



# Essays on international trade, capital flows and financial frictions

Maria Margarita Lopez Forero

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# **Essays on International Trade, Capital Flows and Financial Frictions**

María Margarita López Forero

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# 1

## Résumé

La motivation principale de cette recherche porte sur les multiples implications en matière de développement économique dans un monde globalisé où l'existence des frictions économiques empêche d'atteindre un optimum de premier rang. Ainsi, cette thèse, intitulée "Essais en Commerce International, Flux de Capitaux et Frictions Financières", aborde différents sujets ayant trait aux liens entre l'économie réelle et l'économie financière au sein de l'économie internationale. Deux questions sont, en particulier, à l'origine de cette recherche.

I. Comment interagissent les variables réelles et les variables financières dans une économie globalisée?

II. Quel rôle jouent les frictions financières dans cette relation?

Afin d'y apporter quelques éléments de réponses, trois essais abordent ces questions selon différentes perspectives aussi bien micro que macro-économiques. Ainsi, le premier chapitre traite sur le commerce international et les flux des capitaux, le deuxième chapitre sur les frictions financières et les flux des capitaux internationaux et le troisième chapitre sur le commerce international et les frictions financières.

## IDE Horizontal et Entreprises Multi-Produits

Ce chapitre, co-écrit avec Jean-Charles Bricongne et Sebastian Franco-Bedoya, réexamine la relation entre IDE et les exportations. Plus particulièrement, on évalue l'arbitrage proximité-concentration avec des entreprises multi-produits afin d'identifier le type de lien (complémentarité ou substituabilité) entre les exportations et les IDE.

Tandis que les modèles d'IDE horizontal prédisent qu'IDE et exportations se substituent du fait de l'arbitrage proximité-concentration, une majorité d'études empiriques met en évidence leur complémentarité. Cela s'explique par le fait que dans ces modèles, les exportations et les IDE sont des moyens alternatifs pour l'entreprise pour servir le marché étranger. En effet, les exportations entraînent des coûts variables élevés liés aux obstacles tarifaires et au transport des biens jusqu'à la destination finale, des coûts susceptibles d'être économisés dans le cas où l'entreprise produit ses biens à proximité de la destination finale. Mais les IDE sont relativement plus coûteux en termes des coûts fixes –en concentrant l'ensemble de la production dans une seule unité de production, l'entreprise économise des coûts liés à l'ouverture de plusieurs unités de production. Ainsi, les coûts d'installation d'une nouvelle filiale à l'étranger, afin d'obtenir des gains liés à la proximité du consommateur finale, deviennent d'autant moins élevés que la demande étrangère est forte.

Cependant, une telle complémentarité s'observe empiriquement même lorsque l'investissement est motivé par l'accès au marché étranger bien que l'investissement attendu ici soit du type horizontal. Deux possibles explications pourraient être avancées à cette apparente divergence entre les données et la théorie : soit les prédictions des modèles d'IDE horizontale

ne sont pas valides, soit des canaux additionnels de complémentarité devraient être incorporés dans ces cadres théoriques. Notre travail privilégie la deuxième explication.

Ainsi, ce chapitre apporte un nouvel éclairage théorique et empirique sur ce point. Pour ce faire, nous développons un modèle d'IDE horizontal avec des firmes multi-produits, susceptible de générer une complémentarité avec certains biens finaux produits dans le pays d'origine. Dans ces conditions, complémentarité et substituabilité peuvent coexister au sein d'une même firme. Cette explication s'ajoute à celle généralement avancée, à savoir, le commerce des biens intermédiaires nécessaires à la production des biens finals répliqués à l'étranger, lui-même étant expliqué par les théories existantes du fractionnement international de la chaîne de valeur. Notre modèle prédit qu'il devrait y avoir substituabilité pour les produits les plus performants de la firme dans un pays à forte demande. Réduisant les coûts additifs d'exportation, cette décision entraîne à son tour un phénomène de complémentarité permanente pour d'autres biens moins performants que la firme produit dans son pays d'origine. Ce cadre théorique guide la partie empirique du chapitre afin chercher les effets de substitution dans les endroits adéquats.

Enfin, nous testons empiriquement la validité de notre modèle en se fondant sur des données de firmes françaises. Notre approche empirique consiste à distinguer et à identifier les deux types d'effets en traitant les biais d'agrégation et d'endogénéité qui expliquent partiellement la corrélation positive entre les IDE et les exportations. Par ailleurs, nous introduisons des variables qui reflètent les prédictions du modèle, notamment le type de produit et la demande dans le pays de destination de l'IDE.

Nos résultats empiriques confirment les prédictions du modèle où les exportations des biens appartenant à l'activité principale de l'entreprise (représentés dans notre modèle par les produits les plus performants de l'entreprise) sont négativement liées à l'investissement dans un pays à forte

demande. Ce résultat est particulièrement vérifié pour les investissements élevés, mettant ainsi en évidence l'importance de prendre compte les marges intensive et extensive de l'investissement afin de dissocier les effets de substitution des effets de complémentarité au sein de la firme. En effet, les investissements les plus élevés devraient être associés à l'ouverture d'une nouvelle filiale de production, tandis que les investissements les moins onéreux devraient être associés à l'ouverture des filiales de distribution (Krautheim (2013)). Ce dernier, plaçant sans ambiguïté pour une complémentarité entre exportations et IDE.

## **Productivité Marginale du Capital et IDE sous Frictions Financières**

Dans le deuxième chapitre de cette thèse, j'examine empiriquement le rôle du développement financier dans l'évolution du produit marginal du capital (MPK) dans 50 pays et sa relation avec leurs besoins de finance externe, en lien avec leur production manufacturière durant la période 1995-2008. En se fondant sur des données sectorielles au niveau des pays, les résultats de ce chapitre montrent que la spécialisation dans des secteurs intensifs en finance externe contribue de manière positive au MPK des pays développés et de manière négative dans les pays en développement. Cette relation devient légèrement positive uniquement lorsque le système financier est suffisamment développé dans ces derniers ; ces pays étant généralement caractérisés par des systèmes financiers largement moins efficaces en comparaison avec des pays développés. Cela se traduit par un désavantage comparatif en termes de production dans des secteurs qui, par leur technologie, nécessitent beaucoup de financement externe.

En outre, je trouve que les tendances de la structure de spécialisation dans des pays relativement moins développés au niveau de leurs systèmes financiers sont plus en accord avec leur avantage comparatif dans les années 2000, définit ici d'après le modèle d'Antras et Caballero (2009) : la

production dans les secteurs les moins intensifs en financement externe.<sup>1</sup> D'une part, ceci est conforme avec des MPK plus élevés dans ces pays dans les années 2000, suggérant qu'une spécialisation plus en accord avec l'avantage comparatif d'un pays permet une meilleure affectation des ressources. Par ailleurs, ces résultats sont en conformité avec la tendance croissante des IDE entrants dans ces pays après l'année 2000, où une meilleure affectation des ressources devrait entraîner un retour plus élevé du capital et attirer à son tour des investissements de l'étranger.

Enfin, en se fondant sur des données bilatérales des IDE entrants durant la période 2001-2010, j'examine la façon dont le développement financier et la production dans les secteurs intensifs en financement externe contribuent à l'évolution des IDE entrants dans les pays en développement. Encore une fois, les résultats suggèrent que la spécialisation des pays en développement dans des secteurs intensifs en finance externe décourage l'entrée des IDE et cette relation devient positive uniquement lorsque le système financier est suffisamment développé.

D'une part, cette analyse est en conformité avec la littérature existante qui étudie les déséquilibres mondiaux et le Paradoxe de Lucas (1990)- sur la tendance très modeste des capitaux allant des économies développées aux économies en développement.<sup>2</sup> Avec la mondialisation financière, il est commun de s'attendre à des flux de capitaux importants allant des pays les plus riches vers les pays les plus pauvres, du fait, notamment, d'un rendement du capital espéré plus élevé dans ces derniers. Dans cette littérature, le développement financier est avancé comme un des candidats possibles pour expliquer la tendance des capitaux internationaux qui est en désaccord avec la théorie (Prasad et al. (2007)). En outre, les résultats de ce chapitre font écho à la littérature récente sur les frictions financières et l'affectation des ressources où le sous-développement financier entraîne

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<sup>1</sup>Voir Antràs and Caballero (2009).

<sup>2</sup>Voir Lucas (1990).

une perte de productivité liée à une dispersion plus élevée du retour du capital (Gopinath et al. (2015)).

## **Imports et Emploi pendant la Crise Financière**

Vivre dans un monde de plus en plus globalisé pose de nouveaux défis aux décideurs politiques en raison de la vulnérabilité accrue allant de pair avec une inter-connectivité plus importante. Cela a été mis en évidence au cours de la récession mondiale entre 2008 et 2009, où le monde a vu une accélération de la vitesse à laquelle les chocs économiques se sont propagés à travers les frontières. En raison de sa gravité exceptionnelle et de son degré de synchronisation entre les pays sans précédent, la Grande Récession (ainsi appelée dans le monde anglophone, en référence à la Grande Dépression de 1929) a suscité un intérêt croissant sur diverses questions liées aux spécificités des crises financières et sa relation avec l'activité économique réelle, ainsi que les canaux par lesquels les chocs se propagent à travers les pays. Par conséquent, une bonne compréhension des forces économiques derrière la transmission transfrontalière des chocs est devenue cruciale.

En ce sens, dans ce chapitre co-écrit avec Jean-Charles Bricongne et Fabrizio Coricelli, nous étudions la transmission des chocs mondiaux pendant la Grande Récession et son impact sur l'emploi français. En particulier, nous examinons le rôle du crédit commercial (ou inter-entreprises) dans la propagation des chocs transfrontaliers. En se fondant sur un sous-échantillon des entreprises importatrices économiquement actives sur la période 2004-2009, nos résultats suggèrent que des entreprises ayant de forts liens commerciaux avant la crise avec les pays qui ont le mieux résisté aux chocs économiques, ont eu une meilleure performance au niveau de la croissance de l'emploi entre 2008 et 2009.

Cet effet varie considérablement en fonction de l'intensité du crédit com-

mercial. Une forte dépendance au crédit commercial avant la crise s'est traduite par une vulnérabilité plus forte aux chocs imprévus pour les entreprises, pour lesquelles l'impact négatif de la crise a été exacerbé. Cet effet a été intensifié pour les entreprises ayant des liens commerciaux importants avec les pays les plus affectés par des chocs. A l'inverse, l'effet négatif de la crise a été atténué lorsque les relations commerciales étaient plus fortes avec des pays où les chocs ont été les moins sévères. Suggérant par conséquent, que le crédit commercial a été une source alternative de financement pour les entreprises françaises importatrices lors de la crise, du moment où leurs fournisseurs internationaux leur ont permis de surmonter les contraintes financières liées aux choc imprévus en leur accordant un délai de paiement plus important.

Les résultats de cette analyse contribuent au débat dans la littérature sur le rôle du financement du commerce international dans le ralentissement de l'activité économique réelle à travers les frontières. Nous suggérons un canal supplémentaire par lequel les chocs financiers sont transmis entre les pays en se focalisant par ailleurs sur ses effets sur le marché du travail.

# 2

## Introduction

The main motivation of this research is the multiple implications for economic development of living in a globalized world which is full of frictions that preclude arriving to a first-best outcome. Therefore, my Ph.D. thesis on International Economics and Financial Frictions tackles three different questions related to globalization, each one pertaining to one of my areas of interest. Two particular concerns in international economics motivate the essays.

- I. How are real and financial activities related to each other in a globalized economy?
- II. What role do financial frictions play in this relationship?

Three essays look at these questions from different perspectives.



## **The Proximity-Concentration Trade-Off with Multi-Product Firms: Are exports and FDI complements or substitutes?**

In this chapter, in collaboration with Jean-Charles Bricongne and Sebastian Franco-Bedoya, we revise the old question on the relation between FDI and exports on French firms, where theory seems to be at odds with empirical findings. Most FDI and most trade take place between rich markets, where the horizontal investment type is expected to happen. In this sense, empirical studies have almost invariably found a complementarity relation while standard Horizontal FDI models predict substitutability between FDI and exports given the proximity-concentration trade-off. In these models, foreign investment is an alternative way to serve a sufficiently strong foreign demand (due to the existence of additional fixed costs) when exports costs become important. Two possible explanations to this arise: either these models are not valid or additional channels should be included in these frameworks. We privilege the second one.

We therefore, develop a simple theoretical framework which allows reconciling this apparent empirical and theoretical mismatch. Abstracting from vertical linkages, which partly explain the positive relation between exports and FDI in strong demand markets, we show that by introducing multi-product firms in these models, FDI and exports can coexist. Meaning that a complementarity arises even at the firm level. This set-up shows that the question of whether FDI and exports are complements or substitutes depends on whether the product belongs to the core competency of the firm and the demand in the destination market. This framework provides guidance for the empirical analysis by pointing the places where the substitutability should occur.

The empirical analysis makes use of highly detailed French firm-level data

on exports, foreign investment and firm characteristics that allows disentangling the competing relations between FDI and exports according to the destination market and the different products of the firm. This analysis brings new evidence on the substitutability effect which takes place in the best performing products of the firm when in strong demand markets the investment is sufficiently large.

## **Marginal Product of Capital and FDI under Financial Frictions**

This paper empirically examines how external financial needs- measured at the sector level- and financial development at the country level interact to shape the aggregate marginal product of capital of a country (MPK) and its foreign direct investment inflows (FDI). First, using new available data we construct annual aggregate MPK for 50 developing and developed countries during 1995-2008; we use industry-level data to construct an annual country-level measure of external financial dependence and assess its effects on MPK conditional on the level of financial development.

Our findings imply that financial development seems to be a necessary condition -and certainly not a sufficient one- in order for production in financially dependent sectors to positively affect aggregate MPK in developing countries. Additionally, we find that specialization patterns in financially underdeveloped economies after the year 2000 are more in line with their comparative advantage: less financially intensive sectors, as defined in Antràs and Caballero (2009). This, in turn, is consistent with higher MPKs in these countries after this period, suggesting that it allowed a better allocation of resources. As well as with the increasing trend that foreign capital flows have followed after 2000.

Second, using bilateral FDI inflows in developing countries between 2001 and 2010, we analyze how external financial dependence and financial development determine FDI inflows in developing countries. We find that these are strongly discouraged by the existence of financial frictions. Again, when we allow the effect of producing in financially intensive sectors to depend on financial development, our results suggest that the effect is only positive when a sufficiently developed financial intermediation in the recipient country is achieved. This echoes the existing literature that points that financial underdevelopment can be one of the reasons explaining the existence of global imbalances and the "up-hill" trend of capitals (e.g., Prasad et al. (2007)).

These results contribute to explain why capitals don't flow from rich to poor countries in the ways predicted by theory. Thus, it adds to the literature that contributes to explaining the Lucas' Paradox.

## **International Sourcing and Employment in Times of Financial Crisis**

Living in an increasingly globalised world has brought new challenges to policymakers due to the higher vulnerability that a tight interconnectedness comes with. This has been crystallised during the global downturn in 2008-2009, where the world witnessed an acceleration of the speed at which economic shocks propagated around the world. Due to its exceptional severity and its unprecedented degree of synchronization across countries, the Great Recession has prompted an increasing interest on various questions related to the specificities of financial crises and its relation with real economic activity as well as the channels through which shocks propagate across countries. Hence, good understanding of the economic forces behind the cross-border transmission of shocks has become crucial.

In this sense, in this ongoing joint research with Jean-Charles Bricongne and Fabrizio Coricelli, we study the transmission of global shocks during the Great Recession and its impact on French employment. Particularly, we explore the role of trade credit in the propagation of cross-border shocks. Using a sub-sample of importing enterprises that were active over 2004-2009, our findings imply that strong pre-crisis sourcing ties with countries that were more resilient to the global crisis, translated into better performance in terms of employment growth over 2008-2009. This effect dramatically varies with trade credit intensity. Strongly relying on trade credit made firms more vulnerable to unanticipated shocks, for whom the adverse impact of the crisis was exacerbated. This effect intensified among firms with important sourcing ties with severely shocked countries. While the negative effect of the crisis was mitigated when sourcing relations with countries subject to milder shocks were stronger. Supporting, therefore, the hypothesis that trade credit was an alternative source of financing for enterprises during the crisis, where implicitly borrowing from suppliers helped importers overcoming financial constraints.

Our contribution to the literature adds to the debate on the role of trade finance in explaining the real economic downturn across borders. It lies in suggesting an additional channel of transmission of global financial shocks to the labor market. We do this by linking different economic literature and bringing empirical micro-evidence on the mechanism at play.

# 3

## The Proximity-Concentration Trade-Off with Multi-Product Firms: Are exports and FDI complements or substitutes?<sup>1</sup>

### 3.1 Introduction

*“La globalisation de l’économie est devenue pour un nombre croissant de salariés et de chefs d’entreprise synonyme de délocalisations d’activités et d’emplois hors du territoire national. [...] L’évocation de la mondialisation est devenue profondément anxiogène dans l’esprit de nos concitoyens.”*

– Jean Arthuis, former French Minister of the Economy<sup>2</sup>

The question of whether trade and foreign direct investment (hereafter

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<sup>1</sup>Joint work with Jean-Charles Bricongne (Banque de France - European Commission; Jean-Charles.BRICONGNE@ec.europa.eu) and Sebastian Franco Bedoya (Ecole Polytechnique & CREST; E-mail: sebastian.franco-bedoya@polytechnique.edu).

<sup>2</sup>From a French Senate’s report: “Rapport d’information n° 416 (2004-2005)”. <https://www.senat.fr/rap/r04-416-1/r04-416-10.html>

FDI) are substitutes or complements is an old question - dating back to the Heckscher-Ohlin framework - which has been well documented both theoretically and empirically. The relationship between the two phenomena is at the heart of the globalization process and its analysis can be relevant for a number of reasons. Policy makers have long been worried by the notion that local activity and employment is negatively impacted by domestic firms replacing their exports with foreign affiliate production. Assuming that trade and FDI are substitutes for each other, a fiscal policy aimed at encouraging domestic production by taxing non-domestic activities should be beneficial by countering FDI and encouraging exports. However, if it can be shown that there is a complementary relation between these flows, such a policy would effectively penalize domestic production. Similarly, the success of a policy aimed at attracting FDI to the domestic market might depend on the degree of an economy's openness to trade. For example, if the two phenomena are indeed complementary, in cases where barriers to trade are high enough it follows that capital inflows would be dampened.

This paper has two goals. First, we develop a theoretical framework of multi-product firms within a proximity-concentration trade-off framework to shed light on the competing trade-effects of FDI at the firm level. It provides guidance for searching the substitution effect in the right places in the empirical part of the paper. In addition, although not tested empirically, this framework brings a new explanation for the complementarity effects by allowing the foreign presence to lower the costs of distribution in the host market. This can entail a complementarity with the exports of products further away of the firm's core competency. Second, we bring empirical evidence on the question of how FDI affects exports at the micro level taking into account different aspects such as the intensive and extensive margin of the investment, the destination market and the product category (which proxies the product-level productivity). Our empirical contribution lies in showing that investing abroad entails a substitutability of products belonging to the core competency of the firm when investing in

a market with strong demand and when the investment is sufficiently high.

Although a vast amount of research, both theoretical and empirical, has already been dedicated to the relationship between trade and FDI, the overall picture is still far from conclusive. At the theoretical level, there are reasons to believe that there is a substitution relation as well as a complementary relation. However, the empirical literature seems to conflict with the theoretical research since most of the empirical studies find complementarity. In response to this conflict, some authors have argued that the theoretical/empirical mismatch is due to an *aggregation* and an *endogeneity bias* and they suggest incorporating firm and product disaggregation in the analysis and to account for the fact that exports and FDI may have many determinants in common affecting them in the same direction.

On the one hand, given the proximity-concentration trade-off, a substitutability relation can be expected for some firms for which FDI represents an alternative way to access the foreign market when trade costs are high. However this prediction concerns "a given firm selling a given product to a particular destination"<sup>3</sup>. Hence, the substitutability might fade away if one aggregates data of a firm producing multiple products or data of many firms choosing different strategies at the same time, given the existence of spillovers and vertical relations within and between firms. This is a so-called *aggregation bias*, since the complementarity effects jeopardize the substitutability that occurs at the micro level.

On the other hand, unobserved variation in demand for a multinational enterprise's (MNE) products leads to statistical complementarity -without causality- between FDI and exports even if they are economic substitutes. For instance and in a very general way, one can think about the case of tea and coffee, for which an exogenous increase in the demand for hot

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<sup>3</sup>Head and Ries (2001)

beverages can induce a statistical complementarity in the data<sup>4</sup>. While an increase in demand for milk induced by the increase in demand for coffee, is indeed a so-called economic complementarity. In line with this, different authors (cf., Grubert and Mutti (1991), Graham (2000), Head and Ries (2001) and Swedenborg (2001)) have analyzed to what extent the strong complementarity results have been driven by an endogeneity bias - which arises from a simultaneous determination. The existence of this bias can be reflected by the fact that many studies have indeed found complementarity results, but there is still considerable difficulty in finding support for the vertical FDI model (cf., Carr et al. (2001), Yeaple (2003)).

This means that even at the firm level, distinguishing vertical linkages from statistical complementarity and from spillovers across products is challenging. This is why some authors have stressed the need to search for the right effects in the right places; for example, a substitution effect at the product and firm level. Hence, the empirical aim of this paper is to introduce different strategies accounting - to some extent - for these biases in order to disentangle the various competing trade effects of FDI for the French case.

Finally, our analytical framework contributes to reconcile the theoretical and empirical mismatch, where theory predicts a substitution effect of FDI on exports when the main motive for FDI is *market access*, while most empirical evidence suggests complementarity even when the main motive is market access (*i.e.*, between rich countries). Export-Supporting FDI (Krautheim (2013)) constitutes another contribution to reconcile this mismatch (see *infra*, 3.2.1 ). However, in our setting, we allow for multi-product firms and we emphasize the coexistence of substitutability and complementarity at the firm level, which is not present in his work since he focuses on single-product firms. Therefore, our framework offers a complementary argument to the one put forward in his paper, going one

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<sup>4</sup>As exemplified by Head and Ries (2001).



step further in the disaggregation of strategies by introducing heterogeneous products at the firm level.

The paper is organized as follows: in the next section we examine the related literature and revisit the theoretical mechanisms underpinning the relationship between FDI and trade. In section 3.2.1 we develop a simple theoretical model motivating our empirical results. Then, we present the empirical analysis: data description and stylized facts, empirical model and results. Section 3.4 presents a robustness discussion and possible paths for further research. Finally, in section 3.6, we conclude.

## 3.2 Complementarity vs. Substitutability

### 3.2.1 Theoretical literature

In order to make predictions about this relation we need to recall the theoretical determinants of FDI, which are essentially summarized as *market access* motive and *production cost reduction* motive. Note that the cost reduction motive is linked to production, and rules out other financial motives that have been put forward in the literature, motivated by the fact that under different corporate tax regimes across countries, MNEs have incentives to transfer incomes and profits to affiliates located in low tax countries in order to avoid paying higher taxes<sup>5</sup>. Part of this "profit shifting" happens through intra-group loans and in the data this appears as FDI. However, given the data at our disposal, we are able to identify these cases and exclude them from the empirical analysis<sup>6</sup>.

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<sup>5</sup>For instance, Vicard (2015) provides evidence of profit shifting to low tax jurisdictions by multinational companies in the case of French firms.

<sup>6</sup>See empirical strategy in section 4.2.

**Market access motive:** According to the **Horizontal FDI** (Markusen (1984)) model, a MNE chooses between exporting and locating abroad in order to serve foreign markets where the key element is the *proximity-concentration trade-off*. It implies that FDI replaces exports when proximity gains of being close to consumers are higher than the concentration gains of having a single production plant. In this case, the main motive for FDI is to achieve a better market access when the firm faces high trade frictions. Furthermore, this type of FDI can entail intra-firm exports of intermediate products (that were not exported before) in order to replicate the final goods previously exported. Thus, initial substitution of exports can be consistent with complementarities involving intermediate goods. Note that the substitution effect always happens at the firm level and involves one individual product (the firm's final good). It is important to bear this in mind in the empirical analysis in order to search for the right effects in the right place - aggregating the data can preclude identification of a substitution effect. Similarly, **Export-Supporting FDI** (Krautheim (2013)) is driven by the desire to serve foreign demand, it therefore has a market access motive. Relative to others, this type of FDI has only been studied very recently. In such cases, firms choose to maintain production at home and establish a foreign affiliate in order to reduce distribution costs abroad. However there is no substitution effect as these are meant to enhance exports from home to the host country by facilitating the distribution, sales and after-sales services. These affiliates are therefore mainly located in large target markets and essentially belong to the wholesale and retail sector. Hence, in this case, FDI should unambiguously complement the domestic country's exports of final goods.

**Cost reduction motive:** In contrast, **Vertical FDI** (Helpman (1984)) is driven by the desire to take advantage of lower factor prices through a geographical separation of the firm's activity. The location of production in the host market minimizes production costs given the large differences in factor prices, normally wages. This type of FDI happens essentially in developing countries, where larger wage differences can be found and it

typically entails shipping of intermediate products (from home to the host country) required in the foreign production. Thus, a potential complementarity arises with the domestic country's exports by increasing intra-firm trade.

**Both motives:** While it might be useful to explain these different types of FDI separately in order to understand their determinants and the mechanisms through which they might affect trade patterns, in reality, firms can simultaneously engage in different types of FDI and have strategies driven at the same time by market access and factor cost motives. Many authors have emphasized the importance of these hybrid firms which perform what is known as **Complex FDI** which is for instance the case of **Platform FDI**, where MNEs replicate (or sometimes "offshore") their activity in foreign countries but the affiliates' production is mostly sold in third countries with strong levels of demand (including, in some cases, the home country).<sup>7</sup>

**Further effects:** Additionally, despite the lack of a formal theoretical framework, some other important spillover effects between different products at the firm level can be empirically identified. These effects arise from the experience that a firm acquires in a certain market through the local production of one good, which becomes a determinant of the demand for its other products that are not locally produced. Brainard (1993, 1997), refers to these "proximity advantages" as the spillovers generated from the production presence of one product through various channels such as access to a more efficient distribution system; enhanced sales and after-sales services; better knowledge of the market's tastes and better brand recognition in that market. Therefore, there are additional mechanisms through which a complementarity between exports and FDI arises at the firm level. However, it is important to bear in mind that it concerns only

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<sup>7</sup>See: Ekholm et al. (2007), Grossman and Helpman (2003), Yeaple (2003) and Egger et al. (2004)

multi-product firms and it arises mainly in large demand markets - and hence we talk about a demand driven motive.

### **3.2.2 Empirical literature**

Studies in this area have usually emphasized (cf., Türkcan (2008)) the need to identify the nature of the type of FDI given that horizontal FDI should entail a substitution effect while vertical FDI should have a complementarity effect. However, this view could be misleading given the existence of complex corporate strategies in which a horizontal investment can also involve a vertical dimension and vice-versa. At the same time, for any type of FDI activity, foreign affiliates may generate an increased demand for products produced in the home country, given the "proximity advantages". Hence, whether FDI replaces or boosts exports is primarily an empirical question.

As already mentioned, complementarity results have been found in most studies (cf., Lipsey and Weiss (1981), Blomstrom et al. (1988), Grubert and Mutti (1991), Clausing (2000) and Svensson (1996)), and the empirical evidence for substitution has been rather scant. Indeed, there has been evidence for the horizontal model of FDI, but this evidence has come in different forms from a negative correlation between FDI and exports, hence, an explicit substitution effect. The usual support for the horizontal model (as opposed to the vertical model) comes from the fact that most FDI activity occurs between advanced economies and countries that are similar in terms of development (cf., Carr et al. (2001)), suggesting a market-access motive, or the positive effect that trade impediments have on foreign affiliate sales (cf., Brainard (1997)), thus, providing evidence in support of the proximity-concentration trade-off.

However, studies finding a *causal negative effect* of FDI on exports - and hence, providing explicit evidence for a substitution effect - have been rather scarce. The few analyses that have successfully identified a substitution relation have, on the one hand, concentrated on narrow product data-set, thereby suggesting the existence of an aggregation bias that precludes the detection of substitutability, and on the other hand, have tried to match the tested hypothesis with the right data. This is the case of Blonigen (2001) who uses a narrow product-level data-set for exports of Japanese automobile parts to the US and Japanese foreign affiliate activities in the US between 1978-1991. He distinguishes between investments in automobile parts and in finished automobiles. This allows an intuitive matching of the data with the hypothesis tested: vertical FDI for investments in the former and horizontal FDI for investments in the latter. By so doing, he is able to properly identify and separate significant substitution and complementarity effects. His results support the theoretical predictions, where foreign production displaces exports of the same products but complements with vertically integrated products.

In the same way, Head and Ries (2001) identify an explicit negative effect of FDI on exports using firm-level data on Japanese manufacturers between 1966-1990. When focusing only on the major manufacturing leader enterprises, they find that FDI replaces exports when firms are not vertically integrated. The effect becomes positive the more a firm is vertically integrated, which is explained by the fact that firms are expected to ship intermediate products in these cases. Similarly, Swenson (2004) argues that the identification of the multiple effects of FDI on trade requires the finest disaggregation of data while she also finds that these effects are partly driven by a simultaneous determination which dramatically underestimates the estimations. She studies the effect of inward FDI on imports at the product-level in the US between 1974 and 1994 and she shows the existence of an aggregation bias since the effects of aggregated FDI echo the predominant complementarity findings in the literature. But when decomposing the overall impact, she finds a substitution effect for

product and industry FDI.

Hence, these studies' results emphasize the importance of accounting for both aggregation and endogeneity biases when empirically assessing the effects of FDI on trade. Finally, regarding the importance of matching the data with the hypothesis tested, we wish to highlight the *different time-horizon effects* of FDI. Authors such as Debaere et al. (2010) and Blonigen (2001), have argued that the negative effects of foreign production on exports are more likely to happen in the short-run and should be one-time large changes, while the complementarity is more likely to happen in the longer-run and appear gradually given the spillovers and vertical linkages.

Other studies related to this paper are Fontagné and Pajot (1999) and Madariaga (2010) since they analyze the substitutability/complementarity issue for the case of France using aggregated data. A comparison of our analysis with these papers is interesting as their work constitutes a benchmark for an assessment of the aggregation bias in our calculations, thereby motivating the use of more disaggregated data. Fontagné and Pajot (1999) use sector-level data for relations between France and 43 countries between 1984-2004 and find a positive effect of FDI on exports: a dollar of FDI in a certain country and sector generates 55 cents of exports to that sector-country. Madariaga (2010) studies the effect of FDI (stocks) on exports between 1997-2008 and finds a positive relation as well: where 1 billion euros invested in a certain country-sector generates a 9.6% increase in exports, suggesting complementarity. Consequently, these studies join the predominant literature which finds positive relationships between FDI and exports.

