100)	(0.174)
RTA HIGH	0.004	-1.375	-13.447	-0.002	-3.941	-14.700
	(0.014)	(4.048)	(39.547)	(0.012)	(4.131)	(45.635)
Ln Trade Costs		-5.988	-19.017			
		(13.124)	(33.551)			
Ln Capital Intensity × Ln Trade Costs		0.508	1.644			
		(1.149)	(2.912)			
Ln Trade Costs × RTA HIGH		0.033	2.465			
		(0.040)	(8.628)			
Ln Capital Intensity × RTA HIGH		0.108	1.163		0.320	1.271
		(0.363)	(3.429)		(0.374)	(3.957)
Ln Capital Intensity × Ln Trade Costs × RTA HIGH			0.213			
			(0.749)			
RER Volatility				0.003	-2.609	-4.650
				(0.003)	(4.456)	(8.320)
Ln Capital Intensity × RER volatility					0.222	0.402
					(0.389)	(0.722)
RER Volatility × RTA HIGH					0.012	0.588
					(0.010)	(2.142)
Ln Capital Intensity × RER volatility × RTA HIGH						0.051
						(0.186)
Observations	222	222	222	199	199	199
R^2	0.212	0.284	0.326	0.189	0.155	0.206
Country F.E.			yes			
Year F.E.			yes			
Hansen stat.	5.438	5.772	5.337	3.256	3.296	3.456
P-value	0.142	0.123	0.148	0.353	0.348	0.326
Kleibergen-Paap stat.	10.283	20.635	17.427	13.345	14.613	15.652
Critical value (10%)	9.08	11.12	11.52	9.08	11.12	11.52
Durbin-Wu-Hausman	0.268	0.11	0.19	0.527	1.52	1.67
P-value	0.6049	0.7403	0.6633	0.4678	0.2176	0.196

Heteroskedasticity-consistent (White correction) standard errors in parentheses

^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

Instruments: institutional quality data, first lag of capital intensity effects, while the last three columns show the results when fixed effects are included. The results presented in Table 3.6 confirm the previous results. The table gives evidence of a joint effect of trade costs and capital intensity on current accounts. The coefficient associated with the interactive term between variations in trade costs (for the two measures used) and variations in capital intensity is positive and significant. This confirms the positive coefficient associated with the interactive terms of the levels showed previously. Moreover, this result is not dependent on the presence of country and year fixed effects, even though the elasticity is slightly higher when fixed effects are included.

Table 3.7 presents the results of the estimation for the empirical verification of Prediction 2. Independently from the inclusion of fixed effects, both triple interactions coefficients are positive, even though the one associated with exchange rate volatility is not significant. This result can be interpreted as confirming the findings above.

3.6.2 Lagged Effects

This subsection investigates whether changes in trade costs and in the capital intensity of production have lagged effects on current accounts. When trade cost shocks occur, it is likely that the capital intensity of production will be affected but not necessarily immediately. On the contrary, many studies have shown that factor mobility and factor allocation are sticky processes. In addition, it is well known that trade agreements are likely to have lagged effects on trade. As a result, adjusting factor use takes times and will probably lead to a lagged response of current accounts to changes in trade costs. This idea is tested by regressing the current account-to-GDP ratio on the lagged variables of interest. Two types of lag horizon are tested: the results with a one-year lag are presented in Table 3.8 and the results using a two-year lag are displayed in Table 3.9. All specifications included time and country fixed effects.

The specification based on a two-year lag is the preferred one. The results based on a specification using a one-year lag display the expected (positive) coefficients, but they are not significant. On the contrary, using a two-year lag displays positive and significant results with respect to what is expected.

The results presented in this chapter are therefore robust to checks regarding unobserved heterogeneity and lagged effects.