### 3.3 Analytic framework

This section presents the model that guides the analysis. In order to illustrate the different trade effects of FDI that happen in different time horizons and in different types of products, we develop a simple model of Multi-Product firms facing a proximity-concentration trade-off. To focus on the main theoretical contribution and avoid complicating the presentation, we simplify or abstract away from aspects that the existing literature already explains, such as the international fragmentation of the production process, which results in unambiguous permanent complementary and for which theory predicts a predominance in countries where production costs are lower.

The model will allow explaining the positive and persistent effect of FDI on final goods (when the main motive for investing is the market-access) and not only in intermediate products, the latter being perfectly explained within the Vertical FDI framework. The key element of the model will be the explicit introduction of an effect that accounts for Brainard's "Proximity Advantages" of foreign presence, which lowers the costs of exporting to the foreign market. Our set-up consists of heterogeneous firms that produce an endogenous range of products, some of them are supplied to the destination markets via FDI and others via exports. This choice is made without uncertainty given that the firm already supplies the destination market via exports and knows how profitable its products are in the destination market. Papers like Conconi et al. (2016) and Albornoz et al. (2012) work on this uncertainty resolution.

**Marginal cost at the product level** - Firms export a finite range of products. In fact multi-product firms dominate international trade. We adopt a framework where firms produce a range of goods differing in their productivity, or their "distance" to their core competency. We follow Mayer et al.

(2014) in indexing firms by its core product marginal cost " $c$ "<sup>8</sup>, and within firm products are indexed by  $m$  (with the core product  $m = 0$ ), each of them with a marginal cost  $\varphi(c, m)$  determined by the distance to the core competency as follows:

$$\varphi(c, m) = \omega^{-m} c \quad (3.1)$$

where  $\omega \in (0, 1)$  is the geometric step size that defines the firm competence ladder. This implies that each firm has a finite range of products determined by its core competency<sup>9</sup>. This within firm ranking of products is discussed by Mayer et al. (2014, 2016) in their study about how competition across market destinations affects exported product range.

**Additive distribution costs** - Regarding the distribution costs in the destination market, we follow the Corsetti and Dedola (2005)'s theoretical model, in particular the extension presented in the appendix of Berman et al. (2012). We modify it to make it amenable to our purpose (multi-product firms). There is a set of exported varieties  $\Omega$ , an iceberg trade cost  $\tau_{ij}$ , a fixed costs of exporting  $f_i$  at the product level, and distribution costs (wholesale and retail)  $\eta_j$  in destination country  $j$ <sup>10</sup>. Production and retailing are assumed to be complements, and distribution does not depend on the exporter's productivity. Any additive cost (independent of productivity) such as transport, marketing, advertising or insurance would have the same effect. This way of modeling distribution costs is supported by Irarrazabal et al. (2015). They show that trade costs are often additive. Transportation and distribution costs, as in Corsetti and Dedola (2005), are part of this additive trade costs.

Given the existence of additive and iceberg trade costs, consumers in

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<sup>8</sup>Firms are heterogeneous in their core competency.

<sup>9</sup>All we need to assume for the within firm ranking of products, as in Mayer et al. (2014, 2016), is  $\varphi(c, m) = cz(m)$  with  $z'(m) > 0$ . If  $z'(m)$  is infinite, all firms are single-product

<sup>10</sup>We do not need to assume any particular labor requirement as in Corsetti and Dedola (2005)



country  $i$  face the following price  $p_i^c(\varphi)$ <sup>11</sup>:

$$p_i^c(\varphi) \equiv \tau_{ij} p_i(\varphi) + \eta_j \quad (3.2)$$

where  $p_i(\varphi)$  is the exporter price, set to maximize profits. This optimal price takes into account, first how it affects consumer price, second that the optimal CES demand yields  $x_i(\varphi) = \left(\frac{p_i^c(\varphi)}{P_j}\right)^{-\sigma} Y_j$ , and third that the cost of producing  $\tau_{ij} x_i(\varphi)$  units of good is  $\varphi \tau_{ij} x_i(\varphi) + f_i(\varphi)$ . The exporter price is given by<sup>12</sup>:

$$p_i(\varphi) = \frac{\sigma}{\sigma - 1} \left(1 + \frac{\eta_j}{\sigma \tau_{ij} \varphi}\right) \varphi \quad (3.3)$$

Our key assumption is that when a firm decides to do FDI in at least one product in order to supply the destination market  $j$ , the additive distribution cost falls for all the products supplied to the destination country by the firm doing FDI. This drives the complementary effect of FDI at the product level. As Krautheim (2013) explains, the assumption that exporters face higher variable distribution costs than local firms is quite plausible and can be micro-founded with a setup of trade intermediation with double marginalization or hold-up problems<sup>13</sup>.

## A simple three-period setup

We use a backward induction setup. All the firm decisions might be simultaneous but this setup allows us to intuitively disentangle the one-time substitution effect from the complementarity effect (over-time). We assume that the firm is exporting some products and it already knows that they are profitable to be supplied to the destination country, that is to say there is no uncertainty.

<sup>11</sup>All prices in this paper are expressed in the exporter (Euro) currency.

<sup>12</sup>See Appendix A.1.1 for derivations.

<sup>13</sup>See for instance Felbermayr and Jung (2011).

**Complementary effect: increase in exports for  $t > 1$** 

Once the FDI has taken place, after period  $t = 1$ , the additive distribution costs become local to the destination market for the firm and fall. This generates a complementarity effect on exports.

**Proposition 1.** Once the firm has decided to do FDI in country  $j$  for some products, there is a complementarity effect on exports of the products that were previously exported but are not supplied via FDI now (intensive margin).

→ **Proof:** The derivative of exports with respect to distribution costs is negative:

$$\frac{\partial p_i(\varphi) x_{ij}(\varphi)}{\partial \eta_j} < 0 \quad (3.4)$$

Such that when the additive trade cost falls, exports increase in the intensive margin (see Appendix A.1.3 for derivations). There is a second expansionary effect through those goods that were not exported before, because they were not productive enough, but thanks to the lower distributions costs they now are. Therefore, exports increase also in the extensive margin (of products but not of firms). This effect is observed in the derivative of profits with respect to distribution costs:

$$\frac{\partial \pi_{ij}^*}{\partial \eta_j} = \frac{\sigma^{-\sigma} (1 - \sigma) (\tau_{ij} \varphi + \eta_j)^{-\sigma}}{(\sigma - 1)^{1-\sigma} P_j^\sigma} Y_j < 0 \quad (3.5)$$

since we assume  $\sigma > 1$ . Which means that when the additive trade cost falls, the profits obtained with each product increase and this can make that some products (in the margin) become profitable to be exported for some firms.

### Substitution effect: decision on supplying products via FDI or exports at $t = 1$

In  $t = 1$ , after deciding to do FDI, the firm decides whether to supply each product either via FDI or exports. This problem yields a cutoff  $\varphi^*$ . Those products with a marginal cost  $\varphi > \varphi^*$  are exported and those  $\varphi < \varphi^*$  are supplied via FDI<sup>14</sup>.

**Proposition 2.** *The substitution happens for the best-performing products of the firm. Those closer to its core competency.*

→ **Proof:** The marginal cost cutoff is determined by the following condition (see Appendix A.1.2):

$$(\varphi^* + \eta_j)^{1-\sigma} - (\tau_{ij}\varphi^* + \eta_j)^{1-\sigma} = \frac{f_i^{fdi}(\varphi) - f_i^x(\varphi)}{Y_j} \sigma^\sigma (\sigma - 1)^{1-\sigma} P_j^\sigma \quad (3.6)$$

Note that  $\eta_j$  is the new and lower additive trade costs under FDI. The left hand side of Equation 3.6 is decreasing in the marginal cost of the product,  $\varphi$ . This implies that those products with a low marginal cost (closer to the core competency of the firm),  $\varphi < \varphi^*$ , are supplied via FDI to country  $j$ . These products were supplied via exports before the firm does FDI, leading to a substitution effect on most productive (lower marginal costs) products.

**Proposition 3.** *The substitution happens mainly in markets with strong demand for the firm's products.*

→ **Proof:** Equation 3.6 shows that markets with a larger demand,  $Y_j$ , make more likely the substitution effect in the most productive products of the firm. The right hand side of Equation 3.6 is decreasing in  $Y_j$ . Therefore, the larger  $Y_j$ , the more profitable is to supply a particular product to

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<sup>14</sup>Similarly, there is another cutoff determining those products that are exported and those that are only supplied to the domestic market.

market  $j$  via FDI than via exports.

Using Equation 3.1 and the defined cutoff  $\varphi^*$ , we can define the number of products that are supplied to the destination country via FDI as the *integer floor* of  $m^*$ ,  $\lfloor m^* \rfloor$ :

$$\lfloor m^* \rfloor \equiv \min \left\{ n \in \mathbb{Z} \mid n \geq \frac{\ln c^{-1}}{\ln \omega^{-1}} \varphi^* \right\} \quad (3.7)$$

### Deciding whether to do FDI at all at $t = 0$

Finally, in period  $t = 0$  the firm that is already exporting to the destination market decides whether to do FDI in those products that were anticipated to be profitable in period  $t = 1$ . This is decided by comparing the total profits across exported products before doing FDI and profits that could be obtained if doing FDI. Nevertheless, in this paper we focus in the case in which firms are doing FDI and this period is only a formality<sup>15</sup>.

This simple set-up shows that a substitutability and a complementarity can simultaneously take place at the firm level and provides a guidance for the places where we should look for when assessing the substitutability effects empirically. Two propositions can be established and tested empirically:

**Disclaimer.** The aim of our model is to disentangle the competing effects of FDI on exports and bring some new insights in order to empirically search for the "right effects in the right places". However, in order to keep things simple and tractable, we abstract from international division of production stages which involves shipment of intermediate and final products, and hence, unambiguously results in additional complementarity. Particu-

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<sup>15</sup>This framework can be easily extended to integrate Krautheim (2013)'s export-supporting FDI. Nevertheless, the framework in our paper is able to disentangle both substitution and complementarity effects.

larly, we aim at explaining the coexistence of FDI and exports in markets with strong demand, where a substitution effect for some final products of the firm (given the proximity-concentration trade-off) is consistent with a complementarity effect with other final products of the firm.

Hence, we propose an alternative framework in order to explain the positive relation between exports and FDI, which is complementary to existing models of international division of stages of production such as Vertical FDI and Export-supporting FDI. However, in the empirical part of the paper we do not take any particular stake concerning the place from where the economic complementarity comes from.

## 3.4 Empirical analysis

### 3.4.1 Data sources

Our study relies on a very detailed set of FDI, trade and balance-sheet data for French firms. We build the database by combining 3 different data sources using the unique firm identifier (SIREN code) available in all French administrative files:

1. The Banque de France Foreign Direct Investment data at the firm-level, which reports stocks of outward (inward) FDI for each firm, by destination (origin), broad foreign sector (i.e., financial, real estate and *all others*) and year for the period 2002-2009<sup>16</sup>. Further, the data reports the composition of total FDI; recall that: Total FDI = equity capital + reinvested earnings + other capital associated with inter-company debt transactions. For further details on these data, see Bricongne and Gaulier

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<sup>16</sup>Additional detail about the data base are found in the Appendix A.2.

(2010), who provide a comprehensive descriptive analysis of this database.

2. French Customs firm-level trade data, which contains the universe of import and export flows by French manufacturing firms located in the metropolitan territory. We only make use of export flows in values (in euros) for the period 2001-2009. The data is collected at the 8-digit (NC8) product level, by destination and year. For exports outside the EU, reporting is required from each firm and flow if the exported value exceeds 1 000 Euros. For within EU flows, exports have to be reported as long as the firm's annual trade value exceeds the threshold of 150 000 Euros. Those thresholds do not affect our sample representativeness given that we concentrate in MNEs and these are typically very large firms.

3. Finally we make use of the BRN corporate earnings statistics (normal real profits - *Bénéfices Réels Normaux* - or *BRN*) provided by the French National Institute for Statistics and Economic Research - *INSEE*) from which we obtain firm-specific information. The BRN contains the balance sheet of all French firms with sales above 730 000 Euros. These data cover the entire universe of French MNEs and contain relevant firm-level information, including firms' sales, value added, employment, sector of main activity and other balance-sheet variables.

The combination of these sources results in a final sample data-set that covers 9 years (2001-2009) and contains bilateral information about FDI and trade relations between French MNEs with the rest of the world. Since we are analyzing a *production motive* of FDI, we restrict our analysis to the manufacturing sector. Thereby, these firms belong to 30 manufacturing industries which are classified according to the NAF nomenclature of economic activities (Nomenclature d'activités française, rev. 2, 2008). FDI data contain detailed information about each transaction and the composition of total FDI, and that allows us excluding intra-group loans

which might reflect other things different from a production motive.

On top of this, we only retain information concerning firms that have posted a continuity of their principal manufacturing activity over time (i.e. whose APE code corresponds to the manufacturing sector throughout the period) since our analysis is focused on the manufacturing sector and we wish to avoid cases of firms that change their activity from manufacturing to services or vice-versa. In fact, although some firms do genuinely change their principal activity, in the majority of cases the changes are due to reclassification issues<sup>17</sup>.

In order to better capture the change of exports that is due to FDI, our sample restricts to foreign investors for which we observe a new investment (for the firm-country pairs) and drop those that had a positive investment at the beginning of our sample. Additionally, our sample includes exporters that never did FDI during the whole period in order to well capture the effect of the control variables on exports, given that estimates of the controls uniquely among the investors sample might bias its coefficients which in turn could bias the effect of FDI on exports. In the same sense, we keep only those investors that have positive exports during the period. Further, the data cleaning required dropping as well firms that reported negative values of employment, value added and FDI stocks. This left us with a balanced panel of 22 481 firms exporting to 173 countries (for years 2001-2009), out of which 199 are also foreign investors (for years 2003-2009). Among these investors, we observe their transition from exporters to investors for 501 cases (at the firm-country pair) as indicated in the transition table for a dummy of FDI that takes the value of 1 if there is a foreign presence for a certain firm, at a given destination in a given year:

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<sup>17</sup>In many cases this may be explained by the fact that the NAF methodology of classification was revised in 2003 and then in 2008.

Dummy FDI			
Dummy FDI	0	1	Total
0	2,675,798 99.98	501 0.02	2,676,299 100.00
1	0 0.00	976 100.00	976 100.00
Total	2,675,798 99.94	1,477 0.06	2,677,275 100.00

*Note:* Transitions in frequencies and percentages.

**Table 3.1:** Transitions from exporter to investor

However, the final sample with which we work is further reduced given that the use of gravity equations requires dropping observations for which exports take the value of zero (due to the log linearization). Hence, we are left with an unbalanced panel of 13 880 firms exporting to 173 countries, out of which 190 are also foreign investors. Where the transition from exporters to investors is observed in 380 cases, as shown in Table 3.2. This time, the proportion of transitions from exporter to investor is three times higher with respect to the initial sample. Which might raise concerns about a selection sample bias, nonetheless in both cases this proportion represents less than 0.1 percent of all observations. Section 3.5.4 presents a discussion about this issue.

### 3.4.2 Data at a glance

Table A.1 in the appendix presents the relevant statistics of the variables included on the analysis. Not surprisingly, a first glance at data reveals that firms' in our sample export mostly to big markets both in terms of



Dummy FDI			
Dummy FDI	0	1	Total
0	650,194 99.94	380 0.06	650,574 100.00
1	0 0.00	773 100.00	773 100.00
Total	650,194 99.82	1,153 0.18	651,347 100.00

*Note:* Transitions in frequencies and percentages.

**Table 3.2:** Transitions from exporter to investor (regressions sample)

values and the number of product lines exported. The value of exports of core products to OECD countries are on average 2.5 times those exported to Non-OECD countries, while values of exports of other products to OECD countries are twice the values exported to Non-OECD countries. These differences are attenuated for the extensive margin of exports, where the number of product lines exported to OECD countries is on average 1.4 times the corresponding amount in Non-OECD countries. Additionally, core products exports account for most of the firms' exports at the intensive margin; values of exports of core products are on average 2.5 times the values of exports of other products in OECD countries and the corresponding number for Non-OECD countries is around 2. Interestingly, the opposite is true for the extensive margin, where exports of other products account for most of the portfolio of lines exported. Exports of the number of lines that don't belong to the firms' core competencies are on average 1.6 times the corresponding number for core products (for both OECD and Non-OECD countries). Finally, the differences among OECD and Non-OECD countries are much stronger for foreign investment activities. The value of FDI stocks in OECD countries is on average 3.3 times the value in Non-OECD.

The evolution of the intensive margin of exports clearly reflects the Great Trade Collapse following the financial crisis in 2008. Interestingly, the count of product lines of exports doesn't drop in 2008. Hence, adjustments

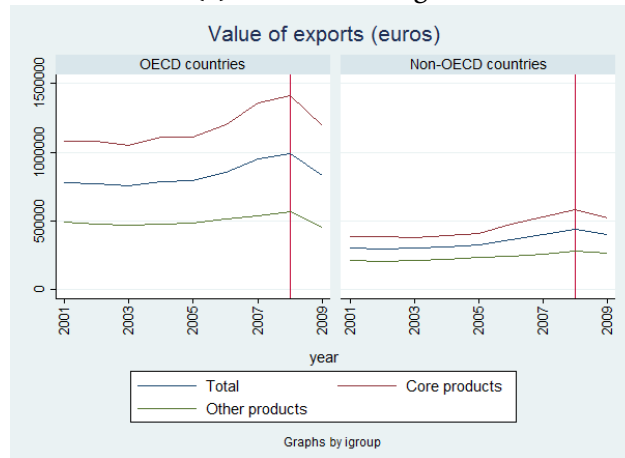
during the crisis seem to have taken place at the intensive margin rather than at the extensive margin. This follows the same logic of the findings in Bricongne et al. (2012) who analyze the effects of the crisis exports using French data and find that most of the drop in exports was driven by the intensive rather than the extensive margin<sup>18</sup>. The evolution of these variables is depicted in figures 3.1 for exports and 3.3 for FDI. From the latter table, it can also be seen that FDI doesn't deteriorate in 2008 either. The reason for this is that we analyze stocks of FDI and not flows, in order for the values of stocks to decrease a disinvestment is required. Though, one of the characteristics of FDI (as opposed to portfolio flows) is its irreversibility related to important sunk costs<sup>19</sup>. Therefore, the effects should be best appreciated with FDI flows than FDI stocks.

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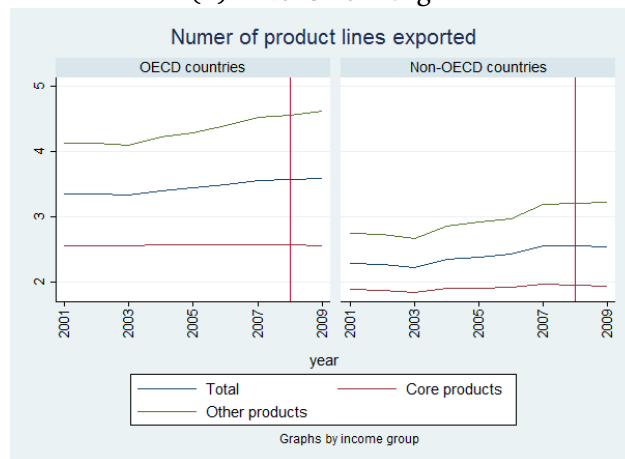
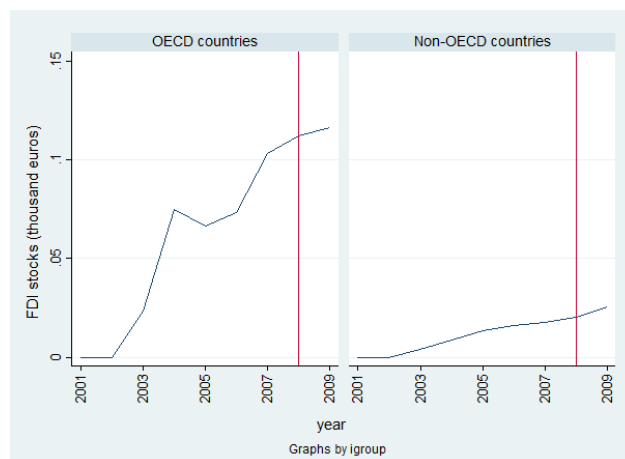
<sup>18</sup>Although their definition of extensive margin is rather the number of destinations served, while intensive refers exported volumes.

<sup>19</sup>This is related to the hysteresis in investment. See for instance: Dixit (1992) and Pindyck (1991)

(a) Intensive Margin



(b) Extensive Margin

**Figure 3.1:** Average exports by income group**Figure 3.3:** Average FDI Stocks

### **3.4.3 Empirical strategy**

Our identification strategy requires estimating the effect of doing FDI on the exports of a specific category of products of a firm to the host destination. Our empirical model includes therefore fixed effects at the firm-destination-product category, which is defined as core products and other products. The use of these fixed effects allows a within firm-destination-product category comparison by controlling for time-invariant unobservable heterogeneity between firms, destinations and product categories that might also affect the variation in exports and bias the estimators. Furthermore, in order to perform the most stringent test given the variation of our data, additional fixed effects at the firm-year and destination-year dimensions are also included. This will be discussed more in detail below.

This analysis studies how FDI is related to exports conditional on the product category and the demand of the host country. For this purpose, we will use two different specifications that will allow us studying in detail how the effects vary depending on the product category and the host destination. A first approach consists in estimating the effect of FDI for the whole sample and then separately for different samples defined according to different types of countries and different product categories and destinations. While the second approach consists in making use of interaction terms between FDI and the product category (again for the different samples defined according to the type of destination).

Running separate regressions for different samples is less restrictive than using interaction terms for the whole sample of products given that it allows the coefficients of the rest of the regressors to be different for different type of products. On the other hand, the use of interaction terms, while restricting all the rest of coefficients to be equal for the whole sample, it allows a relative comparison of the effects of FDI on exports of

core products relative to other type of products. In addition, given that variations in exports are due to both its intensive margin and its extensive margin, we will assess the effects of FDI for both margins running separate regressions for each measure of the variation of exports for every single specification (i.e., changes in exports within the same product categories and the number of product lines exported).

Finally, in order to well disentangle the effects of FDI on exports we also measure the investment both in terms of its extensive and intensive margin. In order to do so, we introduce simultaneously two different variables  $1[FDI_{fdt} > 0]$  and  $FDI_{fdt}$ , where the first is a dummy variable that takes the value of one if firm  $f$  has a positive investment in destination  $d$  at year  $t$ , and the second is a continuous variable measuring the intensity of this investment (value of the FDI stock)<sup>20</sup>. Hence,  $1[FDI_{fdt} > 0]$  indicates the extensive margin while  $FDI_{fdt}$  gives an indication of the intensive margin of the investment. This allows assessing both how foreign presence affects exports and how the effect varies for different sizes of the investment. This is crucial in the analysis if one takes into account the findings in Krautheim (2013). Where Export-Supporting FDI, which unambiguously complements with exports, is related to cheaper investments and Horizontal FDI is linked to more expensive ones. A first simple test of this strategy shows the importance of including both variables in the model, where the effect of the extensive margin (dummy for FDI) is always positive (including and excluding the size of the investment) for the whole sample and for OECD countries. While, the effect of the size of the investment becomes only significant when including the dummy of FDI and when differentiating by the type of products. These results are shown in Table A.2 in the Appendix.

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<sup>20</sup>In the empirical analysis, the stocks of FDI are introduced in levels because the log-linearization of the variable would make us drop the observations for which there is no investment (i.e., the years before doing FDI). Hence, the interpretation of its coefficient will be a semi-elasticity. Additionally, the values of the stocks are introduced in billion euros for the sake of the coefficient's presentation.

The lack of significance of the coefficient on the intensive margin of FDI suggests that there is no overall effect of an increase of the investment, given that it mainly depends on the type of product considered. Which according to our theoretical framework, has opposite consequences. Furthermore, given that Export-Supporting FDI should have opposite effects on the most productive products of the firm, not accounting for the size of the investment, precludes disentangling this type of investment with the horizontal one, which has the opposite effect on these products.

This simple test shows that the mere presence in the foreign market is on average positively related with the value of exports and the portfolio of products offered in the destination market. Further, the higher the size of the investment, the lower the value of core products exported. However no significant effect of the size of the investment arises elsewhere. This might be because both negative and positive effects take place simultaneously and highlights the importance of assessing the effects conditional on the size of the destination market. Therefore, our empirical strategy aims at disentangling these effects on different countries and different products. Thus, searching for the substitution effects there where the theoretical framework predicts it.

Given the set of controls that we discuss below, the estimated coefficients of  $1[FDI > 0]$  and FDI give an indication of the exports differential that is due to foreign presence and to the size of the investment, respectively. The empirical strategy involves estimating the following two models. First, for the different samples strategy:

$$\ln X_{fdpt} = \beta_1 1[FDI_{fdt} > 0] + \beta_2 FDI_{fdt} + \alpha_1 Z_{fdt} + \eta_{fdp} + \alpha_{ft} + \delta_{dt} + \epsilon_{fdpt} \quad (3.8)$$

and for the interactions strategy the following model accounting for the

product category:

$$\begin{aligned} \ln X_{fdpt} = & \beta_1 1[FDI_{fdt} > 0] + \beta_2 FDI_{fdt} + \beta_3 FDI_{fdt} \times Core_{fdpt} \\ & \beta_4 Z_{fdt} + \eta_{fdp} + \alpha_{ft} + \delta_{dt} + \epsilon_{fdpt} \end{aligned} \quad (3.9)$$

where  $\ln X_{fdpt}$  is the log of exports of firm  $f$  to destination  $d$  in the product category (core or others)  $p$  at time  $t$ , and it is measured either as the intensive margin or as the extensive margin. Hence,  $\ln X_{fdpt}$  is estimated separately for values of exports (intensive) and for number of product lines exported (extensive). As already mentioned, variables  $1[FDI_{fdt} > 0]$  and  $FDI_{fdt}$  indicate the investment of the firm as a dummy variable and as the value of the stock, respectively.  $Z_{fdt}$  include the only control that is available at the firm-destination-time dimension, that is *Inward FDI* <sub>$fdt$</sub> . Additionally,  $\eta_{fdp}$  are the firm-destination-product effects,  $\alpha_{ft}$  the firm-time fixed effects and  $\delta_{dt}$  effects at the destination-time dimension. While  $\epsilon_{fdpt}$  is the disturbance term. Finally, the standard errors are allowed to be adjusted for clustering at the firm-level to account for heteroskedasticity and non-independence across the repeated observations within firms.

Note that the additional ingredients of the gravity framework such as bilateral GDP, bilateral distance, sharing a common border with the destination country, having the same language and the existence of colonial trade linkages are captured by the fixed effects ( $\delta_{dt}$  in these cases). Concerning additional possible determinants of exports that vary at the level of the firm-year such as productivity and firm size are also accounted for by the fixed effects ( $\alpha_{ft}$ ). This is of particular importance, following the literature on firm heterogeneity in international trade.<sup>21</sup> Also, other variables at the firm level considered to be important determinants of trade in recent FDI literature, such as past export experience in destination or the existence of firm networks in host markets are also mostly captured by the fixed effects

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<sup>21</sup>See Melitz (2003).

( $\eta_{fdp}$  and  $\alpha_{ft}$ ), to the extent that they don't vary at the firm-destination-time dimension.<sup>22</sup>

In this sense, the first strategy, performs an OLS estimator of specification 3.8 for the different subsamples initially split according to the type of product exported: core and other products. The results are presented in Table 3.3. Next, in order to assess the importance of the heterogeneity in the destinations' demand, the sample is separated further by type of destination country: whether it belongs to OECD countries or to Non-OECD. The results are presented in Table 3.4.

Finally, concerning the second strategy where the stock of FDI is interacted with the product category, OLS estimations of specification 3.9 are carried out for the whole sample of countries and then separately for OECD and Non-OECD countries. Note that the coefficient of the product category (Core) can't be estimated given the firm-destination-product fixed effects, however its interaction with FDI can be estimated given that it varies over time. The results are shown in Table 3.5.

It should be emphasized that this fixed effects strategy allows a particularly stringent test provided that only variables that vary at the firm-destination-product and time dimension can be estimated. Allowing therefore, guarding against omitted variable biases. Particularly, given that our analysis aims at "searching for the substitutability", one concern could arrive if substitution-favoring factors such as exchange rates or tariffs (and in a more general way, any change in the destination market or at the level of the firm, making exports more or less expensive vis-à-vis FDI) were not accounted for.<sup>23</sup> All those determinants are captured by the  $\delta_{dt}$  as long as they are not firm specific. Or alternatively, they are captured by  $\delta_{ft}$  as long as they don't vary over time for a given firm in the specific destination

<sup>22</sup>See Baldwin and Okubo (2014).

<sup>23</sup>See: Blonigen (2001).



market. In the same vein, although less worrisome given that we take no particular stake on the complementarity drivers in these analysis, a simultaneous determination between exports and FDI leading to a positive bias towards finding complementarity is supported by the well-known stylized fact that MNEs are the firms that export the most and are the most productive.<sup>24</sup> Moreover, as previous authors have argued, an increase in demand, generating growth in both exports and FDI, is also expected to generate a positive correlation between exports and foreign affiliate production, and hence, a positive bias.<sup>25</sup> These factors are also controlled by  $\delta_{dt}$  and  $\delta_{ft}$ .

Nonetheless, we are not able to exclude the possibility that exports have an effect on FDI decisions as well, where the direction of the bias can go either way. In particular, uncertainty with respect to profitability in the destination market can induce the firm to start serving a market with exports (due to the lower fixed costs relative to FDI) and decide whether to invest or not upon discovering its real profitability in the destination. Therefore, endogeneity biases coming from a reverse causality, might be a concern. This issue is discussed more in detail in section 3.5, where a robustness check including lagged FDI variables is performed.

Before presenting the results, it is convenient discussing our empirical definition of core products. The method used to identify the product category consists in evaluating the firm's economic activity classification and its exports classification. Firms can export both products that are classified in the same economic activity sector as its principal activity (APE, in French) as well as products classified in a different sector. Therefore, we simply assume that the products that match with its principal activity should be part of its "core products". The criterion used in order to determine whether the sector of each product exported coincides with the firm's

<sup>24</sup>See Gazaniol and Peltrault (2010) for evidence for French firms.