Table 3.6: Regression of the Current Account-to-GDP Ratio - First Difference

	(1)	(2)	(3)	(4)	(5)	(6)
Δ ln GDP	-0.235^a	-0.180^a	-0.179^a	-0.240^a	-0.163^a	-0.167^a
	(0.027)	(0.028)	(0.026)	(0.031)	(0.040)	(0.038)
Δ ln Capital Intensity	-0.042	-0.065	-1.129^b	-0.045	-0.039	-1.429^a
	(0.048)	(0.057)	(0.540)	(0.052)	(0.039)	(0.509)
Δ ln Capital stock$_{t-1}$	0.062	0.076	0.079	-0.093	0.128^c	0.083
	(0.041)	(0.053)	(0.056)	(0.116)	(0.069)	(0.085)
Δ ln Savings	0.009^a	0.004^a	0.005^a	0.009^a	0.005^a	0.005^a
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ ln Population	-0.095	-0.005	-0.023	-0.107	-0.323^b	-0.279^c
	(0.161)	(0.096)	(0.095)	(0.148)	(0.138)	(0.150)
Δ ln Trade costs		-0.030^a			-0.029	
		(0.007)			(0.026)	
Δ ln Capital intensity		0.068^a			0.062^b	
$\times$ Δ ln Trade costs		(0.017)			(0.029)	
Δ RER volatility			-0.613^b			-0.799^a
			(0.293)			(0.282)
Δ ln Capital intensity			0.053^b			0.069^a
$\times$ ΔRER volatility			(0.025)			(0.025)
Observations	256	332	232	256	232	232
R^2	0.132	0.105	0.123	0.167	0.125	0.144
Country F.E.	no	no	no	yes	yes	yes
Year F.E.	no	no	no	yes	yes	yes

Notes : Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.

^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

Table 3.7: Regression of the Current Account-to-GDP Ratio - First Difference

	(1)	(2)	(3)	(4)
Δ ln GDP	-0.186[a]	-0.146[a]	-0.162[a]	-0.133[a]
	(0.030)	(0.027)	(0.040)	(0.037)
Δ ln Capital Intensity	-0.167	-7.428	-0.099	-8.672
	(0.273)	(4.827)	(0.226)	(5.959)
Δ ln Population	-0.071	-0.079	-0.131	-0.124
	(0.087)	(0.069)	(0.187)	(0.296)
Δ ln Trade Costs	-0.163		-0.261[a]	
	(0.114)		(0.101)	
Δ ln Capital Stock$_{t-1}$	0.071	0.036	0.080	0.049
	(0.066)	(0.083)	(0.106)	(0.104)
Δ ln Savings	0.005[a]		0.005[a]	
	(0.000)		(0.000)	
Δ RTA HIGH	5.056[a]	-19.641	5.894[a]	-23.099
	(0.740)	(13.120)	(1.642)	(15.454)
Δ ln Capital Intensity	0.033		0.398[b]	
× Δ ln Trade Costs	(0.150)		(0.184)	
Δ ln Trade Costs	-1.279[a]		-1.395[a]	
× Δ RTA HIGH	(0.246)		(0.533)	
Δ ln Capital Intensity	-0.452[a]	1.691	-0.523[a]	1.989
× Δ RTA HIGH	(0.063)	(1.132)	(0.147)	(1.338)
Δ ln Capital Intensity	0.114[a]		0.124[a]	
× Δ ln Trade Costs × Δ RTA HIGH	(0.023)		(0.048)	
Δ RER volatility		-4.078		-4.852
		(2.532)		(3.165)
Δ ln Capital Intensity		0.351		0.418
× Δ RER volatility		(0.218)		(0.274)
Δ RER volatility		0.925		1.113
× Δ RTA HIGH		(0.581)		(0.696)
Δ ln Capital Intensity		0.080		0.096
× Δ RER volatility × Δ RTA HIGH		(0.050)		(0.060)
Observations	216	252	216	252
R^2	0.142	0.117	0.163	0.146
Country F.E.	no	no	yes	yes
Year F.E.	no	no	yes	yes

Notes : Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.

[a], [b] and [c] respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

Table 3.8: Regression of the Current Account-to-GDP Ratio - Lagged Effects - First Lag

	(1)	(2)	(3)	(4)
Ln GDP	-0.177^a	-0.243^a	-0.246^a	-0.269^a
	(0.053)	(0.025)	(0.069)	(0.059)
Ln Capital Intensity $_{t-1}$	-0.237^b	-0.082^a	-1.043^c	-1.200^b
	(0.106)	(0.027)	(0.551)	(0.601)
Ln Capital Stock$_{t-1}$	0.060	0.071^a	0.079	0.108
	(0.090)	(0.007)	(0.112)	(0.081)
Ln Savings	0.020^a	0.027^a	0.020^a	0.017^a
	(0.003)	(0.001)	(0.002)	(0.001)
Ln Population	-0.175	-0.179	-0.298^a	-0.292
	(0.144)	(0.184)	(0.075)	(0.180)
Ln Trade Costs $_{t-1}$	-0.035		0.144	
	(0.032)		(0.094)	
Ln Capital Intensity $_{t-1}$ $\times$	0.066		1.462^b	
Ln Trade Costs $_{t-1}$	(0.043)		(0.698)	
RER Volatility $_{t-1}$		-0.080		0.205
		(0.370)		(0.459)
Ln Capital Intensity $_{t-1}$ $\times$		0.007		-0.017
RER Volatility $_{t-1}$		(0.032)		(0.040)
RTA HIGH $_{t-1}$			6.908^a	9.145^a
			(1.045)	(1.198)
Ln Trade Costs $_{t-1}$ $\times$			-2.523^a	
RTA HIGH $_{t-1}$			(0.470)	
Ln Capital Intensity $_{t-1}$ $\times$			-0.620^a	-0.794^a
RTA HIGH $_{t-1}$			(0.093)	(0.102)
Ln Capital Intensity $_{t-1}$ $\times$			0.224^a	
Ln Trade Costs $_{t-1}$ $\times$ RTA HIGH $_{t-1}$			(0.043)	
RER Volatility $_{t-1}$				-0.657^a
$\times$ RTA HIGH $_{t-1}$				(0.068)
Ln Capital Intensity $_{t-1}$ $\times$				0.057^a
RER Volatility $_{t-1}$ $_{t-1}$ $\times$ RTA HIGH $_{t-1}$				(0.006)
Observations	275	252	259	204
R^2	0.327	0.344	0.405	0.366
Country F.E.		yes		
Year F.E.		yes		

Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.

^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

Table 3.9: Regression of the Current Account-to-GDP Ratio - Lagged Effects - Second Lag

	(1) A	(2) B	(3) C	(4) D
Ln GDP	-0.161^a	-0.240^a	-0.223^a	-0.245^a
	(0.047)	(0.037)	(0.052)	(0.030)
Ln Capital Intensity $_{t-2}$	-0.228^b	-0.117^a	-0.957^b	-1.135^b
	(0.105)	(0.017)	(0.400)	(0.532)
Ln Capital Stock $_{t-2}$	0.032	0.062^a	0.052	0.073^c
	(0.068)	(0.010)	(0.077)	(0.042)
Ln Savings	0.022^a	0.026^a	0.021^a	0.018^a
	(0.002)	(0.001)	(0.001)	(0.001)
Ln Population	-0.219	-0.250	-0.360^a	-0.378^c
	(0.138)	(0.184)	(0.058)	(0.215)
Ln Trade Costs $_{t-2}$	-0.030		0.354^a	
	(0.036)		(0.090)	
Ln Capital Intensity $_{t-2}$ $\times$	0.022		-2.518^a	
Ln Trade Costs $_{t-2}$	(0.075)		(0.682)	
RER Volatility $_{t-2}$		0.109		0.897^c
		(0.373)		(0.536)
Ln Capital Intensity $_{t-2}$ $\times$		-0.009		-0.077^c
RER Volatility $_{t-2}$		(0.032)		(0.046)
RTA HIGH$_{t-2}$			5.613^a	5.756^a
			(0.944)	(1.891)
Ln Trade Costs $_{t-2}$ $\times$			-2.228^a	
RTA HIGH$_{t-2}$			(0.324)	
Ln Capital Intensity $_{t-2}$ $\times$			-0.513^a	-0.500^a
RTA HIGH$_{t-2}$			(0.083)	(0.162)
Ln Capital Intensity $_{t-2}$ $\times$			0.199^a	
Ln Trade Costs $_{t-2}$ $\times$ RTA HIGH$_{t-2}$			(0.030)	
RER Volatility $_{t-2}$ $\times$				-0.467^a
RTA HIGH$_{t-2}$				(0.073)
Ln Capital Intensity $_{t-2}$ $\times$				0.041^a
RER Volatility $_{t-2}$ $\times$ RTA HIGH$_{t-2}$				(0.006)
Observations	281	225	265	204
R^2	0.320	0.362	0.395	0.348
Country F.E.			yes	
Year F.E.			yes	

Heteroskedasticity-consistent (White correction) standard errors, in parentheses, are clustered at the continental level.