<sup>25</sup>See Grubert and Mutti (1991).

main activity is rather broad as we use a 4-digit code, the NAF-Classes (*Nomenclature d'Activité Française*, the French classification of activities). On the other hand, products are classified according to the Combined Nomenclature 8-digit (CN8) and from this product classification we obtain a 4-digit NAF code which is matched with the NAF code reported by the firm as its main activity. Those products that coincide with the 4-digit main activity of the firm are considered as *core products*. It is worth adding some clarifications concerning these nomenclatures:

- Activité Principale Exercée is a code assigned by the INSEE and it characterizes the firm's principal activity in reference to the French classification of activities. Note that a firm can perform different activities (and have several NAF codes) but one of these NAF codes is declared as its main activity, the APE.
- The CN is the European products classification, which comprises the Harmonized System (HS) nomenclature with further Community subdivisions.
- The matching between the firms' 4-digit NAF and the product in order to classify the product as core or not, is done by using the correspondence table from CN8 to the Classification of products by Activity (CPA). Which is a macro classification of products that comprises the European version of the Central Product Classification (CPC) prepared and recommended by the UN.

#### 3.4.4 Benchmark results

According to the theoretical predictions, the substitutability should take place mainly in destination countries with high demand and should be

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.13 <sup>b</sup> (2.30)	0.06 <sup>a</sup> (2.79)	0.26 <sup>a</sup> (3.61)	0.06 <sup>a</sup> (2.87)	0.07 (0.80)	0.06 (1.58)
FDI	-0.06 (-0.62)	-0.08 (-1.36)	-0.40 <sup>a</sup> (-4.64)	-0.04 (-1.01)	0.27 (1.46)	-0.06 (-0.55)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	867236	867237	831632	831634
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.786	0.762	0.732	0.744
F	0.36	0.60	1.41	0.43	0.20	0.46

OLS estimates. *t* statistics in parentheses  
All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.3:** Is the product category important?

stronger for the core products of the firm. The benchmark results point in this direction by highlighting the importance of accounting for product and destination heterogeneity, as well as for the intensive margin of the investment.

The results for equation 3.8 are reported in Table 3.3. The estimates show that when all products are considered a statistically significant and positive effect of the coefficient of  $1[FDI > 0]$  for both measures of exports (values and number of product lines), however the intensity of the investment measured by the coefficient of  $FDI$ , even if displaying a negative effect it lacks of significance. This indicates that the overall effect of the intensity of the investment is not different from zero and that it might depend on the type of product considered, which is confirmed by the results when the sample is split between core and other products.

We therefore turn to the analysis of the different product categories,

columns (3) and (4) report estimates for core products and columns (5) and (6) for other products. A negative relation, significant at the highest levels of the intensity of FDI shows up only for the value of core products while the positive effect of the foreign presence becomes significantly stronger, which doubles in terms of magnitude. On the other hand, no significant effect of the intensity of the investment is found for the number of product lines of core products neither for other products (regardless of the export measure considered), where the sign of the coefficient is even positive for exports in values (though not significant). Additionally, the lack of significance of both measures of FDI on other products, indicates that most of the effects are driven by the products that belong to the main activity of the firm, what we consider its core products.

Thus, these results highlight the importance of searching for the effects in the right places, where the magnitude of the investment plays an important role in disentangling the relation given that Export-Supporting FDI should generate exports particularly of core products of the firm and especially in big demand markets: there where we are searching for the substitution effect. However, given that the Horizontal-type of investment requires paying much bigger costs than FDI in distribution facilities, the bigger the investment, the stronger the substitution should be. Thus, the negative and significant coefficients of *FDI* stocks go precisely in this direction.

Is this effect economically important? In order to well interpret our coefficients, it is convenient recalling that the stocks of FDI were rescaled for the sake of presentation: they are introduced in billion euros because the coefficients of the stocks of FDI turn out to be very small when introduced in thousand or million euros. This means that for achieving a net negative effect of FDI on the value of exports of core products, it would require an investment of at least 0.98 billion euros according to the estimates in column (3) reported in Table 3.3. This is however, only the case for one single pair of firm-destination; the average value of the stocks being 0.036

billion euros.

Going further in the search of the substitution effect, we now turn to the estimations in Table 3.4 where the regressions are performed by additionally separating the samples according to the destination country: OECD countries and Non-OECD countries. Columns (1) to (6) present the results shown in Table 3.3 only for OECD countries, while columns (7) to (12) display the same estimations for Non-OECD countries.

When considering all products exported to OECD countries in the first two columns, both coefficients of FDI lose significance, pointing that the effect of investing in an OECD country, what we consider a high-demand country, depends significantly on the type of product considered. Where the coefficient on the value of  $FDI$  is positive for the value of exports of other products while it is negative for core products, both significant. Results in column 3 show that even if the coefficient of the FDI dummy remains positive it still insignificant and a significant and negative effect arises for the intensity of FDI. Meaning that no overall effect of foreign presence is found for the value of core products given that it mainly depends on the size of the investment, where small investments should be associated to export-supporting FDI. Nonetheless, this effect is not present for the extensive margin of core products (column 4), where the coefficient of foreign presence,  $1[FDI > 0]$ , is positive and significant and the effect of  $FDI$ , lacks of significance and is actually positive. Indicating, therefore, that there is no substitutability on the extensive margin of exports of core products.

On the other hand, the coefficient of the FDI dummy for Non-OECD countries, indicating the foreign presence, is positive and significant while the intensity of FDI has no significant effect, although it is negative and its magnitude is particularly high. This should be explained by the fact that very big demand countries are also included in this sample (all BRICS for

instance) and most of exports are addressed to these.<sup>26</sup>

Additionally, the effect is mostly explained by exports of core products as indicated by the lack of significance of both FDI measures in the estimates for other products when the samples are split according to the type of product. This suggests that regardless of the size of the investment, foreign presence in a Non-OECD country is on average positively related to the value of exports belonging to the core competency of the firm, suggesting that FDI of the horizontal-type is less likely to take place in these countries and where the positive relation can be explained either by export-supporting FDI where firms invest in these countries in distribution facilities in order to serve these markets (and where the size of the demand is not sufficiently important to invest in production facilities) or by vertical linkages related to a fragmentation of production which involves shipment of intermediate goods to these countries.

A comparison between the estimates in Tables 3.3 and 3.4 point that the positive effect of the foreign presence is mostly driven by Non-OECD countries, where its effect on OECD countries mainly depends on the size of the investment. All things equal, the foreign presence in an OECD country increases (on average) the value of exports of core products by 13.9%<sup>27</sup>. Nonetheless, the lack of significance of this coefficient indicates that the total effect of FDI on the value of exports of core products depends strongly on the size of the investment given that the substitutability effect associated to this coefficient is very strong, where an investment of one billion euros reduces the value of exports of core products to an OECD country by 33.6%<sup>28</sup>.

<sup>26</sup>See descriptive stats in table A.1 in the Appendix.

<sup>27</sup>Recall that the percentage effect of a dummy in a log linearized dependent variable is given by:  $100[\exp(\beta) - 1]$ , where  $\beta$  is the estimated coefficient of the dummy variable. For instance, for the coefficient of  $1[FDI > 0]$  in column (3) in Table 3.4:  $[\exp(0.13) - 1]$  is equal to 0.139.

<sup>28</sup>Recall that when the intensive margin of FDI is not considered, the effect of the FDI Dummy variable is significant and positive, as shown in A.2.

Additionally, the foreign presence in these countries is associated (on average) with an increase of 4% in the number of core product lines exported and an investment of one billion euros is related to an increase of 35% of the value of exports of other products. On the other hand, the foreign presence in a Non-OECD country is on average related to an increase of the values of exports of core products of 70% (column 9) and not significant substitutability takes places in these countries.

Dependent Variable: Ln Exports (in values and number product lines)												
VARIABLES	OECD Countries						Non-OECD Countries					
	All prod.		Core prod.		Other prod.		All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1[ $FDI > 0$ ]	0.08 (1.06)	0.04 (1.39)	0.13 (1.55)	0.04 <sup>c</sup> (1.72)	0.05 (0.52)	0.02 (0.54)	0.29 <sup>a</sup> (2.59)	0.07 <sup>c</sup> (1.73)	0.53 <sup>a</sup> (3.84)	0.06 (1.62)	0.14 (0.94)	0.09 (1.22)
FDI	0.02 (0.17)	-0.02 (-0.91)	-0.29 <sup>b</sup> (-2.52)	0.04 (1.01)	0.30 <sup>b</sup> (2.19)	-0.04 (-0.78)	-2.68 (-0.62)	1.20 (0.56)	-4.86 (-1.29)	0.18 (0.13)	-1.58 (-0.26)	2.06 (0.57)
Sample	OECD	OECD	OECD	OECD	OECD	OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$N$	1000867	1000870	486902	486903	488544	488546	701928	701928	365083	365083	318198	318198
adj. $R^2$	0.783	0.802	0.815	0.824	0.768	0.799	0.700	0.643	0.733	0.643	0.663	0.633
F	0.21	0.14	0.50	0.28	0.43	0.24	0.42	0.26	0.80	0.21	0.10	0.16

OLS estimates.  $t$  statistics in parentheses  
 All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.4:** Is the destination important?



Finally, we examine the results of specification 3.9 where instead of separating core and other products an interaction term is included with the product category in order to assess a direct comparison between the two groups. The estimations are shown in Table 3.5, which are first performed for the whole sample of countries (columns (1) and (2)), then for OECD countries (columns (3) and (4)) and for Non-OECD countries (columns (5) and (6)) separately. The interaction term between *Core* and the value of FDI stocks indicates whether the effect of additionally investing abroad has a different effect between core and other products.

The first column shows that an increase in FDI stocks is negatively related only with the values of exports when the product exported pertains to the core products of the firm (significant at the 1-percent level). Here, the coefficient of FDI captures the effect on other products, which is not statistically significant. While the interaction term reflects a significant and negative difference of the effect of FDI on core with respect others products. This means that an increase of one billion euros on the stocks of FDI is related to a decrease of about 30% in the value of core products.<sup>29</sup> On the other hand, the effect of the foreign presence is positive and significantly related to exports both at the intensive and extensive margin. As it can be seen from the results when splitting the sample between OECD and Non-OECD countries, the positive effect of foreign presence is mostly driven by the effect on Non-OECD countries while the substitutability related to the intensity of FDI is driven by the effect on OECD countries.

The estimates for OECD countries in columns (3) and (4) indicate that, on average, the effect of the foreign presence,  $1[FDI > 0]$ , doesn't have any effect on exports (both at the intensive and extensive margin), where the impact on the value of exports strongly depends on the size of the investment -in the same way as suggested by the results with the previous

<sup>29</sup>Where  $100[\exp(0.26) - 1] = 29.7\%$ . Which is equal to the the difference between the coefficient of other products and core products:  $0.15 - 0.41 = 0.26$ .

strategy. The coefficient on the interaction term remains negative and significant at the highest levels and its magnitude becomes stronger than the one of the whole sample of countries. While the effect on other products remains insignificant (i.e., the coefficient on  $FDI$ ).

Concerning the results for Non-OECD countries, only the coefficient on the FDI dummy is statistically significant, which is particularly high for the value of exports. While no significant effect for the interaction term, neither for the intensity of FDI is found for these countries. These results are also in line with the estimates of the previous strategy, where, on average, the intensity of FDI had no effect on exports to these countries while the mere foreign presence was positively and significantly related to the value of exports core products (note that the differential effect of the effect of the FDI dummy on core and other products is not accounted for in this specification). Finally, a test of significance of the interaction term is strongly rejected only for columns (1) and (3) and can't be rejected for the rest of the columns. Suggesting, therefore, that the substitutability related to the proximity-concentration trade-off can be best captured in OECD countries, for the best performing products of the firm and when the size of the investment is sufficiently high.

Lastly, additional results where effects of FDI are assessed conditional on demand size in the destination country point to the same direction<sup>30</sup>. Table A.3 in the appendix displays estimation results where the interaction term rather accounts for the demand in the destination market as proxied by the log of GDP per capita. The results suggest that foreign presence

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<sup>30</sup>More specifically, we run the following regression:

$$\begin{aligned} \ln X_{fdpt} = & \beta_1 1[FDI_{f dt} > 0] + \beta_2 FDI_{f dt} + \beta_3 1[FDI_{f dt} > 0] \times \ln GDP_{dt} \\ & \alpha_1 Z_{f dt} + \eta_{f dp} + \alpha_{ft} + \delta_{dt} + \epsilon_{fdpt} \end{aligned} \quad (3.10)$$

We therefore abstract from the sample splitting according to whether the destination belongs to OECD countries and carry out the regression for all products of the firm, and then separately for core products and other products.

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.13 <sup>b</sup> (2.30)	0.06 <sup>a</sup> (2.79)	0.08 (1.06)	0.04 (1.39)	0.29 <sup>a</sup> (2.63)	0.07 <sup>c</sup> (1.67)
FDI	0.15 (0.98)	-0.02 (-0.15)	0.24 (1.51)	0.03 (0.59)	-6.23 (-0.77)	3.12 (0.83)
FDI $\times$ Core	-0.41 <sup>a</sup> (-2.59)	-0.13 (-1.15)	-0.45 <sup>a</sup> (-3.14)	-0.11 (-1.19)	5.92 (0.76)	-3.21 (-0.92)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	1000867	1000870	701928	701928
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.783	0.802	0.700	0.643
<i>F</i>	1.34	1.40	1.41	0.35	0.84	0.42

OLS estimates. *t* statistics in parentheses  
All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.5:** Is the product category important?

is, on average, strongly and positively associated with exports of core products and a negative and significant effect arises when this investment takes place in strong demand markets. A graphical representation of this effect in core products can be seen in Figure A.1, where the interaction term is plotted. It represents the change in values for exports conditional on changes in the value of  $\ln GDP$  per capita together with its confidence intervals (bearing in mind that the highest value that takes the variable  $\ln GDP$ , in our sample is around 11 with a standard deviation of 1.4).

It is also worth mentioning that preliminary findings accounting for heterogeneity in productivity across firms, show that the substitution effects are also found especially for the most productive firms. Which is in line with the fact that only the most productive firms are capable of paying the big costs related to the horizontal-type of FDI while the the least productive

among investors are more likely to invest in Export-Supporting FDI. These results can be found in Table A.4 in the appendix.

While these benchmark results can indeed be hiding some endogeneity bias, a comparison in both types of destinations is still of interest: the positive relation is always much higher in Non-OECD countries. Aside from statistical reasons that were already mentioned, this also suggests on the one hand by a stronger substitutability in OECD countries, as shown by the lack of significance of the coefficients of *FDI* (intensity of investment) in the Non-OECD samples. On the other hand, while not proven in our regressions, this higher positive effect in Non-OECD countries is also consistent with a stronger presence of vertical linkages in Non-OECD countries, where theory predicts rather the vertical type of FDI. Therefore, for the sake of robustness, next section 3.5 explicitly accounts for the existence of vertical linkages.

All in all, our empirical analysis highlights the importance of accounting for the heterogeneity in a firm's products, the intensive and extensive margin of the investment and the destination country when assessing the substitutability/complementarity relation between FDI and exports. It brings new evidence of the substitutability related to the proximity-concentration trade-off. Even if most variation is accounted for by the inclusion of a large set of fixed effects, thus, controlling for simultaneity biases, we can't exclude the possibility of an endogeneity bias coming from reverse causality. This issue is discussed in detail in next section 3.5, where we replicate the benchmark analysis introducing lagged FDI variables in order control for a possible bias due to reverse causality.

Next section perform a sensitivity analysis by adding robustness checks accounting for reverse causality, alternative ways of disentangling complementarity/substitutability effects and controlling for the Trade Collapse

during the 2008 world crisis. Finally it discusses the limits of our analysis and future research paths.

## **3.5 Robustness**

### **3.5.1 Endogeneity: lagged FDI effects**

Given the extensive set of fixed effects included in the regressions, the estimation approach provides a very stringent test in the sense that only explanatory variables that simultaneously vary by destination firm, country and product category can be estimated. This allows guarding against omitted variable biases as explained earlier. Nonetheless, we are not able to exclude the possibility that exports determine FDI decisions as well, where the direction of the bias can go either way.

In line with this, the findings in Conconi et al. (2016) suggest that the exports' experience of a firm in a foreign market determines the location of a new affiliate in that destination. Their results rely on the idea that under uncertainty and given the fact that fixed costs of exporting are less expensive than FDI, a firm prefers to serve a foreign market via exports in order to acquire a better knowledge of their ability to earn profits in that economy before engaging in FDI. In this sense, exports can affect FDI in two directions, first, an upward bias given that exports determine the decision of investing a new location. In which case, our results are likely to be suffering from a bias towards finding a complementarity. Consequently, the existence of the endogeneity bias towards finding complementarity would reinforce our results, since the substitution effect would be underestimated. Nonetheless, if the firm switches immediately from exports to FDI (horizontal type) a reverse causation is also likely to generate a negative bias, favouring the substitutability results. One way of controlling

for these kind of substitution-favoring effects is the introduction of FDI variables as lags. Additionally, the economic effects of FDI on exports (in opposition to statistical relation) might take some time to take place for some firms, in which case they should be better appreciated with lagged variables.

Therefore, Table 3.6, Table 3.7 and Table 3.8 display the estimation results from a replication of the benchmark analysis, where instead of analysing current foreign presence and FDI stocks, both variables are introduced as (one period) lags. Estimate results of specification 3.8 for the different product samples are reported in Table 3.6. Compared to the benchmark results in Table 3.3, two main changes arise: the negative effect related to the intensive margin of FDI on the value of core products is strengthened (0.5 versus 0.4 in absolute terms) and a positive and significant effect on the number of lines of core products arises.

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	Values	All prod. Num Products	Values	Core prod. Num Products	Values	Other prod. Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
L1[ $FDI > 0$ ]	0.16 <sup>b</sup> (2.13)	0.06 <sup>b</sup> (2.09)	0.27 <sup>a</sup> (2.95)	0.05 <sup>b</sup> (2.24)	0.11 (0.94)	0.04 (1.07)
L.FDI	-0.15 <sup>c</sup> (-1.90)	-0.07 (-1.38)	-0.50 <sup>a</sup> (-5.89)	0.06 <sup>b</sup> (2.01)	0.14 (1.26)	-0.11 (-1.52)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	1538313	1538313	774457	774457	740242	740242
$R^2$	0.825	0.821	0.848	0.830	0.819	0.827
adj. $R^2$	0.764	0.759	0.794	0.769	0.742	0.754
F	0.27	0.42	2.08	0.69	0.39	0.38

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.6:** Lagged effects: Is the product category important?

Linking this to the theoretical framework, our interpretation for this result is that the complementarity suggested in our model should happen for new products that are the closest the core competency but that were not productive enough to be exported before. At the same time, it can also be reflecting new exports of intermediate goods necessary for the replication of production in the foreign market, where the existence of vertical linkages is not incompatible with our definition of core products. For instance, one can imagine that Peugeot, whose principal activity is "construction of cars" (29.10Z NAF code) is now replicating its production of cars in a foreign market instead of exporting them (the core final product, which falls in the same NAF category 29.10Z). Nonetheless, this replication might require a particular type of motor only produced in France and this investment generates new exports of an intermediate good which makes part of its core competency (where the motor also falls in the NAF category 29.10Z).<sup>31,32</sup>

Turning to the results in Table 3.7, where the destination market is also accounted for. The same thing happens, results related to the intensive margin of FDI are stronger with respect to the benchmark results in Table 3.4, where the substitutability on the value of core products only takes place in OECD countries. While a significant complementarity effect on the extensive margin of exports of core products arises both in OECD and Non-OECD countries, which is compatible with the existence of vertical linkages. Furthermore, the opposite happens for the number of product lines of other products in OECD countries. Probably, related to technological complementarities with its core product, where the firm used to export intensively some goods that are far away from its core competency. In these cases, once the core product is being produced in the foreign market, these goods (where the firm is not particularly efficient at producing them) can now be acquired in the foreign market in order to be sold together with the core product. While exporting the product alone might not be

<sup>31</sup>The NAF classification for this example can be found at: [http://www.insee.fr/fr/methodes/default.asp?page=nomenclatures/naf2008/n5\\_29.10z.htm](http://www.insee.fr/fr/methodes/default.asp?page=nomenclatures/naf2008/n5_29.10z.htm)

<sup>32</sup>The Principal activity information of Peugeot can be found at: <http://www.societe.com/societe/automobiles-peugeot-552144503.html>

profitable due to the high export costs relative to the small productivity related to these goods. This could be exemplified by Apple's exports of an Iphone together with the Iphone's case. See Section 3.5.4 for a detailed discussion of these examples.

Finally, results in Table 3.8 display estimates of 3.9 where we instead use an interaction term in order to assess the differential effects of FDI on core products relative to other goods. Again, compared to the benchmark results in 3.5, the substitutability related the value of FDI stocks on exports of core products to OECD countries is slightly strengthened (0.47 vs 0.45). While an interesting result arises for Non-OECD countries, where all the opposite arises: the intensive margin of FDI is related to a complementarity with core products. Therefore, an additional increase of the investment is related to more exports of core products in Non-OECD countries (given that the difference with respect to the FDI coefficient remains positive).



Dependent Variable: Ln Exports (in values and number product lines)												
VARIABLES	OECD Countries						Non-OECD Countries					
	All prod.		Core prod.		Other prod.		All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L.1[ $FDI > 0$ ]	0.13 (1.31)	0.03 (0.90)	0.14 (1.12)	0.04 (1.38)	0.12 (0.90)	0.01 (0.26)	0.26 <sup>b</sup> (2.03)	0.01 (0.15)	0.43 <sup>a</sup> (3.16)	-0.03 (-0.84)	0.18 (0.97)	0.03 (0.34)
L.FDI	-0.12 (-1.42)	-0.00 (-0.02)	-0.37 <sup>a</sup> (-2.72)	0.11 <sup>a</sup> (2.89)	0.13 (1.15)	-0.08 <sup>b</sup> (-2.20)	-3.70 (-0.72)	4.06 (1.53)	-1.85 (-0.42)	3.93 <sup>b</sup> (2.19)	-7.29 (-1.08)	4.56 (1.07)
Sample	OECD	OECD	OECD	OECD	OECD	OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$N$	890779	890779	434314	434314	433961	433961	627351	627351	326538	326538	284216	284216
$R^2$	0.849	0.862	0.875	0.879	0.849	0.870	0.797	0.758	0.820	0.758	0.790	0.771
adj. $R^2$	0.792	0.809	0.822	0.829	0.777	0.807	0.710	0.655	0.742	0.653	0.674	0.646
F	0.13	0.30	0.48	0.77	0.38	0.88	0.30	0.19	0.63	0.26	0.12	0.18

OLS estimates.  $t$  statistics in parentheses  
 All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.7:** Lagged effects: Is the destination important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
L.1[ $FDI > 0$ ]	0.16 <sup>b</sup> (2.13)	0.06 <sup>b</sup> (2.09)	0.13 (1.31)	0.03 (0.90)	0.27 <sup>b</sup> (2.11)	0.00 (0.10)
L.FDI	0.05 (0.36)	-0.06 (-0.83)	0.12 (1.01)	0.01 (0.18)	-12.20 (-1.37)	5.44 (1.29)
L.FDI $\times$ Core	-0.39 <sup>b</sup> (-2.30)	-0.01 (-0.15)	-0.47 <sup>a</sup> (-4.13)	-0.01 (-0.17)	13.99 <sup>c</sup> (1.80)	-2.28 (-0.67)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	1538306	1538306	890779	890779	627344	627344
adj. $R^2$	0.764	0.759	0.792	0.809	0.710	0.655
F	1.06	0.69	3.60	0.55	0.84	0.37

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.8:** Lagged effects: Is the product category important?

### 3.5.2 Trade Collapse

Following the Great Recession in late 2008, global trade experienced the sharpest decline in history since WWII. One salient characteristic of the global crisis was the so-called *Great Trade Collapse*: a sudden, synchronised and deep decline in world trade which fell 20% relative to global GDP.<sup>33</sup> In line with this, as we have seen from the descriptive statistics in Figure 3.1, firms in our sample experienced a severe decline in the value of exports in 2008. The large set of fixed effects included in our regressions (notably the firm-year effects) should account for the global change in economic conditions in 2008 that might have differently affected different firms. Nevertheless, it is convenient making sure that our results remain robust to the Trade Collapse, especially given the fact that export values deteriorated during in 2008 while FDI stocks kept their increasing

<sup>33</sup>Eaton et al. (2011).

trend. Which would favour a substitutability relation not related to the proximity-concentration trade-off that is tested in this analysis. Thus, we replicate our analysis by restricting our sample to the period 2001-2007.

Tables A.5, A.6, A.7, and A.8 in the appendix replicate the whole benchmark analysis. Although the magnitude changes for some coefficients, results are completely robust to the Trade Collapse and point to our hypothesis where FDI substitutes values of exports belonging to the core competency of the firm in big demand markets and this effect is captured by the intensive margin of FDI. Again, no significant substitutability is found elsewhere. While the simple foreign presence is mostly related to a larger portfolio of core products exported to these countries and related to both, higher exports of core products at the intensive and extensive margin to Non-OECD countries.

### **3.5.3 Complementarity channels: Production Stages**

Are there alternative ways of disentangling substitutability and complementarity? A very intuitive and standard way of testing the different hypothesis predicted by vertical and horizontal FDI models when using product level data is by distinguishing final from intermediate goods, as the substitution effect is expected to occur only for final products. For example Blonigen (2001) used this methodology to find a substitution effect by using data for automobiles and automobile parts in Japan and US Japanese affiliates.

While the discrimination between core and other products of the firm has already been motivated in our theoretical framework, one may argue that we could additionally discriminate the products by their ties with different stages of production (which is absent in our theory) in order

to better disentangle the effects. In this sense, further distinguishing the effects conditional of the type of product according to its ties with different production stages has two advantages: First, it provides a robustness check for the main effect put forward that in this analysis (that is, for the substitutability on core products, related to large investments in strong demand markets). Second, it allows an identification of the vertical linkages at the firm-level and therefore assessing part of the economic complementarity taking place. We therefore use the product information at our disposal and classify them by different stages of transformation and perform OLS regressions of specification 3.9 on the different samples of products, separated according to their "production stage". More specifically, we use a detailed classification of goods from the CEPII (based on the BEC classification from the UN) which classifies each CN8 product as follows: Raw materials, Component parts, Semi finals, Consumption and Capital goods.<sup>34</sup> Thus, estimate results from specification 3.9, allow assessing whether an increase of the investment has a differential effect on core products relative to other products within each sample of products (separated according to their level of transformation nature) and destination (OECD and Non-OECD countries).

Results from this analysis, show that our hypothesis of substitutability on core products in large markets is robust to this test. When considering final goods only, our benchmark results are strengthened. Particularly interesting results arise for Consumption goods in Table 3.9 and Component parts in Table 3.10. Concerning Consumption goods, the substitutability effect on the value of core products is more than 16 times higher than the benchmark results while the complementarity on value other products becomes statistically significant at the highest levels (i.e., the main effect of FDI stocks). This particular complementarity is strongly in line with the one predicted by our theoretical framework, given that it concerns a

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<sup>34</sup>It is worth mentioning that there are many products that do not fall into any classifiable category and therefore the information relating to these products cannot be exploited.

consumption good (where it is less likely be related to vertical linkages). Additionally, the net effect of the investment is unambiguously negative for consumption goods even at the average value of the investment. Concerning Components parts in OECD countries, the intensive margin of FDI is positively and statistically significant for both core and other products, although the positive effect on core products is 8 times higher than on other products. The lack of substitutability in these products points strongly to the existence of vertical linkages, which concerns both core and other products.

On the other hand, in Non OECD countries, there is a negative effect on values of Consumption goods but interestingly, it is not on core products but on other products. While the complementarity related to core products is 1.3 higher than the substitutability on other products. Hence, the net effect remains largely positive for Consumption goods in these countries. Finally, the effects on exports of Component parts in Non OECD countries seems to be taking place only for the number of product lines, where the complementarity is only statistically significant for core products, pointing therefore to the existence vertical linkages in these countries.

Finally, for Semi Final goods in OECD, the effects are more complex. They show a substitutability of the least productive goods (which points in the direction of technological complementarities) while there is a complementarity with the core products (pointing in the direction of vertical linkages). Results also somehow strange for Raw materials, where a strong substitutability effect on core products arises in OECD countries. While the effects on Capital goods in OECD countries point strongly to the existence of vertical linkages. However, we believe that these measures are very general from the point of view of a firm, where the *intermediate* versus *final goods* classification is essentially a subjective measure and products can be officially classified as *intermediate* although they may indeed be *final* for certain firms. Therefore, it might be very difficult to further

identify complementarity/complementarity effects by making more complex distinctions on goods according to official classifications, while the product-tie with the production stage is subjective to the firm. Hence, we content ourselves with the results obtained with Consumption and Components goods.