^{a}, ^{b} and ^{c} respectively denote significance at the 1%, 5% and 10%.

Intercept not reported.

3.7 Conclusion

In this chapter, I use a recent theoretical framework that emphasizes the role of industrial structure dynamics in the savings and investment decisions that are reflected in current accounts. Introducing trade costs into the discussion allows their effect on specialization patterns to be taken into account. Regional integration therefore affects current accounts through changes in specialization patterns and in investment needs. The theoretical predictions are supported by data for OECD countries.

A common view about current accounts has emerged over the past few years: imbalances must be corrected and adjustments must be implemented (Obstfeld, 2012). Yet, the theoretical endogeneization of current accounts occurs through trade reforms. In the present chapter, the theoretical model implies time-series variations for a given country, depending on the trade costs the country faces, their variations and the resulting changes in production patterns. This mechanism leads to increasing cross-country external position imbalances. Socially-efficient trade reforms can produce these optimal imbalances; one may therefore wonder whether correcting them is legitimate.

General Conclusion

In this thesis, I have shed light upon exporter behavior and its aggregate implications.

Main results

In chapter 1, I provide evidence supporting a pro-trade effect of migrant workers at the firm level. I use a French matched employer-employee data to identify foreign-born workers at the firm level and I find that foreign-born workers foster exports at both the intensive and the extensive margins. Evidence is that foreign workers allow for efficiency gains and convey valuable information on their origin countries.

In chapter 2, I study how exporters cope with exchange rate volatility. I show that micro-level heterogeneity helps rationalizing the surprisingly muted aggregate elasticity of trade to exchange-rate volatility. Investigating how firms reallocate exports across destinations following exchange rate volatility shocks provides an explanation to this macro puzzle. Firms tend to reallocate exports away from destinations with unfavourable dynamics in terms of exchange rate volatility, and this effect grows with the scope of possible reallocations. If big multi-destination firms, who account for the bulk of aggregate exports, can react to an adverse exchange rate volatility shock by transferring trade to other and less volatile destinations, this leaves exports mainly unchanged at the macro level.

Chapter 3 investigates the impact of trade liberalization on the global current accounts imbalances. I show that changes in trade costs affect trade and production structures, which in turn is likely to affect national savings and investment. Contrarily to the predictions of most macroeconomic models, I provide evidence that the response of current account to changes in trade costs depend on the capital intensity of production and on the depth of regional agreements on trade and factor mobility. Aside to the direct effect generally emphasized, changes in production patterns could therefore be an additional channel of impact of regional integration on the current account.

The three chapters contribute to the existing literature in trade and macroeconomics. Chapter 1 and 2 provided additional insights about exporters behavior. Chapter 1 proposed a new methodology to estimate the pro-trade effect of immigrants ensuring that reverse causality are left out of picture. All three chapters contributed to fuel the debate on current policy questions: consequences of migrations, risk diversification for major firms and global imbalances are issues of particular importance and the results presented shed additional light upon them.

Research avenues

The present thesis brings additional results in three directions related to international trade and macroeconomics. In particular, the three chapters of this thesis open research agendas that fall in four categories.