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.01 (0.10)	0.07 <sup>c</sup> (1.94)	-0.07 (-0.65)	0.01 (0.19)	0.26 (1.06)	0.13 <sup>c</sup> (1.77)
FDI	0.64 <sup>c</sup> (1.93)	-0.10 <sup>a</sup> (-3.52)	0.68 <sup>b</sup> (2.48)	-0.05 (-1.61)	-5.61 (-0.97)	-1.21 (-0.73)
FDI $\times$ Core	6.31 <sup>a</sup> (13.69)	1.34 <sup>a</sup> (24.24)	5.44 <sup>a</sup> (17.30)	0.96 <sup>a</sup> (18.24)	8.96 (0.73)	5.65 <sup>c</sup> (1.92)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	254120	254120	142681	142681	104060	104060
adj. $R^2$	0.724	0.679	0.772	0.749	0.632	0.575
$F$	125.46	57.32	189.09	42.82	0.55	1.25

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.9:** Component Parts: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.01 (0.14)	-0.00 (-0.00)	0.08 (0.77)	0.00 (0.01)	0.01 (0.06)	-0.00 (-0.07)
FDI	0.63 <sup>a</sup> (5.72)	-0.04 <sup>b</sup> (-1.97)	0.52 <sup>a</sup> (6.15)	-0.02 (-0.75)	-12.86 <sup>b</sup> (-2.24)	-2.56 (-0.76)
FDI $\times$ Core	-5.33 (-1.40)	0.18 (0.17)	-8.55 <sup>a</sup> (-2.98)	-0.17 (-0.38)	17.71 <sup>c</sup> (1.75)	3.73 <sup>a</sup> (2.95)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	341977	341978	223442	223443	109525	109525
adj. $R^2$	0.779	0.789	0.798	0.825	0.732	0.651
F	3.43	1.06	6.17	0.24	0.64	3.78

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.10:** Consumption goods: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	-0.03 (-0.13)	-0.04 (-0.90)	-0.26 (-1.12)	-0.01 (-0.16)	0.72 (1.34)	-0.01 (-0.13)
FDI	5.49 (0.60)	2.36 (1.45)	9.48 (1.12)	2.34 (1.14)	-38.73 (-0.85)	5.70 (1.22)
FDI $\times$ Core	-24.12 <sup>a</sup> (-2.87)	-1.70 (-1.39)	-25.75 <sup>a</sup> (-3.51)	-1.81 (-1.23)	-538.26 (-1.63)	-31.04 (-1.35)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	19723	19723	14744	14744	3970	3970
adj. $R^2$	0.819	0.629	0.827	0.653	0.772	0.492
F	1.68	0.36	2.78	0.26	1.20	0.54

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.11:** Raw Materials: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.14 <sup>c</sup> (1.89)	0.04 (1.61)	0.10 (0.97)	0.02 (0.71)	0.36 <sup>b</sup> (2.44)	0.06 (1.17)
FDI	-0.85 <sup>a</sup> (-5.15)	-0.15 <sup>a</sup> (-3.32)	-0.89 <sup>a</sup> (-12.19)	-0.11 <sup>a</sup> (-2.71)	5.06 (0.54)	1.86 (0.61)
FDI $\times$ Core	0.78 <sup>a</sup> (4.71)	0.14 <sup>c</sup> (1.69)	0.94 <sup>a</sup> (6.46)	0.16 <sup>b</sup> (2.29)	-10.69 (-1.00)	-2.83 (-0.97)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	481770	481775	290052	290057	178192	178192
adj. $R^2$	0.777	0.738	0.801	0.778	0.729	0.662
F	2.96	2.06	17.39	1.41	1.05	0.56

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.12:** Semi Final goods: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.35 <sup>c</sup> (1.94)	0.07 <sup>b</sup> (2.15)	0.39 <sup>c</sup> (1.94)	0.08 <sup>b</sup> (2.28)	0.46 (1.39)	0.06 (1.30)
FDI	0.18 (1.35)	-0.23 <sup>a</sup> (-7.92)	0.33 <sup>b</sup> (2.48)	-0.15 <sup>a</sup> (-8.37)	-3.34 (-0.30)	-3.87 (-0.75)
FDI $\times$ Core	2.02 <sup>a</sup> (5.52)	0.76 <sup>a</sup> (5.86)	2.84 <sup>a</sup> (9.13)	0.87 <sup>a</sup> (11.31)	-4.89 (-0.34)	0.06 (0.01)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	175988	175988	98579	98579	70799	70799
adj. $R^2$	0.711	0.622	0.754	0.707	0.637	0.478
F	9.78	7.75	28.72	20.80	8.52	3.80

OLS estimates.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 3.13:** Capital goods: Is the product category important?



### 3.5.4 Limits and future work

**Alternative measure of Core products** Our empirical analysis has focused on the distinction between core and other products of the firm by relying on one particular way of classifying core products: whether their economic activity classification (CPA) matches with the principal economic activity of the firm (APE). Nevertheless, this measure also has certain drawbacks because it doesn't allow for a ranking across products in terms of their specific productivity. Therefore, this is a glaring limit of our analysis given that the distance of each product with respect to the core competency of the firm is what determines the substitutability and complementarity effects in our theoretical framework. Hence, for the sake of robustness, one could alternatively use the definition of core products provided by Mayer et al. (2014), which allows a ranking of all products exported by a firm. However, a clean analysis that includes the product ranking in this fashion is not an easy task because the product rank is defined with respect to export values, which is the dependent variable. This in turn generates an endogeneity problem. In future work, a possibility to circumvent this issue and include this alternative definition of core products, would be to make use of quintile regressions.

Nevertheless, it is also worth noting that this methodology can also have certain drawbacks. Where the main shortcoming comes from the fact that the ranking is done based on the total sales of the good (either in each specific destination market or in the world) which could in turn consider as core product one that is only highly sold not because of the firm's particular expertise on producing it but because it is complementary to the firm's core products for technological reasons. A way of understanding this argument is by considering a real example: for instance, Apple is a multinational technology company exporting iPhone mobiles to the whole world, which is one of its core products *stricto sensu* (i.e., that the firm is very good at producing this good). At the same time, there are some

other goods that are highly exported by Apple together with the iPhone even if the firm possesses no particular advantage at producing them, but they are highly sold because they are complements to the mobile. The best example in this case being the iPhone protection cases.<sup>35</sup>

**The problem of zeros** The usual drawback of using gravity equations to predict trade flows is that the log linearization of variables requires dropping observations for which the variables take the value of zero<sup>36</sup>. This poses a selection problem as zeros are informative in these cases. In terms of our analysis, one could imagine a pure horizontal FDI case where a firm replaces its exports by local production in the foreign country. Hence, as is common practice in trade literature, we use a Pseudo Poisson Maximum Likelihood (PPML) estimation, as suggested by Silva and Tenreyro (2006). This technique enables correction for the possible biases generated by the fact of not taking into account zero values of exports. This is possible since the estimator does not require a logarithmic transformation of exports, so those observations for which exports take the value of zero can now be taken into account in the regressions. The main shortcoming of this technique is the lack of convergence of the estimator when using too many fixed effects, which is our case given the large set of fixed effects included in order to guard against other biases due to omitted variables. Thus, in a first step we plan to drop all the fixed effects and introduce as many controls as possible and estimate our specification with PPML in order to assess to what extent our results can change. If both estimators turn out to be comparable, the use of an OLS will be motivated.

**Dynamic effects and possible extensions** Additionally, one could wonder about the dynamic effects of FDI on exports. According to the model's

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<sup>35</sup>This issue is largely discussed in a recent paper by Fontagné et al. (2016).

<sup>36</sup>Anderson and Van Wincoop (2003).

predictions, the substitutability should be a big “one shot” change that takes place right after the first investment while the complementarity should gradually happen over time. Although a more robust analysis, is required in order to assess this question, a simple Dummy Impact Function analysis (i.e., a dummy for the first, second, third and following years of foreign presence) can shed some light on these effects.

In this sense, preliminary results accounting for the dynamic effects of FDI point towards a large substitution effect of FDI that happens essentially during the first two years after establishing a foreign affiliate. The coefficient for *Second FDI* is significant at the highest levels and once again, only in OECD countries. The size of the effect is still large but begins to decrease with respect to the first year. Concerning the following year, the magnitude and the sign of the coefficient of *Third FDI* remain in favor of a substitutability, but the significance and magnitude with respect to the previous years show that the substitutability, initially strong and significant, disappears over time.

These results are presented in Tables A.9 and A.9 in the Appendix A.3.5. They show a positive effect of FDI which is reinforced with the introduction of *First FDI* - for all regressions - and an initial significant substitution effect that emerges only for *core products*. The substitution effect on these products, which is captured by the *decision to establish a new affiliate* is offset by the more general complementarity effect of *having an affiliate* (captured by *FDI*): for the whole sample, a positive stock of FDI raises exports of *core products* (on average) by 44.8% while they are lowered by 25.8% with the first investment decision. In addition, the complementarity effect of FDI is higher for *core* than for *other products* (44.8% versus 25.8%).

More interestingly, when the sample is split, the negative effect shows

up only for core products in OECD countries. These results are in line with what we expected, where the horizontal effects of FDI driven by market access motives occur basically for the main products of the firm in advanced countries. No significant negative effect of the first investment is found in *other products* in OECD countries whereas *core products* are reduced by 29.6% with the establishment of the new affiliate. On top of this, the fact of having a foreign affiliate increases exports of *core products* by 32.3% and of other products by 22%. Also, the complementarity effects are higher in all types of products for non-OECD countries; having a foreign affiliate in these destinations raises the main products of a firm by 63% and the rest of its products by 41.9%. Again, we believe this positive effect in non-OECD countries is driven much more by vertical linkages than by demand complementarities within the firm, based on the theoretical predictions from Vertical FDI models.

Finally, when considering the effect *Productivity*, it is interesting noting that the coefficient is only significant and important in magnitude for core products and more specifically, it happens only in OECD countries. This echoes our theoretical framework, where foreign presence lowers the required threshold of product-level productivity since it increases the profitability of exporting other products (some of which were not exported ex-ante) by lowering the cost of serving the foreign market.

Finally, one may think of additional extensions, for future work. First, since the group dimension is important in trade and FDI, one may think of replicating the analysis at the group level (see Appendix A.2.3). Additionally, may try to refine the analysis by using the FDI nature, for example with surveys such as FATS (foreign affiliates statistics)<sup>37</sup>.

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<sup>37</sup>On this latest source, see for example:  
[http://www.insee.fr/fr/methodes/sources/pdf/Questionnaire\\_OFATS\\_2012.pdf](http://www.insee.fr/fr/methodes/sources/pdf/Questionnaire_OFATS_2012.pdf).

### 3.6 Conclusion

This paper provides new insights on the effect of FDI on exports. In order to illustrate the different effects of FDI on exports, we develop a theoretical framework of multi-product firms within a proximity-concentration trade-off, where they produce an endogenous range of products, some of which are supplied to the destination markets via FDI and others via exports. Our theory fills a gap in the literature by explaining the coexistence of FDI and exports at the firm level when the main motive for FDI is *market access*. It hence predicts a substitutability for some products of the firm and a complementarity for some others. In particular, this framework provides a guidance for the places where the substitution effects should take place: the core products of the firm when investing in a country with strong demand. Our empirical work consists in providing new evidence on this substitutability. On top of this, while not tested empirically, this framework also provides a new explanation for the positive effect of FDI on final goods (when the main motive for investing is the market-access) and not only in intermediate products, the latter being perfectly explained within other existing frameworks.

From our analytical framework and previous theoretical models, there are different channels via which FDI can have both a substitutability and complementarity effect on trade at the firm level. However, only empirical analysis can determine which of the two effects is the strongest. Indeed, empirical analysis faces substantial challenges in the form of data availability and the existence of complex corporate strategies, for which there can be an extent of horizontality in a vertical FDI (and vice-versa). At odds with theory, most empirical literature has found a persistent complementarity. On the one hand, this complementarity can be partly explained by an *aggregation bias* given the data availability. Indeed, only a handful of studies have succeeded in identifying a substitutability *causal effect* and they all have in common the use of highly disaggregated data. On the other

hand, the persistent complementarity might also be explained to some extent by an *endogeneity bias*. Behind the complementarity effect there are causal relations (such as vertical linkages and spillovers or demand complementarities), but also simple positive correlations such as growth in demand and the effects of gravity-type variables that simultaneously determine both variables. This means that economic complementarity may be a "second source of positive correlation between exports and FDI" and this makes it even more difficult to disentangle the different relations<sup>38</sup>.

However, performing the analysis with a higher level of disaggregation and matching the data with the hypothesis tested can shed some light on the different strategies of the firms and hence, the importance of the substitution and the complementarity effects. In order to partially disentangle the effects behind the persistent complementarity, our paper proposes a firm level analysis accounting for: a) heterogeneity across product categories of the firm; d) the extensive and intensive margins of the investment; c) controlling for time invariant unobservable heterogeneity at the destination-time-product category. The analysis reveals various interesting patterns in line with theory:

(i) Even at the firm level, there exists a persistent complementarity which can be due both to economic and statistical reasons. (ii) The complementarity effect is always higher for non-OECD countries, explained by the existence of a substitutability in OECD countries and possibly stronger vertical linkages in non OECD countries. (iii) A substitution effect is found only in large markets (OECD countries) and for their best performing products. (iv) The substitutability is strongly related to the size of the investment, where the mere presence in a foreign market shows a positive effect but the intensity of the investment generates a negative effect.

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<sup>38</sup>Head and Ries (2001)

## 4

# Marginal Product of Capital and FDI under Financial Frictions

## 4.1 Introduction

*“[...] seemingly perverse flows of capital from poor to rich countries today are not necessarily a sign of inefficiencies in global financial markets. Rather, they may indicate financial and other structural impediments that limit a poor country’s ability to absorb foreign capital.”*

– Prasad et al. (2007)<sup>1</sup>

Traditional trade theory predicts that if relative capital-to-labor ratios are different across countries and if capital mobility is allowed, then capital should flow from capital rich to capital poor countries, where return to capital should be higher. Therefore, large differences in capital ratios across countries should be reflected in large differences in *marginal product of capital* (MPK) and in capital flowing from capital rich to capital scarce economies, if capitals can move freely across economies. In practice,

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<sup>1</sup>From “Foreign Capital and Economic Growth”, The Brookings Institution, vol. 38(2007-1).

one could reasonably expect to see these patterns taking into account that global cross border financial flows have substantially increased in the past four decades, which suggests a widely financially integrated world. However, many authors have wondered about the validity of the assumptions behind these predictions which imply that differences in income across countries (reflecting differences in capital per capita) result in differences in marginal return to capital. These studies have been motivated by Lucas' (1990) findings, who claimed that in practice we do not observe the kind of flows predicted by standard theory, where they should flow from rich to poor countries. This is what has been dubbed the "Lucas Paradox" and arises from his analysis of the relationship between India and the U.S. in 1988 where he finds that the return to capital should be around 58 times higher in the former Lucas (1990). Given such differences, we should have seen all capitals flowing from the U.S. to India, but this has not been the case. This debate has gained importance among economists and policymakers in recent years because evidence suggests that even if the world has gradually been more financially integrated (e.g., Prasad et al. (2007)), not only have capitals not flown from rich to poor countries, as Lucas pointed out, but recently the pattern seems perverse, as capitals have been moving "up-hill", from poorer to richer countries. Thus, giving rise to the so-called global imbalances which have somewhat motivated recent protectionism proposals.

In line with this, there has been a vast theoretical and empirical literature, attempting to explain the up-hill pattern of capitals. For example, Lucas himself pointed out that large differences in capital-to-labor ratios doesn't mean that the same larger differences can be expected in the return to capital as poorer countries may lack of other factors that complement with capital (such as human capital). First of all, capital flows to and from developing economies include official flows, in the form of foreign aid inflows and in the form of accumulated international reserves as outflows. Nonetheless, these type of flows may are mostly driven by additional factors different from the basic rate-of-return of capital. In line with



this, a recent study by Alfaro et al. (2014) examines the role of official flows in determining the international capital allocation by decomposing international capital flows into public and private flows. They find that government flows explain the "up-hill" pattern of international capital flows while private flows are positively correlated with growth (thus, it flows there where the rate-of-return of capital is higher). Suggesting that private capital behaves according to economic theory. Nonetheless, international capital net of official flows, still flows much more to capital rich than to capital poor countries.

In general, the potential explanations of the paradox have relied on two types of arguments; the first is related to international capital market imperfections and restrictions on international capital flows that prevent capital from moving freely and being efficiently allocated across countries (such as sovereign risk and informational asymmetries).<sup>2,3</sup> The second type of arguments relies on the idea that once the returns to capital are adjusted from risk and other factors that affect the total factor productivity, they might not end up being as high as suggested by the relative scarcity of capital in poor countries. Some explanations for these factors are related to the "fundamentals" of an economy that preclude equalization of marginal return to capital across countries despite relative differences in capital endowments; this would be for example, missing factors of production (e.g., lack of human capital and productive infrastructure), the importance of land in production, technological differences, lack of sound institutions, policy induced distortions (such as tariffs, taxes, capital controls and non-trade barriers) and other *inefficiencies* affecting the overall production structure (such as corruption, risk of expropriation, poor contract enforceability, low rule of law and the lack of a sound financial system).<sup>4,5</sup> Thus, Lucas' Paradox isn't perhaps a paradox anymore given

<sup>2</sup>See for example: Reinhart and Rogoff (2004), Gertler and Rogoff (1990) and Portes and Rey (2005).

<sup>3</sup>Reinhardt et al. (2013).

<sup>4</sup>Caselli and Feyrer (2007).

<sup>5</sup>Alfaro et al. (2008) and Prasad et al. (2007).

that many developing economies are beset by different problems that make that risk-adjusted return to capital is much lower than the return anticipated on the basis of their relative scarcity of capital.

Among all possible explanations of Lucas' Paradox, this paper focuses on a specific inefficiency: financial underdevelopment, defined as the inability of the financial sector to intermediate credit to firms<sup>6</sup>. In particular Antràs and Caballero (2009) (AC henceforth) theoretically explore how financial underdevelopment creates a misallocation of capital across sectors, which is biased against the sectors that rely more on external finance than on internally generated cash flow (i.e., financially dependent sectors) and how trade openness can alleviate this misallocation problem by allowing specialization in less financially dependent sectors. They conclude that given the existence of cross-country heterogeneity in the efficiency of financial systems -that differently affect sectors depending on their external needs of finance- aggregate marginal return to capital is lower in countries with weaker financial systems. This, in turn eliminates the incentives for capitals flowing into these economies. On top of this, departing from the fact that aggregate MPK is the most common measure to approximate the return to capital, Caselli and Feyrer (2007) (CF from now on), propose simple cross-country estimates of MPK -in a given year- using easily accessible macroeconomic data and they find that once one accounts for the importance of "natural capital" in production (such as land) and differences in the relative price of capital, MPK is remarkably similar across countries. They conclude that there is no reason to expect more capitals flowing from capital rich to capital poor countries given that the return to capital isn't relatively higher in the later, hence rejecting the view that impediments to international capital flows play a major role in precluding capital flowing into poor countries. Instead, they attribute the lower capital ratios in these countries to the lack of capital complementary factors, higher relative prices of capital and higher overall *inefficiencies*.

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<sup>6</sup>Which can also be seen as the incapability of firms to pledge future output to potential financiers.

Inspired by AC and CF, we empirically examine these overall inefficiencies through the lens of AC's theory. We follow CF's methodology in order to construct capital-to-labor ratios and aggregate MPK for an unbalanced panel of 50 countries over the period 1995-2008. In line with their findings, we confirm the existence of large cross-country differences in capital ratios and despite these differences MPK is very similar across countries and sometimes it is even lower for capital poor countries. Furthermore, this pattern is stable over time. This means that given the lower capital ratios, there could be scope for increases in MPK in poorer countries, either by alleviating inefficiencies or by improving access to complementary factors with capital (e.g., higher levels of education). We argue that one way through which this inefficiency can work is in the form of an inability of the financial system to optimally allocate capital across different sectors which pins down aggregate capital productivity in relatively poorer countries. This means that if the financial sector of a country is underdeveloped, then domestic and foreign finance cannot easily be intermediated to firms, and some sectors will be disproportionately harmed by this inefficiency. More precisely, despite operating under a common financial system, those sectors that rely more on external finance will be more credit-limited than those that are able to generate sufficient internal funds. Under this scenario, AC claim that countries suffering from financial underdevelopment could circumvent the misallocation problem by specializing in production of sectors that are less harmed by the malfunctioning of the financial system (i.e., less financially dependent sectors) - this specialization being only allowed by international trade. This, in turn raises aggregate return to capital and attracts foreign capital inflows.

Therefore, a testable implication of AC's model is that *higher shares of production in less financially dependent sectors are related to higher aggregate MPK and more capital inflows in countries with weaker financial intermediation systems*. Accordingly, in this paper we empirically evaluate

this proposition by examining how these two types of financial frictions at the country and sector level interact and affect aggregate return to capital (proxied by aggregate MPK) and capital inflows (proxied by bilateral FDI inflows<sup>7</sup>). The identification strategy that we follow in order to test this proposition in different panel regressions, is to separately assess the effect of a country's specialization in the production of financially dependent sectors (proxied by a *weighted average financial dependence* measure<sup>8</sup>) on MPK and in inward bilateral FDI flows, conditional on the development of the financial system. First we rely on a nonlinear MPK regression specification for developing and developed countries that interacts our proxy of external financial dependence with different measures of the level of financial development. Then, we restrict our sample to middle and low income economies (which by selection are relatively less financially developed than high income countries<sup>9</sup>) and estimate the effect of external financial dependence on FDI inflows in a gravity-like framework. Finally, in order to assess whether the mechanism through which financial external dependence affects FDI inflows is through its financial frictions, the effect is again, conditioned to depend on the level of financial development.

Our results suggest that increasing production in financially dependent sectors has a positive effect on MPK only if a country achieves a certain level of financial development, otherwise it has a negative and significant effect. Splitting our sample between developed and developing countries, shows that production in financially dependent sectors is only positive for the former, regardless of their financial development. While the relation is significantly negative for developing countries and the interaction term with financial development is positive and highly significant, which means that for these countries, financial development is a must in order production in financially intensive activities to be related to MPK improvements. Concerning FDI estimates (for developing countries), we find that produc-

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<sup>7</sup>International capital flows are composed of private (FDI and portfolio investment) and official flows (debt and aid).

<sup>8</sup>Section 4.3 details the construction of this and the rest of relevant variables.

<sup>9</sup>Section 4.3 gives stylized facts about this and other facts motivating our analysis.

tion in financially dependent sectors is significantly negative and robust to inclusion and exclusion of standard controls, specially other channels that can explain the up-hill trend of capital flows, such as a country's overall risk (including institutions) and financial openness. These results suggest, as argued by AC, that there could be potential gains from trade openness in developing countries by specializing in less financially dependent sectors, but it seems that even though when trade openness has taken place, specialization in less financially dependent sectors has not happened. On the contrary, our measure of external financial dependence is comparable between developed and developing economies, while there is a big and persistent heterogeneity in financial development between developed and developing economies. Thus, our findings imply that this specialization only presents positive effects for MPK in advanced economies, and the main difference -between developed and developing- driving these results seems to be the existence of a sound financial system.

Summing up, consistent with CF's findings, we find that MPK is similar between capital rich and capital poor countries - sometimes even lower in the latter - and this pattern doesn't change over time. Furthermore, in line with AC's theory, financial development seems to be a necessary condition -and certainly not a sufficient one- in order for production in financially dependent sectors to positively affect aggregate MPK and FDI. In this logic, our paper is also closely related to Prasad et al. (2007), who study the relation between foreign capital and growth. Using industry level data, they find that when countries don't have a sufficiently developed financial system, foreign capital inflows don't play any role in the growth of financially dependent sectors, suggesting that foreign flows are not efficiently inter-mediated. They argue that financial development is a necessary pre-condition in order to be able to absorb foreign capital, and propose financial underdevelopment of poorer countries as a candidate for the explanation of up-hill trends of international capital flows. These results taken altogether contribute to some extent explaining Lucas' Paradox of why more capitals don't flow from capital rich to capital poor countries. In

sum, the empirical contribution of this paper lies in providing new within-country evidence on how production of financially intensive sectors shapes MPK and attracts FDI inflows, and how these effects strongly depend on country's financial sector's soundness.

The rest of the paper is organized as follows. Section 4.2 discusses a brief review of the relevant theoretical and empirical considerations and presents the theoretical mechanism in AC's model that we test in this paper. In order to motivate our results, we start by showing some stylized facts in Section 4.3, where we also describe the data, Section 4.4 presents the econometric strategy, shows the empirical results and explores robustness checks and Section 4.6 concludes.

## 4.2 Relationship to literature

This paper is closely connected to different fields. First, since it aims at examining the determinants of capitals in developing countries, it therefore joins the global imbalances' and the Lucas' Paradox literature. It specially relates to Alfaro et al. (2008), Prasad et al. (2007) and Caselli and Feyrer (2007). The first authors specifically study the determinants of the direction of capital flows, in the same way as we do in this paper and find that the main reason why more capitals don't flow to capital poor countries is their weak institutions. On the other hand, while using a different approach, our results rather echo Prasad et al. (2007), who find that financial underdevelopment in poorer countries limits absorption of capital and this can be one of the explanations for the uphill flows of capital. In line with their findings we argue that financial underdevelopment is one important driver of global imbalances. Concerning Caselli and Feyrer, the authors use a cross-section of countries and find that, at odds with the existence of large capital differences across countries, "correctly measured" MPK results in small differences of MPK across countries. In

this paper we reproduce their analysis for a span of 15 years; our findings are in line with CF, where big MPK differences across capital rich and capital poor countries are not found. On the contrary, it is on average higher in developed countries. However, this pattern is attenuated over time, where MPK in developing countries has followed a modest positive trend from the beginning of 2000's.

Second, this paper also relates to a growing literature where financial development is studied as a comparative advantage which determines production specialization patterns of different countries, such as Rajan and Zingales (1998), Beck (2003, 2002), Do and Levchenko (2007) and Manova (2008). Additionally, our analysis also closely connects to another relatively new literature in international macroeconomics which is inspired in trade literature and applies gravity equations to international finance, such as Martin and Rey (2004), Portes and Rey (2005), Aviat and Coeurdacier (2007) and Okawa and Van Wincoop (2012). In the same fashion, Head and Ries (2008) and De Sousa and Lochard (2011) have shown that gravity equations also fit very well FDI flows.

Additionally, this analysis is closely related to the literature that emphasises the links between capital misallocation and financial frictions. The effect of finance on capital allocation has been studied by Kiyotaki et al. (1997), Banerjee and Duflo (2005), Moll (2014), Midrigan and Xu (2014) and Buera et al. (2011) among others. Particularly, our findings echo the conclusions in a recent paper by Gopinath et al. (2015). They study the allocation of capital and overall productivity in Southern Europe and find that the dispersion in the return to capital has increased due to increased capital inflows (allowed by the integration) that were not efficiently intermediated (given the relative financial underdevelopment in these countries). While this has not been the case for European countries with deeper financial markets.

Finally, since this paper aims at testing one theoretical mechanism in Antràs and Caballero (2009), it closely relates to Kalemli-Ozcan and Nikolsko-Rzhevskyy (2010), which to the best of our knowledge, is the unique attempt in providing empirical evidence of the former, more specifically, they test whether trade determines capital inflows in developing countries. For this purpose, they use panel-data for the period 1859-1913 on trade and FDI between three source countries, namely, France, Germany, and the U.K. and one host country, the Ottoman Empire. In order to test the complementarity between trade and capital flows and provide evidence of the causal impact from the former to the latter, they use an IV approach to correct for the reverse causation. Specifically, they use a variable related to the weather conditions which they interact with the content of trade of the Ottoman Empire as the time-varying instrument for trade. They state that this is a good instrument for the Ottoman Empire's trade by establishing a linkage between trade and production and then by arguing why production is closely tied to weather conditions in this case. The authors argue that their results are consistent with the complementarity between trade and FDI arising from the existence of financial frictions in the sense that trade increases the return to capital in financially underdeveloped economies. This is because trade serves as a channel to circumvent the problem of misallocation of capital due to the financing constraints, as argued by AC. On top of this, they also argue that this complementarity is consistent with the punishment hypothesis as trade works as an "implicit guarantee for creditors" due to the potential loss of benefits related to trade, hence inducing more capital inflows.

Thus, Kalemli-Ozcan and Nikolsko-Rzhevskyy's paper differs from this one in two main aspects. The first is that this paper does not provide a test of the complementary relationship between trade and capital flows as they do, but rather a test of the mechanism through which this complementarity takes place. Second, unlike their paper, ours goes one step further in providing evidence for AC's model by accounting for the existence of financial frictions and the way they interact to shape capital flows into



developing countries. Therefore, the main contribution of this paper is to provide a direct test of the mechanism in AC - linked to financial frictions, which joins many other papers in contributing to the explanation of Lucas' Paradox. On the other hand, the paper also updates and extends the MPK analysis proposed by Caselli and Feyrer (2007), using new available data. Finally, the most important theoretical background of our analysis is AC's paper. Therefore, the following subsection will briefly detail the main mechanisms and implications of their theoretical model.

#### **4.2.1 Antràs and Caballero's Mechanism**

In contrast with the neoclassical international trade theory's predictions, AC argue that in a world with financial frictions that differently affect different countries and sectors, trade and capital mobility become complements from the point of view of less financially developed economies. For this purpose, they develop a benchmark model which consists of two-factor, two-sector and two-countries, where labor mobility is perfect across sectors. Both countries are initially symmetric except for financial heterogeneity at the sector and country level. This financial heterogeneity can be considered as follows:

Concerning the heterogeneity across countries and motivated by one of the characteristics that distinguishes the most the developing -South- from the developed -North- countries, one could expect a "South" developing economy as having a worse financial development, and a developed "North" economy as being more financially developed. On the other hand, when it comes about the heterogeneity across sectors, it is assumed that there are some sectors which are more financially dependent, meaning that they rely relatively more on external funds and thereby, they will face some constraints in financing their production; these ones will be called the

"constrained sectors".<sup>10</sup> In contrast, there are some other sectors which will not find any financial constraint because they rely less on external financing; these ones will be called the "unconstrained sectors". Consistent with the literature, this assumption is motivated by theoretical and empirical findings that support the idea that different industries are differently affected by financial underdevelopment.<sup>11</sup> For the purpose of AC's model, the financial constraint faced by the more financially dependent sectors, can be viewed as the result of a problem of asymmetric information between the lender and the producer, where the latter has more information about the return of his production project and the former faces a costly state verification, which translates into a higher risk for the lender. It is clear then, that in South economies with their worse financial markets, this risk is higher than in North. Thus, the way these financial frictions interact can be seen as the capacity of the financial system to overcome a moral hazard problem that limits the amount of capital which borrowers can pledge to lenders, in some sectors of the economy- where, this ability measures the development of the financial system.

It is convenient to begin by taking a look at the autarkic equilibrium, where goods and factor markets clear domestically. South, with the worse financial institutions, will disproportionately allocate more capital to the unconstrained sector, whose output is then oversupplied and its relative price is depressed. This high capital-labor ratio in the unconstrained sector depresses relative wages and rental rates of capital in South. If international capital mobility is now allowed, capital will flow from South towards North seeking the higher return to capital, where the better financial development allows a more efficient allocation of factors across sectors. The implications on capital flows vary if international trade in goods is considered. When South opens itself up to trade, it will be confronted

<sup>10</sup>Later in this article, when referring to these "constrained sectors", as named by AC in their paper, we will also call to them "financially intensive sectors" or "sectors dependent on external financing" as most literature does. All terms are to be understood as synonyms.

<sup>11</sup>See for example: Bougheas and Falvey (2011) and Sakuragawa and Hosono (2010).

to an increase in the price of the unconstrained sector's good, leading to an incomplete specialization in the unconstrained sector, in which it now has a comparative advantage. Thus, it becomes a net importer of the financially constrained good.

Trade liberalization then allows South to allocate a disproportionate fraction of labor in the unconstrained sector -not being subject anymore to the domestic clearance conditions, thus increasing the marginal product of capital and its equilibrium rental rate. If one lets South to specialize in a sector with lower financial frictions, international trade decreases the negative impact of its financial underdevelopment on the rental rate of capital. Actually, the rate of return to capital becomes higher in South as trade integration not only reduces the discrepancy in the real return to capital in North and South, but in fact, it turns over the relationship.

The implication is thus that, in the presence of financial heterogeneity across sectors and countries, trade liberalization increases capital flows from North to South, so that trade and capital mobility complement each other in less financially developed economies. The key mechanism behind this reversal, is that with specialization, South indeed will allocate disproportionate resources in unconstrained sectors but only labor will be released from the financially constrained sectors. Capital will continue to gain a premium in the constrained sector because it is under-supplied, thus, it will not move. This implies that with perfect mobility across sectors, wages will continue to be depressed in South. This is contrary to what predicts the Heckscher-Ohlin-Mundell model, where factor mobility substitutes with trade because it allows factor price equalization (FPE). Thereby, the determinants of trade, which are given by the difference of factor prices, are not relevant anymore. However, in AC capital mobility alone is not sufficient for FPE.

Thus, two testable implications of this model are that trade and capital flows are complements in less financially developed countries, on the one hand. And on the other hand, one can test the mechanism behind this complementarity which is that *higher shares of production in less financially dependent sectors are related to higher aggregate MPK and more capital inflows in countries with weaker financial intermediation systems*. In this paper we privilege the second one because the relationship between trade and capital flows is far from simple and full of endogeneity concerns. Additionally, studying the determinants of marginal return to capital in financially underdeveloped countries and the way this affects capital inflows can shed interesting insights on the uphill trends of capital flows.

## 4.3 Data

### 4.3.1 Variables of interest

We rely on two different unbalanced panels, one sample at the country level for the MPK regressions in developed and developing economies and a second sample for bilateral FDI gravity regressions restricted to developing countries and its relations with the rest of the world (developing and developed economies). Therefore, we first work with of 50 countries over 1995-2008, and then with a second panel for bilateral relations of 28 countries developing countries (from all partners) during 2001-2010. Data at the sector level come from Klapper et al. (2006) and UNIDO. Data at the country level come from different sources: The World Bank's World Development Indicators (WDI available online); Version 8.0 of the Penn World Tables (PWT); "The Changing Wealth of Nations" database from the World Bank ; Chinn and Ito's (2009); the International Country Risk Guides (ICRG) from the PRS Group; and the IMF's International Financial Statistics (IFS). Bilateral data comes from United Nation's UNCTAD FDI database (2014) and from the ESCAP-World Bank Trade Cost Database

(2014).<sup>12,13</sup>

Concerning the MPK analysis, the selection of the sample was done based on data availability. Only countries for which we observed more than 5 years were kept in order to have a more balanced panel. Additionally, the year 2009 was dropped in to avoid capturing the effects of the Great Recession. Lastly, given that the characteristics of Low income countries is extremely particular they were also kept out of the analysis (these countries are, by far, lagging behind in every variable considered: capital ratios, financial development, Naive MPK and proper MPK).<sup>14</sup> On top of this, there is no data beyond 2000 for these countries. Appendix B.3 provides a full list of the countries in each sample as well as some basic descriptive statistics for each country. Appendix B.4 contains full definitions and sources of all variables included in the analysis.

Finally, the next subsection describes the construction of the two key variables included in the regressions: MPK at the country-year level, which we use as a proxy for the return to capital in a given country; and in order to capture the cross-sector heterogeneity of financial frictions that affect a country in a given year, we construct a "weighted average external financial dependence" by using sector level data.

### **Aggregate Marginal Product of Capital**

MPK is constructed following the methodology in Caselli and Feyrer (2007)

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<sup>12</sup>Feenstra et al. (2015) "The Next Generation of the Penn World Table" available for download at [www.gdpc.net/pwt](http://www.gdpc.net/pwt).

<sup>13</sup>The Wealth of Nations data set provides country level data on comprehensive wealth, adjusted net saving, and non-renewable resource rents indicators, as published in "The Changing Wealth of Nations" (2011). It presents a set of comprehensive wealth accounts for over 150 countries for 1995, 2000, and 2005, which allows a longer-term assessment of global, regional, and country performance in building wealth.

<sup>14</sup>For instance, most of the capital inflows that many of these countries receive comes from Official Flows (e.g., Foreign aid), which does not flow following a reward or return motive. See Alfaro et al. (2014) for more differences on official and private flows.

and using new available data from PWT version 8.0 and from the World Bank. We extend their analysis and construct time-varying "proper" measures of MPK in an unbalanced panel of 50 countries during 1995-2008. The authors propose a measure of MPK by assuming that under perfect competition conditions in the capital markets, MPK equals the return to capital, which multiplied by total capital stock should equal total capital income. Total capital income can be easily calculated using total income (proxied by GDP) and a *proper* measure of the share of capital in total income. They argue that this proper measure should exclude non-reproducible capital from the "naive" common share of capital that is usually calculated (i.e., one minus the share of labor). This is especially important in the sense that non-reproducible capital (which is essentially land and its products) accounts for a larger share of total production in developing countries than in developed countries (reproducible capital being lower in the former than in the latter).<sup>15</sup> This in turn, creates an upward bias in the common naive measure of MPK in developing, capital poor, countries. Furthermore, the fact that capital is scarcer (in poorer countries) makes it relatively more expensive and this creates a second upward bias in the MPK of capital poor countries if they are not taken into account in the estimation. Therefore, MPK for country  $i$  at time  $t$  is constructed using the stock of reproducible capital ( $K_{it}$ ), relative price of capital ( $P^k/P^c$ ), share of labor compensation in  $GDP$  and total wealth  $W_{it}$  (defined as natural wealth plus reproducible capital), as follows:

$$MPK_{it} = \frac{[GDP \times P^c \times (1 - LaborShare)]_{it}}{(W \times P^k \times K)_{it}}$$

All variables used in order to construct MPK are easily and directly recovered from the different data bases with the exception of total wealth ( $W_{it}$ ) for a given country at a given year. It is, therefore, convenient to explain further the way in which we proceeded in this regard. The construction

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<sup>15</sup>See appendix B.1 for details.

of this variable required making some assumptions since the data that we used in order to estimate total wealth requires information on natural capital (i.e., land and natural-resource wealth). As mentioned above, these data comes from the World Bank's database "The Changing Wealth of Nations" and since it is only available for the years 1995, 2000 and 2005, we assumed a linear relation between each of the 2 available points in time and predict a linear change for the last 3 years (i.e., 2006-2008) using the estimated slope in order to get yearly information about natural capital.

Tables B.5 and B.6 the in Appendix B.3 report the MPK measures averaged over 1995-2008 for each country, as well as a graphical visualization of the *proper MPK* measure (Figure B.1). Finally, it is convenient mentioning that since we will also use the naive measures in the robustness analysis, we will follow the notation in CF in what follows. Hence in the rest of the document "PMPKL" will be used in order to make reference to this *proper* measure of MPK, which includes the relative prices correction and the proper share of capital in total income correction.

### **Weighted average external financial dependence**

As it was explained earlier, the construction of this variable combines 2-digits industry-level data on external financial dependence following the definition in Rajan and Zingales (1998) (R&Z, from now on) and production for each country and year at the industry-level. The proxy for each industry's financial dependence is calculated by Klapper et al. (2006) using data on U.S. companies over 1990-1999 from Standard and Poor's Compustat database and it is available in Maskus et al. (2012).<sup>16</sup> While production data come from the Industrial Statistics Database (2010)

<sup>16</sup>Note that while the measure used in this analysis comes also from a newer paper from R. Rajan, the original and widely used R&Z's measure is calculated using the same data during the 1980's for 3 and 4-digits ISIC rev. 2 industries.

collected by the United Nations Statistical Division and the contribution of the manufacturing sector in total production, from the WDI database (online) of the World Bank. The objective is to obtain a time varying measure of the extent of the country's reliance on external finance.

The idea behind this, which has been studied empirically by R&Z and many others, is that for technological reasons, some industries rely more on external finance than others.<sup>17</sup> R&Z define the dependence on external finance as the share of investment that a firm can't finance with its internal cash flows and is calculated as the capital expenditures minus cash flow from operations divided by capital expenditures of a firm. They compute this external dependence for 36 industries varying from tobacco (the industry with the lowest dependence on external finance -which is actually negative) to drugs, the industry with the highest dependence, using U.S. firm-level data from Compustat. The underlying assumption is that the degree of reliance on external finance across industries persists across countries. The argument for this is that given that large companies in the U.S. function under a relatively well-developed financial system, the measures observed for these can be a good proxy for the technological dependence of industries on external finance in other countries.

In this way, we use the time-invariant external dependence of each of the 22 2-digits industries (ISIC rev. 3) in the manufacturing sector and calculate the *weighted average external financial dependence* ( $External\ Dep_{it}$ ) for each country  $i$  in year  $t$ . In order to do so, we multiply the industry's dependence on external finance by the fraction that each industry  $k$  contributes to the total manufacturing production in each country and year over the period 1995-2010, as follows,

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<sup>17</sup>See for example Beck (2002) and Manova (2008).



$$External\ Dep_{it} = \sum_{k=1}^{22} \left[ External\ Dep_k \times \frac{Value\ Added_{kit}}{V.A.\ Manuf_{it}} \right]$$

where  $External\ Dep_k$  is the external dependence index by industry Klap-  
per et al. (2006). An average of these values over 1995-2008 by country  
(Tables B.5 - B.6), as well as a graphical visualization (Figure B.2) is  
presented in the Appendix.

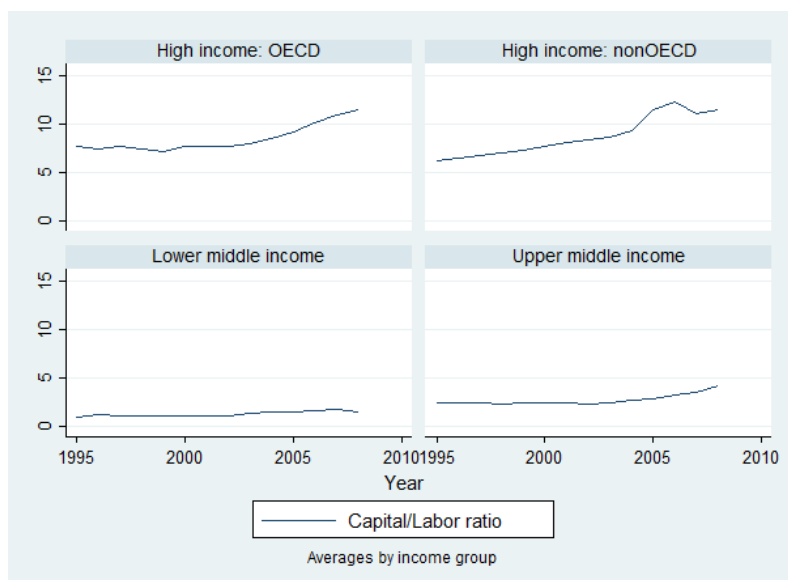
### 4.3.2 Stylized facts

A first glance at data allows us motivating the econometric analysis in  
this paper. Some summary statistics are displayed in Table B.3 in the  
Appendix, where the variables are averaged by income groups, this is also  
the case for all figures presented in this section.<sup>18</sup> In this sense Figure  
4.1 shows the evolution of capital-to-labor ratios over 1995-2008 for the  
different groups, as measured by reproducible capital (in million dollars)  
per worker. The first salient fact that can be seen is the high differences of  
capital ratios among groups and how these differences are maintained over  
time. Together with the information in Table B.3 in the Appendix one can  
sum up Figure 4.1 in a rough way: High income countries (OECD and non  
OECD) have on average three times as capital as Upper Middle countries;  
these in turn have on average twice as capital as Lower Middle countries  
and their capital-to-labor ratios growth over the period has been rather  
modest.<sup>19</sup> One can also say that capital ratios have steadily increased  
over 1995-2008 for all groups. Especially, the highest capital growth has  
taken place in Lower and Upper Middle income countries and in High non  
OECD countries -where it has more than doubled. All in all, differences in

<sup>18</sup>Detailed statistics by country are presented in the appendix B.3

<sup>19</sup>Although Low income countries were excluded from the analysis, as already men-  
tioned, it is worth noting that these are lagging very far behind having on average eight  
times less capital than Lower Middle countries.

capital ratios between rich, middle income and poor countries, were huge in 1995, and continued to be huge in 2008.



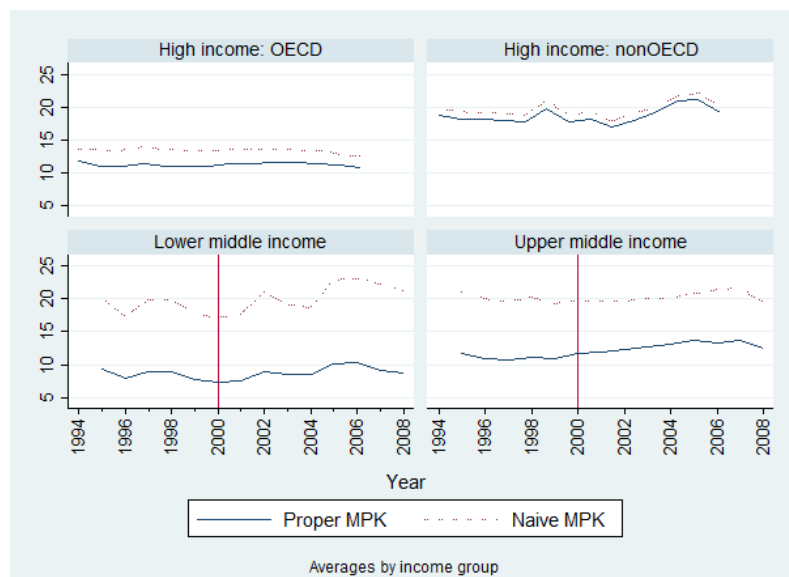
**Figure 4.1:** Evolution of capital-to-labor ratios around the world

Given these differences in capital ratios, it would be reasonable to expect the same big differences in the reward to capital between countries. Nonetheless, Figure 4.2 is in line with the findings in Caselli and Feyrer (2007), where the return to capital (as proxied by the MPK) doesn't reflect the big cross-country capital differences. MPK, being on average, even lower there where it is scarcer: in Lower Middle, and significantly lower in Low income countries (figures for these are not shown). Additionally, the evolution of MPK differences among developed and developing is fairly stable over time, although some modest improvements are noticeable for developing after the year 2000. While the figures for High income Non-OECD countries are very volatile, which is due to the fact that only 4 countries make part of this group.<sup>20</sup>

CF state that a proper measure of MPK must account for the higher rela-

<sup>20</sup>Where all the volatility in High income Non-OECD countries is explained a single country: Singapore. The variance of this variable for the latter is 3 to 4 times larger than for the other 3 countries (Cyprus, Hong Kong and Israel).

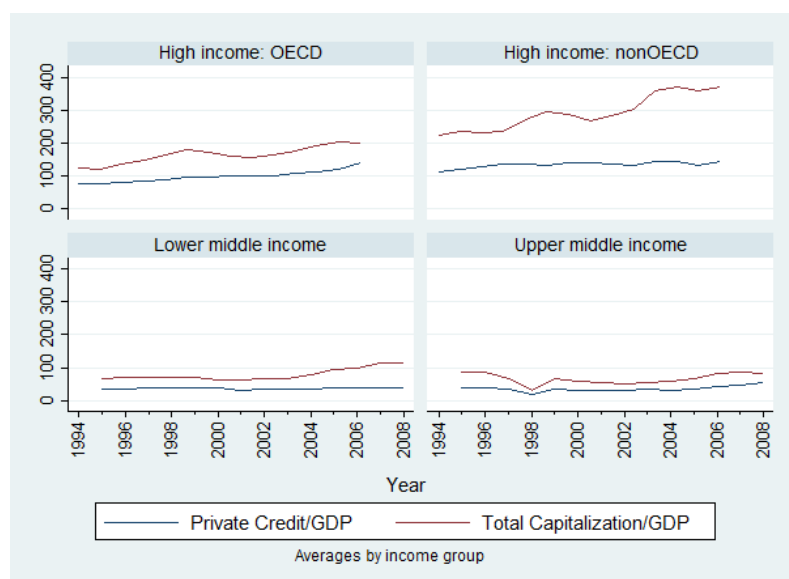
tive importance of other types of capital (i.e., non reproducible capital) in production in capital poor countries. Otherwise, naively measured MPK, is overestimated both in rich and poorer countries, but significantly more in the latter. Furthermore, they emphasize the importance of accounting for the fact that capital goods are relatively cheaper in capital richer countries, which also overestimates MPK in capital poor countries. Accordingly, Figure 4.2 depicts a Naive MPK (the red dotted line) and a Proper MPK measure which takes into account the importance of non reproducible capital in production, both measures having been corrected by the relative differences in capital prices.



**Figure 4.2:** Naive and Proper MPK evolution

The naive measure overestimates MPK for all groups, but the bias is much bigger for Low and (Upper and Lower) Middle income countries where land accounts for a significantly higher share in production than in High income countries. In this sense, naive MPK is on average higher in Middle income countries than in richer ones. However, when considering the proper MPK measure, MPK differences across countries begin to shrink; this is particularly true for rich OECD countries and Upper Middle countries. Whereas, for rich non OECD countries the measure is the least

overestimated and is by far the largest among all groups. However, it is also convenient to point out that the latter group is particular in its kind as well, since it includes countries such as Hong Kong and Singapore. These small differences between MPK across capital rich and capital poor countries, suggest that more than mere impediments to international capital movements across countries, must be at play behind the "up-hill" trend of capitals: if return to capital is not much higher in capital poor countries, the incentives for capital to flow from richer to poorer countries disappear.



**Figure 4.3:** Financial Development measures averaged by income group

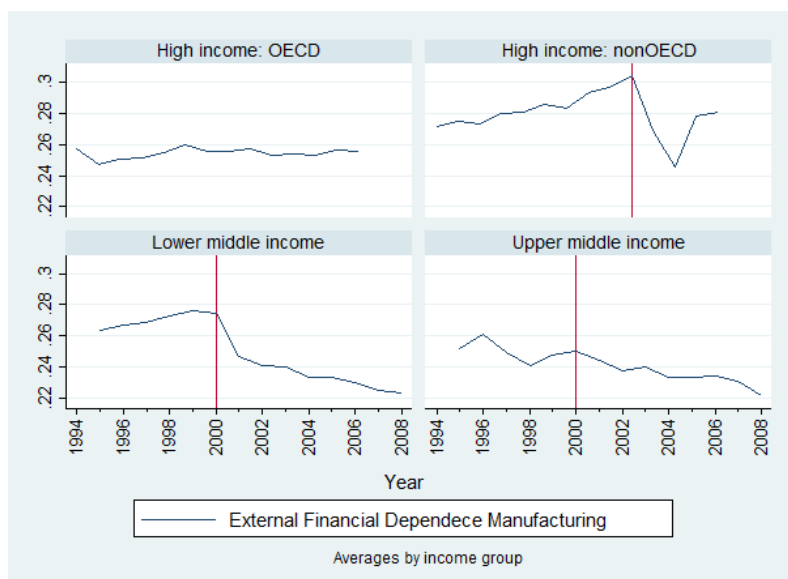
In line with this and in the same way as Lucas (1990), Caselli and Feyrer (2007) argue that lower capital-to-labor ratios in poorer countries are due to lower complementary factors and *inefficient uses of factors*. One type of inefficiency can be related to the financial system's ability to optimally channel resources in the economy, as argued by Prasad et al. (2007) and Antràs and Caballero (2009). When one examines standard measures of financial development for these different groups, a big heterogeneity is found across the groups. Figure 4.3 presents the evolution of financial development during 1995-2008 using two common *de facto* measures of the depth of the financial system: total private credit as a share of GDP

and total capitalization as a share of GDP -which, besides credit includes capitalization of the stock market (the blue dotted line). Regardless of the measure considered, it is clear that the financial system is extremely heterogeneous among rich, middle income and poor countries. Both measures are most of the time, well above 100% (as a share of GDP) for rich countries, while it hardly arrives to 100% for Middle income countries and they are significantly lower in Low income countries - well below 50%. With the exception of a modest improvement in total capitalization in Lower Middle income countries after 2003.

Not only these variables are much higher in absolute terms for richer countries, but when one considers their evolution, rich countries' financial development evolves much faster than in developing countries. Therefore, it seems reasonable to consider the well-functioning of financial markets as a good candidate in explaining one type of inefficiency in developing countries. Which can explain the coexistence of small differences in MPK across countries and the large differences in capital-to-labor ratios. This is reinforced by the strong correlation between our two measures of financial development and capital-to-labor ratios, which is presented in Table 4.1. Which in turn, motivates the analysis opposing developed and developing countries in order to assess our empirical question. On top of this, it is worth noting the drop suffered by Upper Middle countries around 1998-2000. Explained by the fact that during this period most of the countries from this group experienced a crisis or financial turmoil (6 out of 10 countries).

	Credit/GDP	Total Capitalization	K/L
Credit/GDP	1.00		
Total Capitalization	0.83	1.00	
K/L	0.67	0.64	1.00

**Table 4.1:** Cross-correlation between financial development and K/L ratios



**Figure 4.4:** External Financial Dependence measure averaged by income group

One last important stylized fact motivating our analysis concerns the average external financial dependence of a country's manufacturing production. Figure 4.4 displays the evolution of this variable during 1995-2008, which is constructed for each country using industry level data and is averaged by income groups in this figure. It reflects the degree of specialization of a country's production in financially intensive activities. An important aspect of this figure is the similarity of the external financial dependence level between High income and Middle income countries before 2000. This similarity is at odds with the large differences in financial development among developing and developed countries that we just described above.<sup>21</sup>

There is a growing literature indicating that financial intensive activities should develop more extensively in countries with stronger financial systems, since financial development reduces the cost of raising external funds

<sup>21</sup>Again, the volatility for High Income Non OECD is to be taken with caution due to the small number of countries in the group. This time it is explained mainly by the fact that Israel drops out of the sample between 2005-2006 (included) and Israel's figures push up the group average (being on average around 1.5 times the values for Hong Kong and Cyprus). Nonetheless, Cyprus did experienced drop in this variable in 2004, which is the year where it entered the E.U..

for firms.<sup>22</sup> Therefore, one should expect big differences in specialization in financially dependent activities across countries given the important financial development heterogeneity among developed and developing countries. Even though the related literature has shown that financial development and access to finance is positively and causally correlated with faster growth of financially dependent sectors (Rajan and Zingales (1998)) and higher exports (Beck (2003) and Manova (2008)) in these sectors, we observe that before the year 2000 the aggregate differences in specialization in financially dependent sectors are not strikingly important and this might be one reason explaining why the return to capital is not higher in capital scarce economies.

One explanation behind these different results is the different periods of time under analysis. Therefore, we don't use the same external financial dependence measure that these studies use, which is the original index in Rajan and Zingales (1998). Actually, the index from Klapper et al. (2006) is not positively related with the original R&Z's index. The latter measure is based on Compustat data from the 1980's, while the one that we rely on is based on Compustat data from the 1990's given that our analysis studies the period over 1995-2008. Where the difference between both indexes arises in large part because of changes in industrial environment between the two periods in the U.S.. Which means in turn, that the industry external dependence index varies over time. In this sense, one could wonder about the adequacy of assuming that the index is constant across countries while it varies within a single country. A detailed discussion about this issue is found in Appendix B.2.1.

Nonetheless, the pattern clearly changes after 2000 in developing countries, where there is a sharp decline in the production in financially intensive sectors. This is in line with a mean differences t-test between developed and developing countries, where differences in specialization in

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<sup>22</sup>See for example: Rajan and Zingales (1998), Beck (2003), Beck (2002), Do and Levchenko (2007) and Manova (2008).

	mean		Difference	(p-value)
	Developing	Developed		
<i>MPK_t1</i>	9.63	12.56	-2.93 <sup>a</sup>	0.00
<i>EFD_t1</i>	0.26	0.26	0.00	0.63
<i>MPK_t2</i>	10.79	12.44	-1.66 <sup>a</sup>	0.00
<i>EFD_t2</i>	0.23	0.26	-0.02 <sup>a</sup>	0.00

t1 is the period over 1995-2000 and t2 is the period over 2001-2008.

EFD is the weighted average External Financial Dependence.

**Table 4.2:** t-test Mean differences among groups

financially intensive sectors are not statically different in the years before 2000 but they are statistically different after 2000. These differences after 2000 are statically significant at the highest levels of acceptance and are driven by lower production in financially intensive sectors in developing countries. Table 4.2 displays these results. This point towards a production structure in developing countries that is more in accordance with their comparative advantage in the second period. Finally, the mean differences test for MPK (using the proper measure) in Table 4.2 is also in line with the stylized facts where average MPK's are statistically different in both periods, with always higher MPK in developed countries, but the differences are much lower in the second period. These results taken altogether suggest that specializing in accordance to the country's comparative advantage (here, determined by financial development) is related to increases in its MPK.

These facts point to the validity of AC's theory, who claim that financial underdeveloped economies have a comparative advantage in less financially dependent sectors. Therefore, a better reallocation of resources allowed by trade openness -as suggested by their model- cannot take place without specializing in these sectors. Next section, formally examines this question in detail within an econometric framework that takes into account other possible mechanisms behind these stylized facts. Before turning to the econometric analysis, it is convenient noting that even



if the "properly measured" MPK shrinks the MPK differences across developed and developing countries (and even turns around the relation for the low and low and middle income countries), there is still enough between variation in this measure in our panel in order to perform an econometric analysis on this variable. Table B.4 in the Appendix decomposes the MPK variation between countries and within countries and it can be seen that most of the variation comes from between country differences.

## 4.4 Econometric analysis

Our empirical objective is to examine how financial development at the country level and external financial dependence at the sector level interact to shape aggregate MPK and capital inflows. More specifically, we test whether *higher shares of production in less financially dependent sectors are related to higher aggregate MPK and more capital inflows in countries with weaker financial intermediation systems*. For this purpose, we first work with time-varying data at the country-level in order to examine MPK among capital rich and capital poor countries. Next, we focus on FDI inflows in developing countries by relying on bilateral time-varying data at the level of the country.

### 4.4.1 MPK developed vs. developing countries

How the overall return to capital of a country is affected by production in financially intensive sectors? Given that developed dramatically differ from developing countries in terms of financial development and that we expect production in financially intensive sectors to differently affect both types of countries, we proceed in two steps in order to answer this question. First, we examine how financially intensive production is related to MPK in a given country, where we condition the relation to depend on whether the country is a developing or a developed one. Second, we evaluate whether these differences among developed and developing countries come from differences in the efficiency of their financial intermediation.

We, therefore, begin by estimating the following two-way fixed effects models by OLS,

$$\ln PMPKL_{it} = \alpha + \lambda_1 \text{External Dep}_{it} + \beta' X_{it} + \eta_i + \psi_t + \epsilon_{it} \quad (4.1)$$

and

$$\begin{aligned} \ln PMPKL_{it} = \alpha + \lambda_1 \text{External Dep}_{it} + \lambda_2 \text{External Dep}_{it} \times 1[\text{Dev}_i = 1] \\ + \beta' X_{it} + \eta_i + \psi_t + \epsilon_{it} \end{aligned} \quad (4.2)$$

where  $\ln PMPKL_{it}$  is the aggregate marginal product of capital for country  $i$  at time  $t$ , corrected by relative capital prices and using a proper measure of capital share in income, as explained in section 4.3.  $\text{External Dep}_{it}$  is the logarithm of weighted average external financial dependence and  $1[\text{Dev}_i = 1]$  is a binary variable taking the value of one when the country is classified as developed and zero otherwise.<sup>23</sup> Provided our hypothesis, we expect  $\lambda_2$  to be positive given that financial development is strongly related to the level of development of a country.  $X_{it}$  are time-varying control variables at the country level such as financial development, natural resources rents, financial openness (*Chinn-Ito Index*), trade openness (de facto measure). All these variables are introduced in logarithms. Finally, following the literature, overall risk is accounted for and proxied by the following variables: democracy accountability, government stability, law and order, and internal conflict. Finally,  $\eta_i$  are country fixed effects and  $\psi_t$  are time effects. In order to account for heteroskedasticity and allow correlation of errors across repeated observations within countries, standard errors are clustered at the country-level.

Next, going one step further in testing our proposition, we evaluate whether the different effects of financially intensive production between

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<sup>23</sup>The list of developing and developed countries is provided in the appendix B.3.1.

developed and developing countries are driven by differences in the development of the financial system. For this purpose, we estimate a non-linear version of equation 4.1 by allowing the effect of financially intensive production to vary with the country's level of financial development. This, with the aim of assessing whether it is only aggregate development that matters, or if it is rather financial development the key variable driving the results. We do so by including an interaction term between our proxy of external financial dependence and two alternative measures of financial development by focusing on each one at a time, as follows,

$$\begin{aligned} \ln PMPKL_{it} = & \alpha + \beta' X_{it} + \lambda_1 External\ Dep_{it} + \lambda_2 Fin\ Dev_{it} \\ & + \lambda_3 (External\ Dep_{it} \times Fin\ Dev_{it}) + \eta_i + \psi_t + \epsilon_{it} \end{aligned} \quad (4.3)$$

where  $Fin\ Dev_{it}$  is the logarithm of a time-varying measure for financial development in each country, as measured by either of the two alternative standard variables: (1) *Total private credit over GDP* and (2) *Total Capitalization*, which is total private credit plus stock market capitalization over GDP. This estimation is first performed on the whole sample of countries and then separately on developed and developing countries. The separate samples estimations imposes less constraints given that it allows the estimated coefficients (for both, those of our variables of interest and those of the rest of controls) to differ between developed and developing countries. In this sense, given the hypothesis that we aim at testing, we expect  $\lambda_3$  to be positive and  $\lambda_1$  negative. Meaning that production in financially intensive sectors should be positively related to higher return to capital only if there is a sound financial system capable of efficiently intermediating resources to these sectors.

Estimation results for the MPK analysis are presented are presented in the following section 4.4.2.

## 4.4.2 Results

	Dependent variable: lnMPKL	
	(1)	(2)
External dependence	-0.27 (-1.14)	-0.62 <sup>a</sup> (-2.81)
Fin. Development	0.00 (0.10)	0.00 (0.03)
$1[Dev_i = 1] \times \text{External dependence}$		1.01 <sup>a</sup> (4.27)
<b>Controls</b>		
Natural resources rents	-0.01 (-0.44)	-0.03 (-1.63)
Trade openness	0.06 (0.36)	0.04 (0.27)
Chinn-Ito index	0.03 (0.28)	0.05 (0.71)
Democracy Acc.	0.01 (0.60)	0.01 (0.63)
Government Stability	-0.00 (-0.23)	-0.00 (-0.22)
Law and Order	0.03 (0.88)	0.03 (0.93)
Internal Conflict	-0.01 (-0.46)	-0.01 (-0.51)
Country F.E.	Yes	Yes
Time F.E.	Yes	Yes
Observations	590	590
$R^2$	0.904	0.916
Adjusted $R^2$	0.891	0.904
F	2.80	6.27

*t* statistics in parentheses. All variables in logs.