Interdependence of export decisions across countries

Chapter 2 provides evidence of a reallocation behavior for multi-destination firms. Firm-level export decisions across destinations thus appears to be jointly decided. Contrarily to the assumption of workhorse trade models, that implicitly assume that exports decisions are destination-specific, evidence I provide suggests the opposite pattern. When deciding how much to export to country j, the average firms (independently of its multi-destination status) seems to account for the possibilities to export to some other destinations, at least the ones already served. Such a behavior deserves more attention for at least two reasons. First, it is a radical departure from standard trade models à la Melitz (2003) even though some extensions already focused on alternative behaviors. Second, accounting for an alternative exporting behavior across destinations has non-trivial consequences on the empirical analysis of export flows. The recent success of models assuming independent trade flows across destinations is based upon its high explanatory power of observed trade flows, selection process and its consistency with gravity equations. The set of evidence I provide in chapter 2 may echo alternative trade patterns, without compromising the success of previous models. In this area, research agenda is thus both empirical and theoretical.

Relatedly, the reallocation behavior we emphasize in chapter 2 may also be extended to account for any market-specific risk. The results that are presented in chapter 2 help rationalizing a puzzle regarding the muted aggregate trade elasticity with respect to RER volatility, which is a specific form of country risks. The mechanism put forward in this analysis may be contributive to understand and assess the aggregate consequences of exporter's behavior when facing country-specific risks on foreign markets. In particular when this risk is hardly hedgable using traditional financial instruments.

Trade and heterogeneous firm-level organization

In recent research, trade has been documented to induce some within-firm changes in terms of organization, production process, employment, skills distributions that may result in non-trivial aggregate results, due to firm heterogeneity. The present work sets these changes out of the picture, as if these mechanisms were absent, and thus limits the extent of contributions of the chapters. I would like to account for these changes and investigate how within-firm changes may affect aggregate outcomes. In particular, I intend to investigate how multi-product exporting firms determine aggregate inequalities. If trade liberalization generates a fall in the number of products produced and exported by the firms, it follows, from technology variation across products (or quality variations), that changes in the product scope may result in lower skill and wage dispersion within each firm. This mechanism would generate opposite patterns for within- and between-firm wage inequalities following trade liberalization.

Migration and firm-level behavior

My work in chapter 1 shows that the trade-migration nexus is of particular importance when dealing with export outcomes at the aggregate level. My work in this field however is part of a broader research agenda I believe to be contributive in the next years.

First, I would like to extend my work in chapter 1 to estimate to what extent top-managers influence their firm's exporting performance at the intensive and the extensive margins. In particular, I would like to test whether the nationality diversity within executives has a significant impact on total exports and on the number of export destinations. The ideas stands as an extension to chapter 1, by focusing on a particular type of workers. Skilled immigrants involved in business-related activities should foster exports by transferring valuable information on business opportunities between their origin and host countries. However, only few papers in the trade literature distinguish skilled workers from top-managers when looking at their impact on their firm's performance in terms of exports, even though top-managers have been the focus of the management literature.

Second, I would like to study another channel through which migrant workers affect firm-level export performance. immigrant workers could impact their firms' imports of intermediate goods. Either by sourcing it from another country, or by affecting the quality of the inputs, migrant workers may provide information leading to increase efficiency. Even though the way how firms choose imported inputs has focused recent attention, the link with migrant workers remains unexplored.

Finally, I intend to widen the scope of analysis on migration by investigating the interplay between migration and technological/organizational adjustment at the firm level. As can be inferred from the results in chapter 1, migration at the firm level tends to affect productivity and the effect is far from being small. I would further investigate how firm organization reacts to this change in labor force.

Micro-level heterogeneity and global imbalances

Chapter 3 provides evidence of the interest in including richer trade microfoundations into otherwise-standard macroeconomics models. The analysis I provide in this chapter is however limited by the data at hand, and by its (in)capacity to provide suggestive evidence of sectoral reallocations following trade liberalization. Schematically, I provide evidence of an aggregate effect of trade liberalization on industrial structure and capital demand without being able to investigate whether such changes are accompanied by between-sector reallocations or within-sector changes. The extent of the contribution is thus limited by the aggregate nature of the data at hand. I would like to pursue my investigation of trade-led changes in industrial structures, but I would like to conduct a micro-level analysis. Evidence is that factor intensities differ significantly more across firms than across industries or countries. Using this source of variation could lead me to identify the consequences of trade liberalization on factor use at the firm level and to derive aggregate consequences for global imbalances.

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