All regressions include country time-varying controls, country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.3:** MPK, External dependence and Overall development

Table 4.3 shows the estimates for the basic MPK unconditional specification 4.1 and for specification 4.2, where the effect of financial dependence is allowed to depend on the overall development of the country, captured by the dummy variable,  $1[Dev_i = 1]$ . Both specifications are performed on

the whole sample of countries.

The estimated coefficient on External Dependence,  $\hat{\lambda}_1$ , in column (1), is negative but insignificant. Suggesting, therefore, that there is no overall effect of specializing in financially intensive sectors on the MPK of a country. However, this relation seems to be hiding both a strong negative and a strong positive effect at the same time. This is confirmed by the results in column (2), where the effect is allowed to adjust for developed and developing countries.  $\hat{\lambda}_1$  becomes stronger in magnitude and significant at the 1-percent level, while the coefficient on the interaction term with the development dummy,  $\hat{\lambda}_2$  is positive and also significant at highest levels. Where, the interpretation is this that production in financially intensive sectors is on average, negatively related to the aggregate return of capital in a developing country while the relation is positive for developed countries ( $\hat{\lambda}_2 > \hat{\lambda}_1$  in absolute terms).

Are these differences among developed and developing countries due to the existence of financial frictions? This question is assessed with the help of specification 4.3, where the effect of specializing in financially intensive sectors is estimated conditional on the country's level of financial development. Table 4.4 displays these results, where columns (1) and (2) estimations correspond to the unconditional and conditional (on financial development) MPK regressions on the whole sample of countries, columns (3) and (4) report the results on the High income countries sample and columns (5) and (6) on the developing countries sample (Low and Middle Income economies).

From the comparison between the signs and significance of the *External Dependence* coefficients in the different MPK regressions an interesting pattern arises: when all countries are pooled together, there seems again to be no average effect of specializing in financially dependent sectors,

	Dependent Variable: ln PMPKL					
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
External dependence	-0.27 (-1.14)	-2.00 <sup>a</sup> (-5.27)	0.38 <sup>a</sup> (3.77)	-0.07 (-0.11)	-0.54 <sup>b</sup> (-2.43)	-2.37 <sup>a</sup> (-5.62)
Fin. Development	0.00 (0.06)	0.63 <sup>a</sup> (5.39)	-0.06 (-1.24)	0.06 (0.34)	0.08 (1.37)	0.88 <sup>a</sup> (4.20)
External Dep. × Fin. Development		0.45 <sup>a</sup> (5.79)		0.09 (0.73)		0.56 <sup>a</sup> (4.21)
<b>Controls</b>						
Natural resources rents	-0.01 (-0.45)	-0.04 <sup>c</sup> (-1.92)	-0.02 (-1.00)	-0.02 (-1.02)	-0.06 (-0.91)	-0.10 <sup>c</sup> (-1.76)
Trade openness	0.07 (0.37)	0.06 (0.36)	-0.00 (-0.00)	0.01 (0.04)	-0.05 (-0.24)	-0.03 (-0.18)
Chinn-Ito index	0.03 (0.30)	0.07 (0.88)	0.10 (1.04)	0.10 (1.08)	-0.05 (-0.58)	-0.02 (-0.22)
Democracy Acc.	0.01 (0.58)	0.02 (1.04)	0.04 <sup>c</sup> (1.89)	0.03 <sup>c</sup> (1.86)	-0.03 (-1.19)	-0.01 (-0.71)
Government Stability	-0.00 (-0.23)	-0.00 (-0.07)	0.00 (0.23)	0.00 (0.29)	0.00 (0.22)	0.00 (0.32)
Law and Order	0.03 (0.88)	0.03 (1.08)	0.01 (0.53)	0.01 (0.57)	0.07 (1.44)	0.08 <sup>c</sup> (1.80)
Internal Conflict	-0.01 (-0.46)	-0.00 (-0.37)	-0.01 (-0.62)	-0.01 (-0.66)	-0.03 (-1.37)	-0.03 (-1.37)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	590	590	332	332	258	258
$R^2$	0.904	0.918	0.947	0.947	0.901	0.911
Adjusted $R^2$	0.891	0.906	0.937	0.937	0.880	0.892
F	2.82	7.52	16.30	15.22	41.37	8.53

*t* statistics in parentheses. All variables in logs.

All regressions include country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.4:** MPK, External dependence and Financial development

given that  $\hat{\lambda}_1$  is not even significant at the lowest level of acceptance. However, the unconditional regressions results (for High income and Low-Middle income) suggest that this apparent insignificance is due to the highly significant and opposite effects that *External Dependence* has on

developed and developing countries' MPK. Very interestingly, when the interaction term with financial development is introduced for the whole sample, the magnitude of the coefficient on *External dependence* becomes 7 times bigger and statistically significant at the highest levels, while the sign of the interaction is positive and also significant at the 1-percent level. This means that for a given country in our sample, on average, increasing its local production of financially intensive goods is negatively related to its aggregate MPK, unless it works under a sufficiently developed financial system. Nonetheless, the total effect remains on average largely positive given that it requires a level of financial development lower than 4.4 for the total effect of *External dependence* to be negative, while the median level of financial development is 66.7.

Regarding each of the groups of countries separately, the results seem to hint at the same effect and in favor of our hypothesis. For High income countries,  $\hat{\lambda}_1$  is positive and significant at the 1-percent level for the unconditional regression. While it becomes statistically insignificant and the sign flips when it is interacted with financial development. Furthermore, neither the coefficient of the interaction term is significant at any level of acceptance. Exactly, the opposite happens to Low and Middle Income countries, where  $\hat{\lambda}_1$  has a significant, important (in magnitude, with respect to the ones in the whole sample of countries) and negative effect on MPK in both specifications. On top of this, the introduction of the interaction term strengthens the negative main effect of *External Dependence* with respect to the unconditional regression (being 4.3 times more important in absolute terms). Where, both effects become significant at the 1-percent level and go in the opposite direction ( $\hat{\lambda}_1 < 0$  and  $\hat{\lambda}_3 > 0$ ). Hence this findings point in the direction of our priors, where the existence of financial frictions in developing countries add to the reasons explaining why the level of the aggregate return to capital is not as high as predicted by their relatively low level of capital-to-labor ratios.



Given that we are exploiting the within variation of the data, this means that for a given High income country - where the financial system is considered to be sufficiently developed, producing in financially intensive sectors improves, on average, the aggregate return to capital. Furthermore, providing additional credit to the economy doesn't seem to matter for this effect to take place, possibly because firms already get enough finance. On the other hand, in developing countries, the results show that providing additional credit to the economy is a necessary condition in order to expand production of financially intensive sectors. Suggesting, thus, that firms do not get enough financing in these economies, given their relatively less efficient financial intermediation.

Concerning the controls variables, most of them are self-explicative and display the expected sign: from the overall country risk -represented by *Democracy Accountability*, *Government Stability*, *Law and Order* and *Internal Conflict*- only *Law and Order* appears to be significant for Low and Middle income countries and *Democracy Accountability* seems to matter only for developed countries. The negative coefficient of financial development for developed countries might seem somehow strange, even if it is estimated without precision. However, one possible explanation for this can be that credit, efficiently intermediated to firms, translates into more capital. Thus, lower aggregate MPK as well since it is a decreasing function of capital given the classical hypothesis of diminishing marginal returns. On top of this, the coefficient on *Chinn-Ito Index* in developing countries may also be a bit puzzling at a first glance. On the one hand, *Chinn-Ito Index* reflects financial openness of a country and its coefficient has a negative sign. However, surprisingly, it doesn't appear to be significant. There can be two possible explanations for these results. Either, foreign finance does not necessarily translate into capital given the relatively inefficient domestic financial markets. Or *Chinn-Ito Index* is not necessarily reflecting overall capital openness in our estimations. The latter argument can be explained by the fact that financial openness is likely to be collinear with *Trade openness*.

Additionally, given that natural resources abundance should be a source of comparative advantage, although not necessarily related to economic performance (as suggested by the negative sign on its coefficient and as has been shown by several authors), it may be the case that for these countries there is still a trade-off in producing in financially intensive sectors despite being financially underdeveloped.<sup>24</sup> Therefore, the argument put forward in this analysis should be less relevant for these countries. In this sense, we replicate the analysis by excluding countries whose rents/GDP are above 10 percent. As expected, we find that the results are strengthened. Although only for developing countries (in magnitude), while for the whole sample, the estimates display lower coefficients. Nonetheless, statistical significance remains at the highest levels. This is not surprising given that on the one hand, out of the 9 resource intensive countries only one of them is a developed economy (Norway). On the other hand, from the benchmark results we know that the mechanism that we test is not at play in developed countries (where production in financially intensive sectors is positively related to MPK). These estimations can be found in Section B.5.1 in the Appendix, together with the list of countries excluded. Finally, when an alternative measure for financial development is considered, the results point in the same direction. Estimation results for equation 4.3 with the logarithm of *Total Capitalization* as a proxy for the efficiency of the financial system are reported in Table B.11 in the Appendix.

Thus, before turning to the analysis on the effect of financial frictions on capital inflows in developing countries, it is convenient exploring the drivers of production in financially intensive sectors. Descriptive statistics in section 4.3.2 has shown that before 2000 production in these sectors among developed and developing countries was not significantly different despite the large differences in financial development. It is therefore, convenient shedding some light on what are the determinants of these

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<sup>24</sup>For a recent overview of the literature on the Resource Curse see: Frankel (2012).

patterns in developing countries.

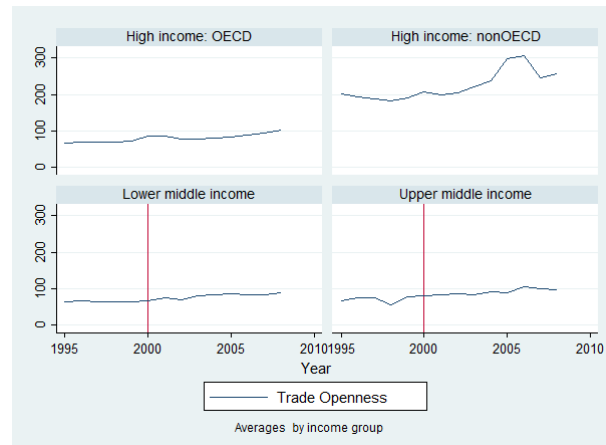
#### 4.4.3 What drives specialization in financially intensive sectors?

From the results of the mean differences t-test for specialization in financially intensive sectors between developing and developed countries (Table 4.2) we can't reject the hypothesis that differences in specialization in these sectors are equal to zero before 2000. However, these differences are statistically significant at the highest levels for the following years. Where the main driver of these result seems to be the change in the production structure in developing countries, which moves towards a specialization in less financially intensive sectors. Thus, perhaps a more pertinent question to ask is: why, despite the strong differences in financial development, these differences in production were not significant in the first place?

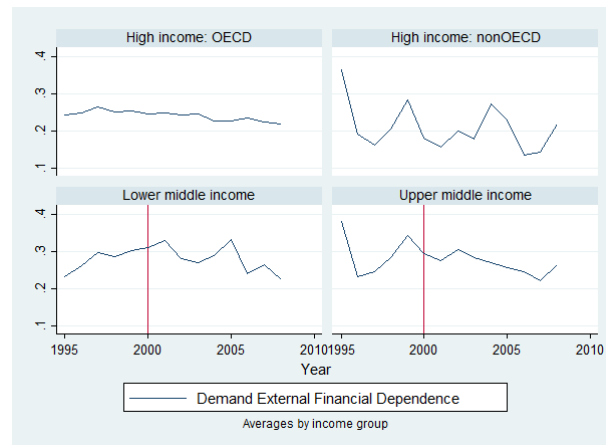
In Antràs and Caballero (2009)'s model, besides trade integration and financial development, demand for financially intensive sectors determines production in these sectors. Additionally, when trade is allowed in financially underdeveloped economies, resource allocation is improved and capital inflows should flow to less financially intensive sectors. This, because it is assumed that foreign capital doesn't substitute for underdevelopment of the financial system.<sup>25</sup> Nonetheless, existing evidence suggests that foreign capital substitutes for financial underdevelopment. For instance, Manova (2008) shows that capital account liberalizations increase production disproportionately more in financially intensive sectors that require more external finance, where the effects are more pronounced in

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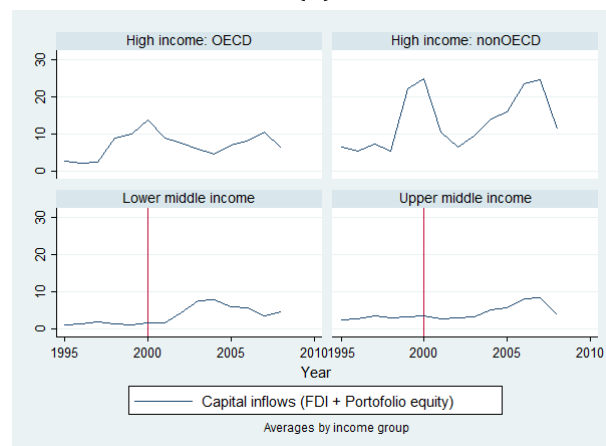
<sup>25</sup>Financial development is viewed as the capacity of the financial intermediaries to overcome a problem of asymmetric information that limits the amount of capital which borrowers can pledge to lenders. See Section 4.2.1 for details.



(a)



(b)



(c)

**Figure 4.5:** Averages by income group of (a) Trade Openness (b) Demand External Financial Dependence (c) Capital inflows.

countries with less developed financial systems.

Therefore, assessing which of the two relations between domestic financial markets and capital inflows is at play should provide a clearer understanding of the patterns of production of these sectors in developing economies. In this sense, taking a look at Figure 4.5, which depicts the evolution of these variables averaged by income group, shows that after the year 2000: (1) trade has modestly followed an increasing trend in developing countries, (2) at the same time as demand for financially intensive sectors has clearly decreased in these countries, and (3) capital inflows have also followed an upward evolution in these economies. The two first trends are in line with lower production in financially intensive sectors. However, the effect of foreign capital on production in these sectors depends on the way in which foreign capital interacts with the domestic financial system. Where a complementarity relation, as suggested by Antràs and Caballero (2009)'s model, should result in foreign capital flowing to less financially intensive sectors. While a substitutability should result in an increase of financially intensive production. In this sense, the patterns that we have observed after 2000, where specialization moved towards less financially intensive sectors at the same time as more foreign capitals have been directed to developing countries points towards a complementarity relation rather than a substitutability between foreign capital and domestic financial systems (given the relative inertia of the latter).

An econometric analysis allows a better interpretation of these patterns. Hence concentrating on developing countries and integrating these determinants we perform a two-way fixed effects regression on production in financially intensive sectors. More specifically, the following specification for developing countries is estimated with an OLS model:

$$\begin{aligned}
\text{Supply External Dep}_{it} = & \alpha_1 \text{Demand External Dep}_{it} + \alpha_2 \text{Trade}_{it} \\
& + \alpha_3 \text{Fin. Development}_{it} + \alpha_4 \text{Capital inflows}_{it} \\
& + \alpha_5 \text{Demand External Dep}_{it} \times \text{Trade}_{it} \\
& + \alpha_6 \text{Fin. Development}_{it} \times \text{Capital inflows}_{it} \\
& + \beta' X_{it} + \eta_i + \psi_t + \epsilon_{it}
\end{aligned} \tag{4.4}$$

Where *Supply External Dep<sub>it</sub>* and *Demand External Dep<sub>it</sub>* are the log of the weighted average financial dependence of production (i.e., what we have called financially intensive production earlier) and of demand in manufacturing sectors, respectively. *Capital inflows<sub>it</sub>* include total FDI and portfolio inflows, *Fin. Development<sub>it</sub>* is credit to private sector and  $\eta_i$  and  $\psi_t$  are country and year fixed effects. Furthermore, following the comparative advantages theory, capital-to-labor ratios should be a determinant of a country's production structure. Additionally, institutional controls and abundance of natural resources are accounted for. All of these are included in  $X_{it}$ . Errors are clustered at the country level.

The computation of *Demand External Dep<sub>it</sub>* follows the same logic as production in financially intensive sectors, where instead of using sector-country-year value added it uses apparent consumption at the same dimension from the IDS UNIDO database. More specifically it is calculated as follows:

$$\text{Demand External Dep}_{it} = \sum_{k=1}^{22} \left[ \text{External Dep}_k \times \frac{\text{Consumption}_{kit}}{\text{Consumption Manu}_{fit}} \right]$$

## 4.4.4 Results

	Dependent variable: Supply External dependence				
	(1)	(2)	(3)	(4)	(5)
External dep. Demand	0.53 <sup>c</sup> (1.97)	-0.00 (-0.05)	0.63 <sup>b</sup> (2.49)	-0.00 (-0.09)	0.51 <sup>c</sup> (2.03)
Trade openness	-0.10 (-0.99)	-0.02 (-0.18)	-0.19 <sup>c</sup> (-1.99)	-0.00 (-0.04)	-0.14 <sup>c</sup> (-1.82)
Capital inflows	0.03 (1.18)	0.16 <sup>a</sup> (3.26)	0.17 <sup>a</sup> (3.76)	0.12 <sup>a</sup> (2.96)	0.12 <sup>a</sup> (2.98)
Fin. Development	-0.03 (-0.75)	0.03 (0.70)	0.02 (0.61)	-0.01 (-0.16)	-0.01 (-0.30)
External dep. Demand × Trade openness	-0.12 <sup>c</sup> (-2.01)		-0.14 <sup>b</sup> (-2.48)		-0.11 <sup>b</sup> (-2.09)
Capital inflows × Fin. Development		-0.04 <sup>a</sup> (-3.38)	-0.04 <sup>a</sup> (-3.80)		
Capital inflows × Democracy Acc.				-0.03 <sup>a</sup> (-2.86)	-0.03 <sup>a</sup> (-2.86)
<b>Controls</b>					
Natural resources rents	-0.01 (-0.46)	0.01 (0.21)	0.00 (0.06)	-0.01 (-0.33)	-0.01 (-0.46)
Capital per worker	-0.20 <sup>b</sup> (-2.36)	-0.17 <sup>b</sup> (-2.21)	-0.18 <sup>b</sup> (-2.40)	-0.20 <sup>a</sup> (-3.02)	-0.21 <sup>a</sup> (-3.02)
Investment Profile	-0.02 (-1.50)	-0.02 (-1.46)	-0.01 (-1.50)	-0.01 (-1.12)	-0.01 (-1.08)
Democracy Acc.	0.02 (1.58)	0.01 (0.64)	0.01 (0.95)	0.03 (1.35)	0.03 (1.65)
Country F.E.	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes
Observations	190	190	190	190	190
$R^2$	0.907	0.913	0.916	0.916	0.918
Adjusted $R^2$	0.880	0.888	0.891	0.892	0.894
F	2.26	2.55	2.56	2.70	2.84

t statistics in parentheses

All regressions include time-varying country level controls, country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ **Table 4.5:** Production in financially intensive sectors in developing countries

Estimate results for specification 4.4 are found in column (3) in Table 4.5. Column (1) displays the results when only the interaction between

Demand for financially intensive production and Trade openness is considered, while column (2) includes only the interaction between Financial development and Capital inflows. It can be seen that the overall effect on financially intensive production is not significantly different from zero for each of these variables, where their effect mainly depends on additional factors (their interactions). Results from our preferred specification in column (3) show that the coefficient on demand for financially intensive sectors is positive and significant (at the 5 percent level), the coefficient on Trade openness is negative (at the 10 percent) and the interaction of these is negative and significant as well (at the 10 percent). Therefore, suggesting that trade does allow a better allocation of resources by decoupling demand and production decisions. Where stronger demand for financially intensive, translates in more production in these sectors. However, if trade is allowed production moves towards less financially intensive sectors and demand for financially intensive sectors is served with foreign production.

Concerning the coefficient on capital inflows, we find that it is positive and significant at the highest levels, while financial development doesn't seem to have an average effect on financially intensive production in these countries (although it is positive). While the interaction with capital flows is negative and significant at highest levels. This means that foreign capital allows expanding production in financially intensive sectors, particularly when there is a weaker level of financial intermediation. Pointing therefore to a substitutability rather than a complementarity between foreign capital and domestic financial underdevelopment. Which strongly supports Manova (2008)'s findings, where foreign capital has resulted in an expansion of financially intensive sectors in countries that have undertaken capital account liberalizations, with stronger effects in more financially underdeveloped countries. Considering that many countries in our sample liberalized capital accounts between 1987-2000, this can provide an explanation for the relatively similar patterns of production in financially intensive sectors between developed and developing countries before 2000.



At first sight, this seems to be in sharp contrast with the predictions in Antràs and Caballero (2009), where foreign capital doesn't substitute for domestic financial development and where capital inflows should go to less financially intensive sectors in countries with weaker financial markets. This would be the case if the coefficient on the interaction term on capital inflows and financial development was positive. A way of reconciling this apparent opposing views is that following the capital account liberalizations that took place in the 90's, foreign capital might indeed have enabled expanding production in sectors that were more in need of external finance (hence in countries with weaker financial systems). However, the fact that foreign capital allows an expansion of these sectors doesn't necessarily mean that capital inflows substitute for financial underdevelopment if one considers the negative relation between production in these sectors and MPK found in the previous section. Where foreign capital doesn't replace the financial system in its efficient intermediation role. That is, the ability of overcoming asymmetric information problems in credit markets, which is essential in order to channel resources towards the most productive firms. Therefore, the lack of sound financial markets preclude an efficient intermediation of capital (towards the most productive firms) and this in turn translates in capital missallocation.

This echoes the findings in a recent paper by Gopinath et al. (2015) that studies the allocation of resources in European countries. They show that cheaper access to capital (allowed by the deeper integration) resulted in lower MPK's in Southern European countries due to the absence of deep financial markets. Where foreign capital resulted in misallocation of capital and lower productivity in Southern Europe (Spain, Italy and Portugal), while it was not the case for other European countries with efficient financial sectors (France, Germany and Norway). This is also in line with Prasad et al. (2007) who show that developing countries -and more specifically, less financially developed countries- have limited capacity to

absorb foreign capital. Their results suggest that foreign capital needs a sound domestic financial system in order to be effectively channeled into productive projects. In this sense, they argue that financial underdevelopment -by limiting the ability to absorb capital, could be a good candidate in explaining the lower capital ratios in developing countries.

Then, the question that may arise at this point is: what has led to the changes towards a less financially intensive production after the year 2000? A proper analysis might be required in order to assess this question given that our current analysis doesn't account for this. Nonetheless, some suggestive facts point towards economic crises. For instance, consider Upper Middle income countries for which we have seen a clear financial downturn around this period in Figure 4.3. At the same time, Figure 4.4 has shown a clear decrease in financially intensive production around this period. Actually, out of the 10 countries in this group, 6 experienced a deep crisis or a mild financial downturn around 1998-2000.<sup>26</sup> Given that many of these countries experienced economic crises around 1998-2000, this may have led to a more efficient reorganization of production. Where the MPK patters that we have observed are in line to an improved allocation of resources in these countries after 2000. This could be motivated by the creative destruction view, where crises facilitate the exiting process of unproductive firms and liberate resources that are channeled to more productive ones, put forward longtime ago by Schumpeter (1934). For instance, Ranciere et al. (2006) studying the dual effect of financial liberalizations on crisis and growth and find that countries with higher incidence of crises have experienced faster growth relative to those with smooth credit paths.

However, this interaction effect between capital inflows and financial development is not robust to the alternative measure of financial develop-

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<sup>26</sup>These Upper Middle Income countries are: Bulgaria, Colombia (crisis) , Latvia (mild crisis), Lithuania, Malaysia (crisis), Mexico (crisis), Poland, Romania, Turkey (crisis) and Uruguay (crisis).

ment that we consider in this analysis: Total capitalization, which is the sum of private credit and market capitalization as a share of GDP.<sup>27</sup> These results suggest that financial development is only one aspect of the whole picture. Which is confirmed by the results provided in columns (4) and (5), where instead of including financial development we consider a proxy variable for overall quality of institutions: Democracy and Accountability. These results point exactly in the same direction as those obtained with financial development (as a proxied by Credit to Private Sector).

Finally, at odds with theory, regardless of the measure used to proxy for factor abundance (whether it is capital-to-labor ratios or labor share in total production), regression results suggest that stronger labor abundance is positively and significantly statistically related to production in financially intensive sectors in developing countries. This might be explained by a possible complementarity between labor and capital.

Before turning to next section, it is worth mentioning that accounting for the interaction term between natural resources rents and capital inflows suggests that more foreign capital increases production in financially intensive sectors when natural resources rents are higher. However this effect becomes negative (although insignificant) when excluding natural resources intensive countries. And it also vanishes when considering the interaction between capital inflows and financial development. Meaning that more factors other than the existence of natural resources determine financially intensive production under financial underdevelopment. Particularly, the way how financial markets and foreign capital interact.<sup>28</sup>

Now, in the following subsection we turn to the evaluation of the effect of these financial frictions on the inward FDI in developing countries.

<sup>27</sup>However the interaction effect between trade and demand for financially intensive goods are robust remain significant. Tables not reported but available upon request

<sup>28</sup>Tables not reported but available upon request.

#### 4.4.5 FDI developing countries

Are financial frictions a possible additional explanation of the Lucas' Paradox? In order to assess this question, we analyze how financial dependence affects capital inflows in financially underdeveloped economies and whether this effect varies according to the level of financial development of these economies. To that end, we restrict our sample to Middle and Low income countries -which by selection are relatively less financially developed than High income countries- and we estimate the effect of external financial dependence on FDI inflows in a gravity-like framework. Subsequently, with the purpose of assessing whether the mechanism through which production in financially intensive sectors affects FDI inflows is through the existence of financial frictions, we assess its effect conditional on the level of financial development. Hence the following two gravity equations for bilateral inward FDI flows are estimated by OLS,

$$\ln(FDI_{ijt}) = \alpha + \lambda_1 External\ Dep_{it} + \phi' X_{ijt} + \beta' X_{it} + \delta_{ij} + \psi_t + \epsilon_{ijt} \quad (4.5)$$

and

$$\begin{aligned} \ln(FDI_{ijt}) = & \alpha + \lambda_1 External\ Dep_{it} + \beta_1 Fin\ Dev_{it} \\ & + \lambda_2 (External\ Dep_{it} \times Fin\ Dev_{it}) \\ & + \phi' X_{ijt} + \beta' X_{it} + \delta_{ij} + \psi_t + \epsilon_{ijt} \end{aligned} \quad (4.6)$$

where  $FDI_{ijt}$  are FDI inward flows in a developing country  $i$ , from partner  $j$ , in year  $t$  and where partners can be both developed and developing

countries.  $X_{ijt}$  are bilateral time-varying controls such as the product of the GDP of both partners and bilateral trade costs in year  $t$ .  $Fin Dev_{it}$  is financial development as measured by *Total private credit over GDP*.  $X_{it}$  are additional domestic controls varying over time, such as trade openness, financial openness, country overall risk and institutions related variables (all in logarithms). The latter are of especial importance since *weaker institutions* in developing countries have been found to be a strong determinant of capital flows to these countries and a potential explanation of the Lucas' Paradox<sup>29</sup>. Finally,  $\delta_{ij}$  is the dyadic fixed effect for domestic and partner, and  $\psi_t$  are time effects. The dyadic term captures important gravity variables that don't vary over time such as distance, contiguity, common language, colonial ties and common trade agreement (to the extent that it does not vary over time). The standard errors are clustered at the country-pair level to account for heteroskedasticity and non-independence among repeated observations within countries pairs.

Before presenting the empirical results, it is convenient to motivate the use of gravity in this framework. Gravity equations, despite of its earlier lack of theoretical foundation, have long been used in order to explain trade flows between two partners given their extremely good data fitting<sup>30</sup>. Thus, recent literature has provided them with a theoretical micro foundation which requires an explicit admittance of countries' multilateral resistance terms in order to have theory-consistent estimations.<sup>31</sup> Roughly speaking, accounting for multilateral resistance translates in taking into account cross-country differences in terms of prices and fixed costs of trading. Within a panel framework, these effects are controlled for by introducing fixed effects at the country-time dimension for importer and exporter and country-pair dummies. In this paper, while we introduce the latter, we are not able to introduce time-varying country dummies due to

<sup>29</sup>See for instance: Alfaro et al. (2009).

<sup>30</sup>The so-called gravity variables (i.e., distance and GDP, in its simplest form) where introduced by Tinbergen (1962) and, ever since, have extensively been used in international trade given their remarkable empirical performance in predicting trade flows.

<sup>31</sup>See Anderson and Van Wincoop (2003).

the fact that our variables of interest vary on the country-time dimension. Therefore, we will content to use as much as time-varying controls as possible, and of especial interest, we introduce bilateral time-varying trade costs which should take care -to some extent- of multilateral resistance since it accounts for changes in trade costs across all bilateral partners.

Similarly, gravity variables have been shown to fit data on international financial flows at least as well as trade in goods, where distance is strongly and negatively correlated with assets trade, which seems to reflect informational costs<sup>32</sup>. At first sight, this could be perplexing to a certain extent, when the type of capital flows that one has in mind is FDI, where distance could be positively related to FDI given the proximity-concentration trade-off<sup>33</sup>. However, this theoretical negative effect is rarely found in the data given the "aggregation biases" and the fact that purely horizontal FDI is seldom seen in practice.<sup>34</sup> Furthermore, since distance is used as an utter control in this paper, we can safely dismiss its effect, which is captured by the country-pair fixed effects. Additionally, one of the purposes of using gravity equations has always been analyzing the trade effect of different trade policies, therefore the gravity ingredients become mere controls when the actual interest is the trade effect of a given additional variable. In the same way, this paper uses gravity-type variables aiming at controlling for all possible determinants of capital inflows and introduces the additional variables of interest: financial frictions.

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<sup>32</sup>See Portes and Rey (2005) and Aviat and Coeurdacier (2007) for motivations on the use of gravity equations to explain bilateral capital flows.

<sup>33</sup>This trade-off is related to the fact that FDI and trade can be substitutes since they are alternative ways of serving a foreign market. Specifically, this is the case of horizontal FDI where distance increases the incentives for investing abroad given that trade costs are an increasing function of distance.

<sup>34</sup>See Blonigen (2001) and Head and Ries (2001) for a discussion on the difficulty in identifying the substitutability between FDI and exports implied by pure horizontal FDI.

#### 4.4.6 Results

Table 4.6 presents the FDI gravity equations, where specifications 4.3 and 4.5 are estimated for developing countries, in column (1) and (2) respectively. Where the effects of interest are the coefficients on *External Dep<sub>it</sub>* and its interaction with *Fin. Development<sub>it</sub>*.

The FDI gravity equations, also confirm our hypothesis: producing in financially intensive sectors is negatively related to FDI inflows in developing countries given that  $\hat{\lambda}_1$  is negative, significant at the 5-percent level and robust to the inclusion of standard gravity controls. Furthermore, the effect is robust to the introduction of other possible country time-varying determinants of capital inflows, especially those that are related to *institutions* which have been put forward in the literature (Alfaro et al. (2008)).

When we assess whether this negative effect depends on the development of the financial markets, by interacting it with financial development in column (2),  $\hat{\lambda}_1$  becomes much stronger in magnitude and remains statistically significant at the 5-percent level. While  $\hat{\lambda}_2$  is positive and highly significant as well. The coefficient of financial development is also strong and significant. The positive sign might be an indication that FDI needs a well-functioning financial system in order to take place, which is also in line with the results in Prasad et al. (2007). A counterargument at which one could think is the fact that FDI should actually substitute for the malfunctioning of the domestic financial system and therefore, one should expect it to be negatively related to financial development<sup>35</sup>. Even if this might be true, it is also reasonable to think that once an affiliate is established in a foreign country (i.e., first FDI has already taken place), *ex post* it needs a good domestic financial system in order to well develop its investment project (e.g., finance day to day expenses, face an unexpected shock, reorganize or expand its production, etc.), investors can anticipate

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<sup>35</sup>See for instance, Hausmann and Fernandez-Arias (2000)

	Dependent Variable: $\ln \text{FDI}_{ijt}$	
	(1)	(2)
External dependence	-0.73 <sup>b</sup> (-2.12)	-4.70 <sup>b</sup> (-2.51)
Fin. Development		1.90 <sup>b</sup> (2.49)
External dependence $\times$ Fin. Development		1.04 <sup>b</sup> (2.17)
<i>Controls</i>		
GDP_ijt	0.60 <sup>a</sup> (3.24)	0.46 <sup>b</sup> (2.08)
Trade Costs_ijt	-0.56 (-1.52)	-0.48 (-1.28)
Trade openness	0.09 <sup>b</sup> (2.08)	0.08 <sup>c</sup> (1.87)
Chinn-Ito index	0.41 (1.41)	0.31 (1.08)
Corruption	-0.10 (-0.80)	-0.09 (-0.79)
Government Stability	0.01 (0.23)	0.01 (0.23)
Law and Order	-0.11 (-1.01)	-0.10 (-0.90)
Internal Conflict	-0.23 <sup>a</sup> (-3.43)	-0.24 <sup>a</sup> (-3.50)
Country-pair F.E.	Yes	Yes
Time F.E.	Yes	Yes
Observations	2704	2704
Adjusted $R^2$	0.763	0.764
F	21.67	19.59

*t* statistics in parentheses. ll variables in logs.

All regressions include country-pair F.E. and time F.E., errors clustered at country-pair level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.6:** FDI developing countries



this and incorporate it in their decision-making. All in all, there seems to be a great deal of evidence rather supporting the second view, which is also being echoed by our results<sup>36</sup>.

Additionally, in what concerns the control variables, it can be seen that only the bilateral size variables, overall domestic trade openness and the internal conflict dummy (with the highest significance) -all of them having the expected sign- seem to remain important determinants of bilateral FDI. This might be a consequence of the restrictions imposed by the country-pair and time effects. In sum, since we are examining the within variation of the variables, we can say that for the average developing country from our sample, expanding its production towards the more financially dependent sectors unambiguously discourages FDI inflows from the rest of the world, unless the country has a sufficiently developed financial market (more private credit, in this case).

Summing up, our analysis of the different impacts of a higher specialization in financially dependent sectors, shows that its effects on MPK and FDI inflows differ dramatically depending on the financial system's efficiency. A well functioning financial system seems to be a necessary condition for this variable to positively affect MPK and attract FDI flows, otherwise, it is significantly and negatively related to both variables. These results comply with the theory developed by Antràs and Caballero (2009), where the lower development of the financial system creates an artificial comparative disadvantage in the sector that uses it intensively. Therefore, specializing according to its comparative advantage allows circumventing the negative effects on aggregate return to capital within a country producing under a worse financial system. This in turn, increases the incentives for capital inflows from the rest of the world.

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<sup>36</sup>See for example: Alfaro et al. (2009) and Desbordes and Wei (2014).

These findings combined with the stylized facts presented earlier, suggest that the production in financially dependent sectors is too high for these developing countries considered in our sample, given their financial development level. Which in turn, seems to be one plausible explanation of why MPK is not higher in these countries where capital ratios are significantly lower than in richer countries. This indicates that there is scope for improvements in MPK in financially underdeveloped countries, given their lower relative capital per worker, and that one way through which this could be done is by alleviating the misallocation due to a weaker financial system. Thus, either by improving their financial intermediation or by increasing specialization according to their comparative advantage. Nevertheless, one could think the second option to be unrealistic and even undesirable given the fact that more financially dependent sectors are usually the more technological and the ones that bring about the highest innovation, which seems to be essential for growth. Therefore, we believe that a better interpretation of our results should be that financial development is crucial for increasing aggregate return to capital in developing countries in order to overcome the misallocation problems within these economies.

## 4.5 Sensitivity Analysis

### 4.5.1 Robustness MPK

In this section we consider two alternative "naive measures" of MPK : a first one including only the correction concerning the relative prices of capital (PMPKN), and a second one without any correction (MPKN). Following the notation in Caselli and Feyrer (2007), where N stands for "naive" and P for "price corrected".<sup>37</sup>

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<sup>37</sup>See section 4.3 for more details on the differences between the naive and proper measures.

We begin by presenting the estimations of equations 4.1 and 4.2 for each of these alternative MPK's in Table 4.7. Next we estimate of equation 4.3, where the effect of *External dependence* varies according to the level of financial development and is estimated for the three different samples. These results are reported in Table 4.8 for the price-corrected measure and in Table 4.9 for the MPK measure with no corrections.

Additionally, one clear econometric result pointing to the validity of Antras and Caballero's model has been added to the analysis of production in financially intensive sectors: when both types of countries are considered, an interaction term between a dummy for developed countries and trade openness shows that trade is significantly and positively related to production in financially intensive sectors in developed countries, while the main trade effect (which reflects the coefficient for developing countries) is negative although insignificant.

Results in Table 4.7, show that the results are robust to alternative MPK measures, although the less corrections introduced in the MPK measure, the lower the effects and the less precisely estimated. However, the coefficient on the interaction term between *External dependence* and the overall development of the country, remains significant at the 5-percent level even with the "naïvest" MPK measure (and at the 1-percent level with the price-corrected measure). Suggesting, thus, that production in financially intensive sectors is negatively related to MPK in developing countries while the relation is positive for developed countries (given that it is still the case that  $\hat{\lambda}_2 > \hat{\lambda}_1$ ).

The same happens with the effect on the alternative MPK measures when we examine *External dependence* conditional on the level of financial development, where the magnitude of the coefficients is lower than before

Dependent variable:	lnPMPKN		lnMPKN	
	(1)	(2)	(3)	(4)
External dependence	-0.21 (-0.92)	-0.48 <sup>b</sup> (-2.09)	-0.22 (-1.08)	-0.42 <sup>c</sup> (-1.88)
1[ <i>Dev<sub>i</sub></i> = 1] × External dependence		0.81 <sup>a</sup> (3.21)		0.61 <sup>b</sup> (2.14)
Fin. Development	-0.01 (-0.39)	-0.02 (-0.52)	0.08 <sup>c</sup> (1.86)	0.08 <sup>c</sup> (1.87)
Controls	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
Observations	590	590	590	590
<i>R</i> <sup>2</sup>	0.925	0.934	0.879	0.885
Adjusted <i>R</i> <sup>2</sup>	0.915	0.925	0.863	0.868
F	2.34	2.95	6.10	7.31

*t* statistics in parentheses. All variables in logs except for IPR indexes.

All regressions include country and time F.E., errors clustered at country level.

<sup>c</sup> *p* < 0.10, <sup>b</sup> *p* < 0.05, <sup>a</sup> *p* < 0.01

**Table 4.7:** Alternative MPK measures and Overall development

but they point to the same direction. Table 4.8 displays estimation results for the price-corrected MPK measure, which remain significant at the 1-percent level. An interesting difference with respect to the "proper MPK measure" arises for High income countries: regardless of the specification considered,  $\hat{\lambda}_1$  is positive. Nonetheless, it is only significant (at the highest levels) for the unconditional regression, while it is estimated without precision when it is interacted with financial development (the interaction is even negative for price-corrected measure).

Concerning the "naivest MPK measure", in Table 4.9, where the coefficients display the lowest magnitude and significance with respect to our baseline specifications, the estimates still comply to our hypothesis. When the whole sample of countries is considered in column (2), the estimates of the interaction term as well as the main coefficient on *External dependence*

	Dependent Variable: ln PMPKN					
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
External dependence	-0.21 (-0.92)	-1.59 <sup>a</sup> (-3.61)	0.32 <sup>a</sup> (3.67)	0.50 (0.82)	-0.41 <sup>c</sup> (-1.84)	-1.93 <sup>a</sup> (-5.47)
Fin. Development	-0.01 (-0.39)	0.48 <sup>a</sup> (3.74)	-0.06 (-1.34)	-0.11 (-0.64)	0.06 (1.15)	0.73 <sup>a</sup> (4.75)
External dependence × Fin. Development		0.36 <sup>a</sup> (4.09)		-0.04 (-0.30)		0.47 <sup>a</sup> (5.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	590	590	332	332	258	258
$R^2$	0.925	0.935	0.936	0.936	0.920	0.930
Adjusted $R^2$	0.915	0.926	0.925	0.925	0.904	0.916
F	2.34	6.44	16.71	16.24	14.37	6.84

*t* statistics in parentheses. All variables in logs.

All regressions include country time-varying controls, country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.8:** Alternative MPK (including the price-correction) and Fin. development

	Dependent Variable: ln MPKN					
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
External dependence	-0.22 (-1.08)	-1.21 <sup>b</sup> (-2.53)	0.13 (0.76)	0.14 (0.19)	-0.39 <sup>c</sup> (-1.88)	-1.35 <sup>b</sup> (-2.51)
Fin. Development	0.08 <sup>c</sup> (1.86)	0.44 <sup>a</sup> (2.96)	-0.04 (-0.73)	-0.04 (-0.23)	0.10 (1.62)	0.53 <sup>b</sup> (2.13)
External dependence × Fin. Development		0.26 <sup>b</sup> (2.64)		-0.00 (-0.02)		0.30 <sup>c</sup> (2.01)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	590	590	332	332	258	258
$R^2$	0.879	0.885	0.858	0.858	0.890	0.894
Adjusted $R^2$	0.863	0.869	0.834	0.833	0.867	0.871
F	6.10	7.29	24.60	28.87	5.08	5.31

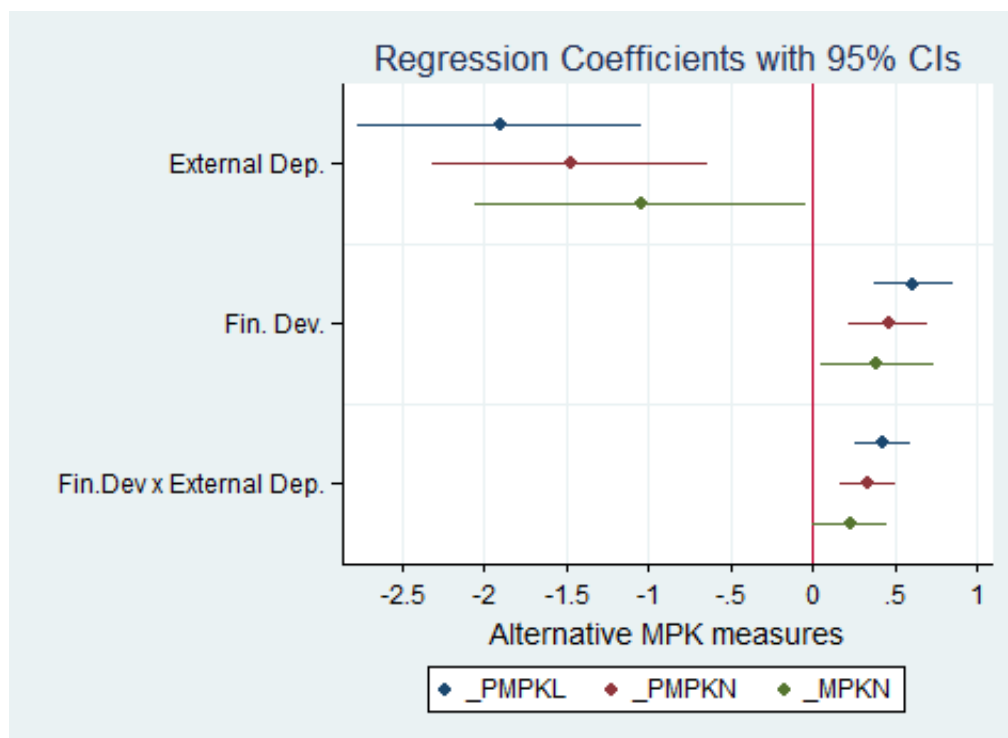
*t* statistics in parentheses. All variables in logs.

All regressions include country time-varying controls, country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.9:** Alternative MPK (no corrections at all) and Fin. development

are significant at the 5-percent level, while the one on *Fin. development* remains significant at the highest levels. Thus, again suggesting that fi-



Notes: Estimation results for equation 4.3 on all the alternative MPK measures.

**Figure 4.6:** Coefficients Plot among alternative MPK measures

nancially intensive production is negatively related to MPK when financial development is low. Finally, estimation results for Low and Middle Income countries, in column (6) point that this effects are mostly driven by these countries, where the effects are strengthened. However, the coefficients on financial development and on the interaction term are estimated with less precision but remain significant at 5 and 10-percent, respectively.

A graphical comparison of the different results with the alternative measures is displayed in Figure 4.6, where the different coefficients obtained are plotted, together with their confidence intervals. It can be seen that the results are robust to the alternative MPK measures, although the more corrections introduced in the MPK measure, the further away from zero is the coefficient and the narrower its confidence intervals. A possible inter-

pretation of these results is that the price-correction might be important when assessing the effects of financial frictions on MPK. Given that a less efficient financial market translates into costlier production in financially intensive sectors, these differences should be accounted for in the analysis. This is the case when the aggregate MPK measure is corrected for the fact that capital is relatively more expensive in less developed economies.

#### 4.5.2 Endogeneity concerns

First, concerning the FDI gravity equations, one could think that our results are likely to be endogenous if one has in mind a potential reverse causality from capital inflows to financial development and average external financial dependence of the country. This could be the case if foreign capital substitutes for the malfunctioning of the financial system. Nonetheless, even if this argument might be true at the aggregate level, we think that the fact of using bilateral data on FDI is a good way to be safe in terms of reverse causality, given that financial dependence and financial development are aggregate variables. For bilateral FDI to determine one of these aggregates, it would require that a country's partner's FDI inflows represent a sufficiently important share among the aggregate flows from the rest of the world. Additionally, from the stylized facts presented above, we can recall that one of the motivations for our empirical analysis is the relative inertia in the differences (concerning financial development and capital-to-labor ratios) and similarities (concerning average external dependence) across countries and over time. Thus, we think that there are good reasons to believe that these variables are not being causally determined by our measure of capital flows.

However, one could arguably be concerned about potential endogeneity problems related to a simultaneous determination of financial development and the production in financially intensive sectors. For instance, in

relation to this potential bias, Do and Levchenko (2007) find that domestic demand shapes the development of the financial system. Even though we don't claim any causality relation in this analysis, where the aim is to test the validity of Antràs and Caballero (2009)'s model and where the variables are considered as equilibrium outcomes, this section performs a robustness test for the MPK regressions accounting for possible endogeneity biases using lagged variables for our financial frictions proxies. Estimation are presented in Table 4.10.

Results concerning our the variables of interest remain significant at the highest levels using lagged variables for financial development and financial intensive production. However, the magnitude of the coefficients are slightly lower with respect to the baseline analysis in 4.4. Additionally, from the additional controls, the only that were significant become insignificant (i.e., "Natural resources rents" and "Law and Order").

#### 4.5.3 Future work

- With respect to endogeneity concerns, one could alternatively consider the use of an instrument for financial development in order to tackle possible concerns regarding the endogeneity related to a simultaneous determination of our variables. A possible future path in this direction, could be to follow the literature on the empirical link between financial development and growth. More specifically, one could use the "legal origins" instrument proposed by de Silanes et al. (1997), who use cross-country differences in legal origin as an exogenous determinant of the differences in financial development.
- Additionally, a standard issue when using gravity equations is the problem of "zeros". This, due to the fact that the log-transformation of the variables requires dropping zero values which can in turn be informative and create selection biases. Therefore, one could apply



	Dependent Variable: ln PMPKL					
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
L.External dependence	-0.14 (-0.60)	-1.63 <sup>a</sup> (-3.39)	0.39 <sup>a</sup> (2.85)	0.44 (0.56)	-0.41 (-1.47)	-2.02 <sup>a</sup> (-3.91)
L.Fin. Development	-0.04 (-1.12)	0.48 <sup>a</sup> (3.51)	-0.08 <sup>c</sup> (-1.76)	-0.09 (-0.44)	0.01 (0.11)	0.72 <sup>a</sup> (2.85)
L.External dependence × L.Fin. Development		0.38 <sup>a</sup> (4.13)		-0.01 (-0.06)		0.50 <sup>a</sup> (3.22)
<b>Controls</b>						
Natural resources rents	-0.00 (-0.21)	-0.02 (-0.83)	-0.00 (-0.16)	-0.00 (-0.16)	-0.04 (-0.70)	-0.08 (-1.37)
Trade openness	0.02 (0.09)	0.01 (0.06)	-0.10 (-0.57)	-0.10 (-0.55)	-0.10 (-0.36)	-0.06 (-0.24)
Chinn-Ito index	0.05 (0.52)	0.09 (0.95)	0.09 (0.82)	0.09 (0.79)	0.04 (0.43)	0.04 (0.36)
Democracy Accountability	0.02 (1.38)	0.03 (1.60)	0.04 (1.44)	0.04 (1.47)	-0.01 (-0.41)	-0.01 (-0.32)
Government Stability	-0.00 (-0.47)	-0.00 (-0.46)	0.00 (0.58)	0.00 (0.55)	-0.01 (-0.48)	-0.00 (-0.28)
Law and Order	0.01 (0.32)	0.02 (0.54)	0.01 (0.52)	0.01 (0.51)	0.04 (0.65)	0.06 (0.98)
Internal Conflict	-0.01 (-0.46)	-0.00 (-0.15)	-0.01 (-1.15)	-0.01 (-1.15)	-0.02 (-1.02)	-0.02 (-1.09)
Country F.E.	Yes	Yes	Yes	Yes	Yes	
Time F.E.	Yes	Yes	Yes	Yes	Yes	
Observations	516	516	294	294	222	222
$R^2$	0.915	0.924	0.949	0.949	0.906	0.914
Adjusted $R^2$	0.901	0.912	0.939	0.939	0.883	0.893
F	2.40	6.32	12.54	22.60	47.63	21.21

*t* statistics in parentheses

All regressions include country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 4.10:** MPK, External dependence and Financial development

a Poisson estimate, as suggested by Silva and Tenreyro (2006) in order to account for the zeros that are lost in the FDI flows due to the log-transformation of the variable.

- Concerning possible extensions of this work, one could replicate the country-level analysis at the sector level, both for MPK and for

FDI in order to assess whether our results hold for more granular data. Particularly one could consider exploiting the CEPII database on bilateral sector-level flows. Although it only covers a single year (2004) it allows performing an analysis more in the spirit of Rajan and Zingales (1998). Where unobservable heterogeneity across sectors and across destinations can be accounted for properly. This could help better understanding what drives the changes in production towards less financially intensive sectors after 2000. Particularly, it allows assessing whether FDI are addressed to less financially intensive sectors in developing economies, providing an additional test for the model's predictions.<sup>38</sup>

- Finally, one could use BIS database for bilateral capital flows to see how banking capital behaves with respect to FDI. Analysing the composition of flows is convenient given that they should behave differently with respect to financial underdevelopment. This, because FDI involves "a less costly verification of production processes", which is the one of the problems related to financial underdevelopment. Hence we expect banking flows to be relatively more addressed to less financially intensive sectors.

## 4.6 Conclusions

Large differences in capital ratios across countries should be reflected in large differences in marginal product of capital (MPK) and in capital flowing from capital rich to capital scarce economies. New available data allowed us extending the proper MPK measures proposed by Caselli and Feyrer (2007) over time, for an unbalanced panel of 50 countries during 1995-2008. Our findings comply with their results where the return to capital in capital-poor countries is not as high as predicted by their lower

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<sup>38</sup>See: <http://www.cepii.fr/CEPII/fr/bddmodele/presentation.asp?id=4>

level of capital-to-labor ratios. Indeed, MPK seems to be the lowest in the capital poorest countries. This implies that there are no incentives for capital to flow into capital poor economies. CF attribute the lower capital ratios to lower endowments of complementary factors, *inefficiencies* and differences in relative prices of capital. This suggests that given the lower capital ratios, there is scope for increases in MPK in poorer countries, by alleviating these inefficiencies or by improving complementary factors with capital (e.g., higher levels of education).

On the other hand, Antràs and Caballero (2009) develop a theory where given the existence of heterogeneity in external financial needs across sectors, financial underdevelopment at the country level creates a misallocation problem which can be circumvented by specializing in sectors that are less subject to suffer from the financial malfunctioning. Therefore, financially underdeveloped countries could increase aggregate MPK and attract capital inflows by specializing in less financially intensive sectors. Thus, in this paper we connect this theory with the findings concerning the lower MPK's in developing countries and we examine the *inefficiencies* behind these lower return to capital in capital poorer countries through the lens of AC's theory. One way through which this inefficiency can work is in the form of an inability of the financial system to optimally allocate capital across different sectors, which pins down aggregate capital productivity.

Hence we examine how aggregate MPK during 1995-2008 in developing and developed countries is related to financial frictions, as measured by their aggregate production in financially intensive sectors and their level of financial development. Our findings point that on average, production in financially intensive sectors is negatively related to the aggregate MPK of a country and the effect becomes positive only when the financial markets are sufficiently developed. The relation being only relevant for developing countries, who markedly differ from developed countries in terms of financial development. For the sake of robustness, instead of

following Caselli and Feyrer (2007) we alternatively analyze the "more naive" MPK measures, and find that our findings still hold. Nonetheless, the less corrections introduced to the MPK measure the lower the magnitude of the coefficients (in absolute terms) and the less precisely estimated.

Additionally, we find that specialization patterns in financially underdeveloped economies after the year 2000 are more in line with their comparative advantage: less financially intensive sectors, as defined in Antràs and Caballero (2009). This in turn is consistent higher MPKs in these countries after this period, suggesting that it allowed a better allocation of resources. Where foreign capital flows have also followed a positive evolution after 2000.

We thus, evaluate bilateral FDI inflows in developing countries between 2001 and 2010 and find that these are strongly discouraged by the existence of financial frictions. Again, when we allow the effect of producing in financially intensive sectors to depend on financial development, our results suggest that the effect is only positive when a sufficiently developed financial intermediation in the recipient country is achieved. This echoes the existing literature that points that financial underdevelopment can be one of the reasons explaining the existence of global imbalances and the "up-hill" trend of capitals (e.g., Prasad et al. (2007)).

Finally, even though we do not directly evaluate misallocation of capital in this analysis, our findings imply that financial frictions depress the return to capital in financially underdeveloped economies. This, in turn, points that there is no misallocation of capital across countries given their actual levels of financial development and financial dependence. However, this suggests that there is, indeed, misallocation of capital within less financially developed economies and this might one of the reasons why aggregate MPK is not higher in these countries. That is, that if capital

was well allocated within these countries their aggregate MPK should be higher (i.e., than that of capital-rich countries), as their capital-labor ratios predict.

# 5

## International Sourcing and Employment in Times of Financial Crisis: The case of France<sup>1</sup>

### 5.1 Introduction

*“Moreover, the linkages between markets, and between markets and institutions, are now more pronounced. [...] it also exposes the system to large systemic shocks”*

– Raghuram Rajan, former IMF chief economist<sup>2</sup>

The Great Recession has prompted an increasing interest on the specificity of financial crises and the propagation of shocks across countries. Particularly, the increased globalization that the world has witnessed in the past decades, both in terms of financial and trade flows, translated what

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<sup>1</sup>Joint work with Jean-Charles Bricongne (Banque de France - European Commission; Jean-Charles.BRICONGNE@ec.europa.eu) and Fabrizio Coricelli (Univ. Paris 1 Panthéon-Sorbonne and Paris School of Economics; E-mail: fabrizio.coricelli@univ-paris1.fr).

<sup>2</sup>From Rajan (2006).

started as a housing bubble in the United States into dramatic cross-border repercussions in economic activity. For instance, one of the most salient features of the 2008-2009 crisis was the 20% decline in global trade relative to global GDP, dubbed the “Great Trade Collapse”.<sup>3,4</sup>

As this decline in trade followed a financial crises episodes, the question of the relative contribution of financial factors versus real factors, such as the fall in demand and the disruption of supply chains, has been extensively debated in the economic literature. Evidence on whether trade finance magnified the Great Trade Collapse and more generally, to what extent it contributed to the downturn in real economic activity across borders is somewhat mixed. For instance, findings in Eaton et al. (2011), Levchenko et al. (2009), Bricongne et al. (2012) and Bems et al. (2010) point in the direction that trade finance played little role in contributing to the trade collapse in 2008-2009. Where most of the collapse is explained by demand drops and compositional effects (that is, that trade dropped more in sectors whose domestic absorption was more important). While Ahn et al. (2011), Chor and Manova (2012), Niepmann and Schmidt-Eisenlohr (2016) and Coulibaly et al. (2013) among others, argue that trade finance did play a role.<sup>5</sup>

Additionally, unemployment persistence following recessions has been a major concern among economists and in the public debate since the Great Depression and it has regained special interest after the Great Recession in 2008-2009. In this sense, this paper adds to the literature on the role of trade finance in explaining the slowdown of real economic activity across borders, by focusing on one particular kind of trade credit contract and its effects on employment. Specifically, our analysis concentrates on “open

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<sup>3</sup>As documented by Eaton et al. (2011).

<sup>4</sup>See Baldwin (2009) for a comprehensive analysis on the causes and consequences of the collapse.

<sup>5</sup>Furthermore, focusing on earlier crisis Iacovone and Zavacka (2009)’s and Amiti and Weinstein (2011)’s findings suggest that trade finance plays a magnifying role during a financial downturn.

account” or ”post-shipment payment”. Which is the type of payment contract in which the exporter finances the transaction and the importer only pays after the arrival of the good. Hence, it is a short-term financing that the supplier extends to its client, which is characterized by the fact that it doesn’t involve financial intermediaries.<sup>6</sup> We explore the mechanism through which firms may be financed by their suppliers in the presence of a financial shock, that is, the global financial crisis. Even if the financial crisis was global, some countries were hit much harder than others and everything else equal, this may have led suppliers in different countries to react differently towards their clients. More precisely we are interested in answering the following question: *can the development of a relationship between trade partners mitigate the adverse effects on employment associated with limited access to institutional finance?* Linked to this specific channel where suppliers become potential lenders for its clients, another strand of the literature seeks to understand the role of open account contracts or inter-enterprise credit when institutional financing is scarce. Various theoretical and empirical studies document the ”substitutability” relation that arises between bank credit and inter-enterprise credit, when the former is unavailable. These range from the early contribution of Meltzer (1960), passing through Burkart and Ellingsen (2004), Fisman and Love (2003), Petersen and Rajan (1997) to the late contribution of Antras and Foley (2015), among others.

Given that cross-border goods linkages involve a financial transaction, international trade has implications for the transmission of shocks across countries. This implications may depend on the type of payment contract related in the transaction. Hence, a crucial distinction must be made among the different types of financing instruments supporting international trade that are encompassed in the ”trade finance” broad term. These include: 1) cash-in-advance, where the importer bears the risk and pays

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<sup>6</sup>In the rest of the analysis, the term ”trade credit”, ”open account” and ”post-shipment terms” will be used indistinguishably to denote the short-term financing extended to the importer by the exporter.



before the shipment of the good; 2) open account, where importer pays upon delivery and the exporter bears the risk; and 3) letters of credit, which involve a financial intermediary and insurance activities and where the bank guarantees the obligation on behalf of the importer upon confirmation that the exporter meets the contract conditions. Focusing on open account payments allows us to analyse an additional channel of transmission of shocks across borders given that firms are linked through a short-term financial relation. Thus, credit restrictions from banks to non financial companies in each respective country, alters the ability of a supplier to bear the risk of the transaction and export under open account contracts. Therefore, adding to the channels through which shocks across countries can be propagated. In this sense, besides accounting for banks lending and banks backing international transactions, a more comprehensive assessment of the contribution of trade finance to the cross-border transmission of shocks should also evaluate the way in which credit restrictions to non financial companies alter their trade financing terms towards their foreign partners. Where, besides its effects on trade, these cross-border contagion can have implications on demand and production across countries.

In this sense, beyond the Trade Collapse and, more generally, the Great Recession has revived a great interest on the global interdependence of real and financial variables, due to its exceptional severity and its unprecedented degree of synchronization across countries. In line with this, there is a growing literature investigating the real effects of financial crises and how financial shocks are transmitted across borders. For instance, Kalemli-Ozcan et al. (2013), Dedola and Lombardo (2012) and Cetorelli and Goldberg (2012) study how the propagation of shocks across countries is linked to the existence of global banks. While Calvo et al. (2014), Campello et al. (2010), Greenstone et al. (2012), Chodorow-Reich (2014) and Bentolila et al. (2015), among others, analyse how financial shocks affect the real economic activity.

Among the real effects of a financial downturn, our paper focuses on its effects on the labor market, where our findings suggest that firms with higher exposure to international shocks and relying more on trade credit before the crisis experienced the most severe employment declines during the crisis. These results are consistent with the literature on financial frictions and employment, which is still relatively undeveloped.<sup>7</sup> Two studies are particularly linked to ours, not only because of the focus on the effects of credit constraints on employment, but because of the econometric methodology employed. Which lies in assessing the firm level impact of the financial crisis due to pre-crisis exposure to shocks given the pre-established relations with more or less healthy banks during the crisis.

First, Chodorow-Reich (2014) studies the relation between the health of financial institutions and employment outcome in non financial institutions in the US in 2008. The simultaneous sharp contraction of employment (the largest drop in 60 years) and bank lending (to non-financial institutions) motivates his analysis. This proves particularly relevant given the strong policy interventions backing the financial markets, that were extremely unpopular among the public and which policymakers defended arguing the need to avoid further employment losses. Matching bank and firm level data, he finds that credit contraction was responsible for one third to one half of employment losses among small and medium enterprises in 2008.

In the same fashion, Bentolila et al. (2015) also rely on bank-firm level matched relations in Spain and conclude that credit shocks in 2008-2009 caused more severe employment losses among firms with stronger pre-crisis relations ones with less healthy banks. The theoretical channels implying the relation between credit disruptions and employment put forward by this paper rely on the existence of labor frictions (such as hiring and licencing costs) that make of employment a quasi-fixed fac-

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<sup>7</sup>Benmelech et al. (2011)

tor of production.<sup>8</sup> Which in turn induces a more conservative behavior in terms in its financial decisions given that the firm can't adjust labor costless. Additionally, complementarities between labor and capital in production can create a link between external finance and labour. Where lower investment, limited by the availability of external finance translates in lower employment which is adjusted for the decline in capital.

Finally, Calvo et al. (2014), document how financial crisis are particularly detrimental for employment compared to other "normal" recession episodes, notably in the presence of low inflation and nominal rigidities. They argue that tighter lending conditions may induce firms to use more capital-intensive technologies given that capital can be pledged as collateral for credit while labor can't, which in turn implies a *jobless recovery*.<sup>9</sup> This is related to the literature on the *inalienability of human capital*.<sup>10</sup> Though, as shown by the authors, this channel of transmission of the financial crisis on employment is relevant at the aggregate level and has macroeconomic effects, it relies on a micro argument which begs to be studied with the help of micro-data. On the one hand, one of the major interests of using disaggregated data is the fact that it allows a better empirical identification of the parameters and better assessing heterogeneous effects among firms. While data availability doesn't allow us assessing whether firms switched to a more capital intensive technology following the financial crisis, a direct implication of this mechanism is that employment effects of crisis are stronger among more financially constrained firms, which is consistent with our findings.

We use a very rich set of French firm-level data to analyse the effects of the Great Recession on the French labor market and its connection with the

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<sup>8</sup>See: Oi (1962).

<sup>9</sup>While most studies on jobless recoveries focus on labor market frictions such as wage rigidities or inflexibility of markets. Some analyse the effect of credit constraints on the dynamics of unemployment, such as Acemoglu (2001) and Dromel et al. (2010) but they focus on long run rate of unemployment and not on recoveries from crisis.

<sup>10</sup>See Hart and Moore (1994).

cross-border transmission of shocks through the ability of foreign suppliers to finance their clients. More specifically, we explore how sourcing goods from countries that were subject to lower financial pressure helped firms mitigating the adverse employment effects of the crisis by alleviating firms' financial constraints through the provision of inter-enterprise credit. Our strategy is to exploit the large differences in firms' exposure to global shocks and their reliance on trade credit at the onset of the Great Recession to uncover whether the financial health of its foreign suppliers (that we view as potential lenders) helped cushioning the negative effect of the crisis.

For this purpose and given the data at our disposal, we proceed in two steps. We begin by evaluating the employment variation for French firms (sourcing goods internationally) that is due to the transmission of different global financial shocks in the countries from where they source their goods. Next we evaluate whether these effects are intensified for firms strongly relying on trade credit. Our sample period starts in 2004 and ends in 2009 and we rely on a two-way fixed effects panel data model where identification comes from a pre-determined exposure to exogenous global shocks. To this aim, we construct a firm-specific measure reflecting the crisis exposure based on the geographical composition of its *international sourcing structure* prior to the global crisis. This measure accounts for cross-country differences in the severity of the financial shocks where each country's shock is weighted by the firm's pre-crisis sourcing ties with each specific country.

Given that the hypothesis that this paper puts forward is that an additional channel of transmission of the global financial shocks is through the ability of foreign suppliers to finance their clients by "lending them goods", we then interact the exposure-to-crisis with the firm's average pre-crisis reliance on trade credit. The reason for this is twofold: first, we don't observe the amount of trade credit involved in each bilateral

transaction with different countries which we would ideally have liked to observe, in order to evaluate how suppliers subject to different shocks varied their trade credit provision. Therefore, the interaction provides an alternative way of evaluating our hypothesis by telling us whether the transmission effects are intensified for Trade Credit intensive firms. Second, given that the provision of inter-enterprise credit requires trust and reputation, firms with well established relations with suppliers may have less difficulty in benefiting from trade credit financing. Thus, the ratio of accounts payable over total inputs averaged in the years before the crisis is used as a proxy for established credit relations with its partners that we expect to be only affected by the partners' ability to provide trade credit. The latter argument can be motivated by the fact that this measure is determined by the technology of the firm and its established commercial relations rather than any other firm-level characteristics related to the firm's ability to react during the crisis, as described above. In consequence, using this ex-ante measure is safer in terms of endogeneity.

In this sense, the exposure-to-crisis measure allows assessing the employment effects of the crisis due to shocks suffered by firms' international suppliers by comparing the evolution of employment at different firms with varying pre-crisis exposure to the global financial shocks. The interaction with Trade Credit intensity assesses the importance of the effect conditional on the average use of trade credit in the production of the firm. In order to assess any causal effect it is required that the exposure-to-crisis is as close to randomly assigned as possible. We argue that, conditional on firm-level characteristics, this is indeed the case given that firms could choose ex-ante their sourcing strategies conditional on gravity variables, technology and any other firm-level characteristics independent to their ex-post exposure to the crisis (through their suppliers) given that the Great Recession could not possibly be anticipated by firms.

Using a sub-sample of importing enterprises that were active over 2004-

2009, our findings imply that strong pre-crisis sourcing ties with countries that were more resilient to the global crisis translated into better performance in terms of employment growth over 2008-2009. This effect dramatically varies with trade credit intensity. Strongly relying on trade credit made firms more vulnerable to unanticipated shocks, for whom the adverse impact of the crisis was exacerbated. This effect intensified among firms with important sourcing ties with severely shocked countries. While the negative effect of the crisis was mitigated when sourcing relations with countries subject to milder shocks were stronger. This supports, therefore, the hypothesis that trade credit was an alternative source of financing for enterprises during the crisis, where implicitly borrowing from suppliers helped importers overcoming financial constraints.

More specifically, our findings suggest that the suppliers' ability to provide trade credit was weakened under declines in the perceptions of the country's creditworthiness, economic recessions, equity market collapses, credit contractions or sharp currency appreciations. This added to the adverse impact of the crisis for French importers, particularly, if trade credit was an important source of short-term external finance for the firm.

Living in an increasingly globalised world has brought new challenges to policymakers due to the higher vulnerability that a tight interconnectedness comes with. Raghuram Rajan, former IMF chief economist, wrote in 2006: "While this helps the system diversify across small shocks, it also exposes the system to large systemic shocks".<sup>11</sup> This has been crystallised during the global downturn in 2008-2009, where the world witnessed an acceleration of the speed at which economic shocks propagated around the world. As a consequence, understanding well the economic forces behind the cross-border transmission of shocks has become crucial. In this sense, our contribution to the literature adds to the debate on the role of trade finance in explaining the real economic downturn across borders. It lies in

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<sup>11</sup>Rajan (2006).

suggesting an additional channel of transmission of global financial shocks to the labor market. We do this by linking different economic literature and bringing empirical micro-evidence of the mechanism put forward in the paper.

The rest of the paper is organized as follows. Section 5.2 introduces and describes our data sources; section 5.3 explains our econometrical methodology. Results are analysed in section 5.4, while a robustness analysis and a discussion about possible future paths is presented in section 5.5. Finally, 5.6 concludes.

## **5.2 Data**

In this section we provide a detailed description of our data sources, how we selected the data included in the analysis and the construction of our main variables of interest. Additional details are presented in Appendix C.2. Our analysis makes use of detailed French firm-level information for 14 703 importers, it contains firms' relations (imports, exports and FDI) with the rest of the world and covers the period 2004-2009. The main reason why the analysis stops in 2009 is because of data availability where the last year that we observe is 2009. However we do not think that the fact of not being able to expand the analysis beyond 2009 is problematic as we want to focus on the specific effects of the global financial shocks and its transmission. Whereas it is well-known that the crisis in 2009 was followed by the Eurozone crisis triggering additional sovereign debt problems related to the structure of the Eurozone being a currency union without a fiscal union. Thus, even if studying these additional implications of the Great Recession remain very interesting, extending the analysis to the following years would mix our results with additional implications of the crisis that are beyond the scope of the current analysis.

The firm-level base is constructed by merging three different data bases with the help of the French fiscal unique identifier for each firm (the siren number in French):

**Balance-sheet data.** We use the French fiscal files BRN (Benefices Réels Normaux) which is provided by the French statistical agency, the INSEE, in order to get firms' characteristics. Those firms whose turnover is above 730 000 Euros in the manufacturing sectors and 230 000 in the services sectors are subject to fiscal declaration by these means. Therefore, this base covers almost the whole universe of French importing firms given that these are usually big enterprises. From this base we use information on employment, principal economic activity, total sales, trade credit and total assets. Unfortunately, the analysis will be limited to some extent by data availability given that we only observe employment and sales until 2009, while the rest of the variables are only available until 2008. We exclude services because even if firms pertaining to these sectors might also source foreign goods for their functioning we also believe that the effect that we aim at testing is better identified in the production in manufacturing sectors.<sup>12</sup> Additionally, since we want to analyse firms' employment behavior during the crisis, we only keep firms surviving in 2009. Finally, provided that our analysis is based on the assumption that trade credit is extended to clients with well-established relations with their suppliers and that we use pre-crisis variables in order to measure the firm's *international sourcing strategy* we focus only on firms that existed already in 2004. Thus, based on this sub-sample of importers conditional on existing in 2004 and surviving in 2009 we also drop firms for which we observe negative values for value added, sales at some point of the whole period and drop those observations with other extreme values based on our variables of interest.<sup>13</sup>

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<sup>12</sup>A complete list of the sectors included in the sample is available in the Appendix C.2.

<sup>13</sup>Outliers were defined in terms of employment growth and imports-to-production



**Trade flows.** The second source of firm-level data that we use comes from the French Customs. It contains detailed information of values of imports and exports for each firm and month at the 8-digit (NC8) product level, discriminated by bilateral destination and origin, for exports and imports, respectively. In what concerns import flows, values aggregated at the firm, destination and year level are exploited in order to construct the firm-exposure variable, while for exports, only the exporter status for each firm is used in our analysis, as will be explained in the empirical section. Reporting is required for each firm and flow if the extra EU transaction value exceeds 1 000 Euros or 1 000 kilograms. As for the within EU flows, transactions have to be reported as long as the firm's annual trade value exceeds the threshold of 150 000 Euros. Our selection criteria for this base is based on importer status: we kept firms if they were importing from at least one country over the period 2004-2007 conditional on continuing importing in 2009, which is the moment where we expect them to be receiving trade credit from their suppliers. Therefore, given that importers are typically the biggest and more productive firms, as will be shown in descriptive statistics in subsection 5.2.3, these thresholds do not affect our sample representativeness.

**FDI.** In the sensitivity analysis we consider an alternative economic channel that could also be consistent with our results, which will be exposed in 5.5.2 and it is related to the fact that firms can also be linked with each bilateral partner by foreign direct investment (FDI). We will test whether this link is relevant and especially it will allow ruling out other economic phenomena that might be driving our results. For this purpose, we use the Banque de France Foreign Direct Investment base. It is collected at the firm-level and it reports stocks and flows of outward and inward FDI for each firm, by destination and origin, broad foreign sector (i.e., financial, ratios for values below the 1st and above the 95th percentiles, this will be discussed in detail later.

real estate and all others) and year. The data is very rich as it reports the composition of total FDI, that is, discriminated by equity capital, reinvested earnings and other capital associated with inter-company debt transactions.<sup>14</sup>

In the next subsections we describe how the main variables of interest are constructed and how they contribute in allowing to establish a causal effect on employment growth during the crisis. Our aim is to replicate as closely as possible the conditions of a natural experiment which requires the exposure-to-crisis variable to be randomly assigned among firms. This requires defining our strategy in such a way that the self-selection into exposure is minimized, we thus proceed as follows: we exploit cross-country differences in the severity of the crisis during 2008-2009 and weight them by the geographical composition of the firms' sourcing strategy in the onset of the crisis in order to assess the transmission of the global financial shocks and its effects on employment. In this sense, we obtain a firm-specific variable reflecting the "intensity" of exposure to the financial crisis given its pre-crisis international sourcing structure, which can reasonably considered to be determined by gravity variables and other ex-ante firm characteristics but not chosen as way to minimize its exposure to the global financial shocks. We argue that this a fair proposition, given that firms could not possibly anticipate the global financial crisis as not even banks were able to do so.

Certainly, the existence of a pre-crisis relationship with more resilient suppliers during the crisis would be irrelevant if firms whose suppliers were hit harder by the crisis could readily switch to suppliers that were in a better financial shape. We think that this is not likely to be the case for two reasons: in order for the exposure variable not to be capturing the firm's ability to switch to "healthier suppliers" during the crisis, the

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<sup>14</sup>For a full description of these bases see: Bricongne et al. (2010) chapter in the Conseil d'Analyse Economique report by Fontagné and Toubal (2010).

variable should only reflect the firm's technological reliance on each foreign partner. Using the average pre-crisis geographical sourcing structure provides a proxy for this. On the other hand, as it has been extensively documented in the literature, the provision of trade credit requires considerably trusting the counter-party, this is likely to happen if the partners have developed strong commercial ties through repeated interactions<sup>15</sup>. Hence, if we observe a firm with lower or null pre-crisis relations with a healthy partner, we believe that it is reasonable considering that the likelihood of receiving trade credit from this new partner is low.

Furthermore, provided that we aim at exploring the idea that suppliers are potential lenders for their clients helping them to overcome financial constraints, we need evaluating the exposure-to-crisis conditional on the use of trade credit. This will be done with the help of an additional variable where the same reasoning as before applies in terms of its construction, as we also expect this variable to be a proxy for the firm's technological trade credit intensity in order to safely assume that it is only affected by the financial health of the supplier. Sub-sections 5.2.1 and 5.2.2 describe in detail the way these variables are constructed.

### 5.2.1 Variables of interest: Imports-Exposure-to-Crisis

Given that our empirical strategy exploits differences in the severity of shocks during 2008-2009 across countries we begin by presenting the way we measure these shocks. Next we discuss the way these can be linked with the firm-level data which we use to obtain the firm-specific exposure variable.

**The Financial Crisis.** As it has been already argued by different authors,

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<sup>15</sup>See for instance Antras and Foley (2015) and Fisman and Love (2003).

quantifying the cross-country intensity of the financial crisis, as well as the timing and its duration is not an easy task.<sup>16</sup> Crises manifest in several dimensions and some of these dimensions can be the outcome of government policies. In this sense, GDP growth is the most standard indicator of the severity of the crisis, but one could think that an aggressive fiscal and monetary intervention could have made the GDP drop milder during the crisis, even in the case where the financial sector was severely harmed. On the other hand, each dimension might differently affect different countries.

For this reason, we use six alternative measures reflecting the manifestation of the crisis and evaluate each one at a time: (1) Growth Index ; (2) Credit Index; (3) Special Drawing Right (SDR) Index; (4) Equity Index; (5) Rating Index and (6) Resilience Index. Where except from Credit Index, which is constructed using World Bank data, we mainly rely on the work done by Rose and Spiegel (2012) who provide four different indicators of the consequences of the financial crisis as manifested between 2008-2009. Namely, the percentage change of the following variables during the financial crisis: real GDP, the national equity market, the country credit rating and the SDR exchange rate.<sup>17</sup> Additionally, we construct an overall resilience to crisis measure where we account for its different manifestations by simple averaging the three of these indicators for which an increase translates into a stronger resilience: GDP, the stock market and country credit rating. Finally, since we are interested in the broad financial conditions in the supplier's country given that we aim at assessing its likelihood of providing trade credit to its foreign clients, we also include the standard proxy for overall financial conditions used in the literature. That is, credit to private sector over GDP from the World Bank, which we also transform to get the percentage change between 2008 and 2009. The interpretation for most of these measures is self-explanatory and except for the SDR measure, the higher the value taken by each of

<sup>16</sup>For a further discussion on identifying the incidence and intensity of crisis see: Rose and Spiegel (2012) and Berg et al. (2005).

<sup>17</sup>A full description of the way the authors construct these variables is presented in Appendix C.2.

these, the less severe was the crisis. They reflect, therefore, the *resilience to the crisis* in the respective country. In what concerns the SDR measure, it reflects the country's currency depreciation during the crisis. Thus, a higher value taken by this variable means a greater severity of the crisis.

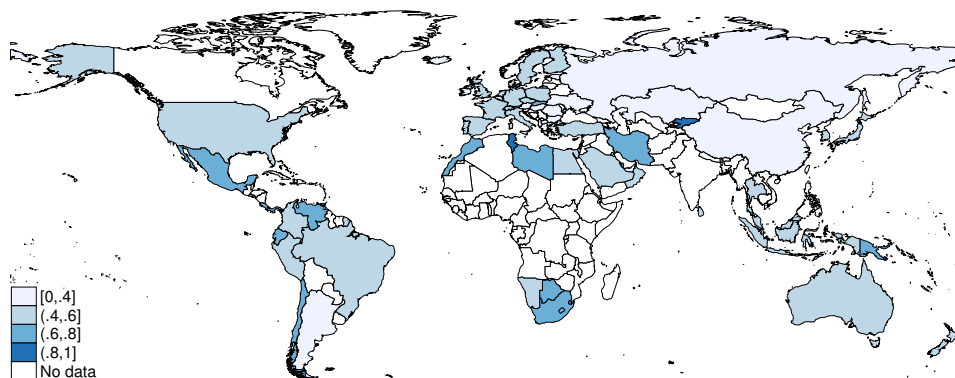
In order to avoid negative values and for the sake of comparability across the different resilience indicators, we transform each of these by normalizing the measure with the highest and the lowest values taken by the countries included in the sample. At this point it is convenient mentioning that oil-exporting countries were kept out of the sample given that these countries' specificities could introduce some noise in our analysis<sup>18</sup>. On top of this, we kept only the 71 countries for which all measures were available. Therefore, focusing on one measure at a time, we obtain an index ranging from zero to one, where the highest value of each index is assigned to the country that was the most resilient to the global shocks with the exception of the SDR index where the highest value should be interpreted as a stronger incidence of the crisis.

The cross-country crisis severity using each of these measures can be visualized in figures 5.1- 5.3. These figures display the Resilience Index (which summarizes the growth, equity market and credit rating indexes based on Rose and Spiegel (2012)), the SDR Index and the Credit Index (which are not included in the resilience measure).<sup>19</sup>

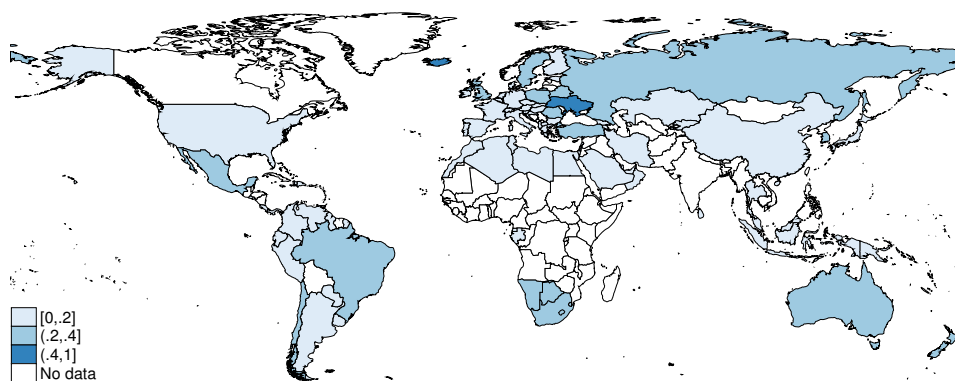
Table 5.1 reports the correlation between the six indicators where it can be seen that they are not particularly strongly related, except for the Resilience index which is tightly related to the Equity index and the Rating

<sup>18</sup>The oil-exporting countries that were dropped are: Algeria, Ecuador, Indonesia, Iran, Kuwait, Libya, Qatar, Saudi Arabia and United Arab Emirates. Nevertheless, for the sake of robustness, we include these countries in our regressions and find the estimations unaltered. Results are available upon request.

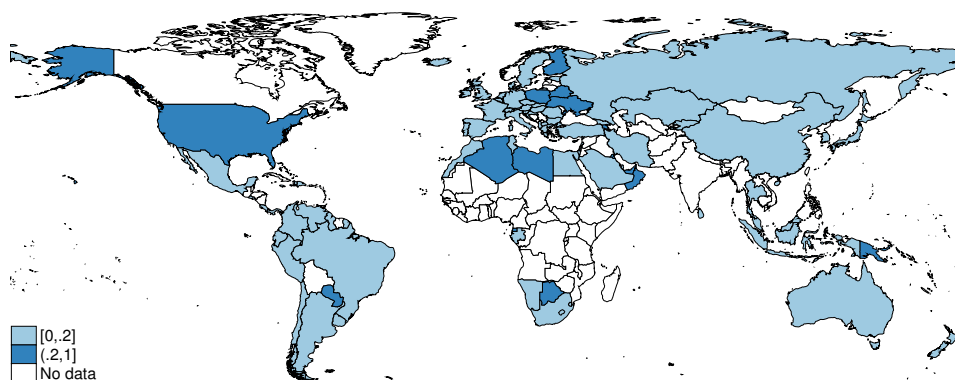
<sup>19</sup>Appendix C.1 presents the figures for each of the other 3 alternative measures: Growth Index, Equity Index and Rating Index.



**Figure 5.1:** Cross-country Crisis as measured by: Resilience Index



**Figure 5.2:** Cross-country Crisis as measured by: SDR Index



**Figure 5.3:** Cross-country Crisis as measured by: Credit Index

index (although, to a lower extent). This means that the consequences of the crisis manifested in various dimensions that differently affected different countries according to their specific characteristics. Which in turn, turns out to be convenient for the aim of our empirical analysis provided

	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Res. Index
Growth Index	1.000					
Credit Index	0.032	1.000				
SDR Index	-0.315	-0.226	1.000			
Equity Index	0.168	-0.131	-0.140	1.000		
Rating Index	0.277	0.268	-0.542	0.459	1.000	
Res.Index	0.312	-0.068	-0.250	0.978	0.603	1.000

71 countries. Source: Author's calculations using data from World Bank and Rose and Spiegel (2012)

**Table 5.1:** Cross-correlation between crisis indicators

that the interest of using different measures is that they all reflect the severity of the crisis but there would be no point in considering them as alternative measures if there was no variation among them.

**Geographical Composition of International Sourcing Strategy.** Next, in order to get a firm-specific variable, we combine each of these indicators with the average reliance on imports coming from each country in the years before the crisis, this is what we call "international sourcing strategy of the firm". More precisely, we compute the following measure for each firm  $f$  in our sample:

$$Imports\ Exposure\ Crisis_f = \sum_{t=2004}^{2007} \frac{1}{4 \cdot Inputs_{ft}} \sum_c (Imports_{fct} \cdot Res_c) \quad (5.1)$$

Where  $Inputs_{ft}$  is total inputs of firm  $f$  in year  $t$ ,  $Imports_{fct}$  is the total value of inputs that the firm imports from country  $c$  in year  $t$  and  $Res_c$  is each one of the resilience indexes using the measures discussed above by focusing on one measure at a time.<sup>20</sup> Since the resilience indexes are comprised between 0 and 1, ideally, this measure should also range between 0 and 1, giving us an indication of the share of inputs that are

<sup>20</sup>Total inputs is measured by adding: "Achats de marchandises", "Achats de mat. prem. et autres approv." and "Autres achats et charges externes".

	<b>mean</b>	<b>sd</b>	<b>p50</b>	<b>min</b>	<b>max</b>	<b>N</b>
imports/inputs	0.16	0.18	0.10	0.00	7.79	72988
imports/production	0.12	0.14	0.07	0.00	0.61	72988
imports/sales	0.11	0.12	0.06	0.00	1.70	72988

*Source:* BRN, French Customs. Units: Imports, Production and Sales given in Euros.

**Table 5.2:** Descriptive statistics: Imports ratios

sourced internationally out of the total inputs needed for production. In fact, in some cases (81 out of 72 988) observations from our final sub-sample (which already excludes outliers) import values are larger than total inputs, which are directly recovered from the balance-sheet data. Table 5.2. presents relevant statistics for this ratio, as well as for the share of imports in production and of total sales, which are undoubtedly more likely to be comprised between 0 and 1. Nonetheless, even for the imports to sales ratio, some observations remain higher than 1.

We think that the reason why imports might be larger than total inputs and sales is mainly due to two things. On the one hand, the level at which we actually observe the data is the firm. However, many firms are part of bigger economic groups and it can perfectly be the case that one firm of the group is in charge of importing for the whole group while total production takes place at the group level. In this case, the correct way of assessing any effect on employment would obviously be at the group level. Unfortunately, we are not able to observe the group structure and identify these cases. Nevertheless, this problem can be overcome with the help of the financial linkages LIFI base (Liaisons Financières). This base comes from INSEE and provides information about the composition of economic groups through firm's ownership (foreign and domestic) of companies residing in France. We plan to include this in future work when the data will be readily available.<sup>21</sup>

<sup>21</sup>The INSEE has already given us an official confirmation to our demand access for this base but the administrative procedure is currently in process in order to be able to use the data.



On the other hand, there may be another reason, linked to the fact that imports is not an information available in income statements, and must be taken separately, from Customs data, leading to possible mismatches. Hence imports and firm variables (such as sales or total inputs) that we use may not necessarily relate to the same period of time. Indeed, firms are not obliged to report their balance sheets and income statements over 12 months and they can choose to change over time both the date at which they display the figures, and the number of months under reporting. In this case, if a company chooses to settle its accounts over a period shorter than twelve months, making the ratio between annual imports and sales coming from the income statements may lead to inconsistencies such as imports to intermediate consumption or imports to sales higher than what they would be if the same period is used for the numerator and the denominator.

Finally, in the the case of imports to sales ratio, it may also be due to the fact that in the period where they are bough, imports can become inventories which are used be or re-sold (in the case where this constitute final goods that the firm resells in the local market) in future periods.

Bearing these limits in mind, *Imports Exposure Crisis<sub>f</sub>* still provides a sense of the extent to which the firm is exposed to international shocks in its suppliers' countries given their average sourcing ties before the crisis. More precisely, it should capture well the average reliance of a firm on a particular market and the extent to which this market was hit by the crisis. Finally, the importance of the normalization should also be highlighted. Even if a time-varying proxy for size will be included in the econometric analysis, we want to avoid that the exposure measure captures time-varying heterogeneity in terms of firm size (which could be the case if we kept only the numerator of the exposure measure given that

it will be interacted with crisis dummy in 2009).

### **5.2.2 Variables of interest: Trade credit**

A crucial variable in the mechanism that is put forward in this paper is the provision of Trade Credit granted by the firm's supplier. Thus, one would ideally like to observe this variable as disaggregated as possible, that is, discriminated by foreign and domestic suppliers and in the best scenario by country of origin (as imports). In the absence of this data, we can still make use of the amount of yearly Trade Credit at the firm-level that we observe from the balance-sheet base in order to make conjectures about the mechanism that we are exploring.

The construction of this variable is guided by the same motivations as Imports-Exposure-to-Crisis as we want this to be determined by other things not related to the firms' ability to react to the crisis in order to be safe in terms of endogeneity. We thus view this variable as a technologically determined reliance of each firm on Trade Credit. In particular, this will allow us to make conjectures pointing towards the mechanism that we test, provided that we do not directly observe the share of trade credit coming from each country. Our reasoning is as follows: given that the granting of trade credit requires trust and reputation, benefiting from it should be the result of repeated interactions with the supplier. So firms with longer relations with suppliers may find it less difficult benefiting from trade credit financing. Hence, the use of an averaged pre-crisis measure covering a fair number of years can reasonably be thought as being determined by technology and the firm's establishment of relations with its supplier, which in turn, allows to assume that trade credit during the financial crisis is only affected by shocks. Thus, its interaction with the exposure-to-crisis during the crisis should reflect the ability of its suppliers to continue providing trade credit to its clients.

An additional motivation for this hypothesis is provided by Antras and Foley (2015), who show that as trade partners begin developing a relationship over time, they trade more frequently on "post-shipment terms" (or trade credit) than in cash in advance terms -in which case, the importer is required to pay before the shipping is done. Additionally, the authors show that the choice between all possible trade financing terms is closely related to the quality of institutions in each partner's country: the partner located in the country with the weakest institutions is more likely to finance the transaction. In this sense, if the exporter's client is located in a country with weak contractual enforcement then it is more likely that it requires the importer to pay in cash in advance in the absence of legal guarantees in case the importer defaults or doesn't fully cover its payments. In consequence, given that in our case the importer is always a French firm where institutions are strong, we can safely assume that suppliers usually trust their French clients and we have no reason to believe that this trust was affected during the crisis. Thus, allowing French clients to trade on post-shipment terms should be only affected by their financial health.

We thus construct the following firm-level average of use of Trade Credit over total imports in the onset of the crisis (2004-2007),

$$Trade\ Cred_f = \frac{1}{4} \sum_{t=2004}^{2007} \left( \frac{Trade\ Cred_{ft}}{Inputs_{ft}} \right) \quad (5.2)$$

where  $Trade\ Cred_{ft}$  is the total yearly value of *accounts payable* for a given firm  $f$  at year  $t$  as reported in the firm's balance-sheet. We normalize by total inputs  $Inputs_{ft}$ , in order to get the average share of inputs that are financed by trade credit. The problem with this indicator is that we are not able to distinguish the extent to which payables are related to imports and domestic inputs.

One limit of this indicator is that we are not able to distinguish the extent

to which payables are related to imports and domestic inputs. Being aware of this issue, the *Trade Cred<sub>f</sub>* still provides a sense of the extent to which the firm relies on inter-enterprise credit. While its interaction with foreign shocks and the extent to which the firm is linked to these shocks provides an indication of the transmission of these shocks conditional on the firm's average reliance on inter-enterprise credit. Nonetheless, section 5.5.3 discusses possible paths for future work in order to overcome this limit.

### 5.2.3 Descriptive Statistics

Before presenting summary statistics, it is convenient to comment on the criteria used for selecting outliers. As already mentioned in the previous paragraphs, the construction of our data has some limits, and for this reason some extreme values in our sample can reflect real measurement issues related to this. On the other hand, even if some other extreme observations can indeed be informative, it is also undeniable that firms are extremely heterogeneous. Which in turn, makes it difficult to find an average effect among such different firms. Hence we were obliged to drop some extreme observations but it was done based on the minimum number of variables as possible: yearly employment growth and average pre-crisis imports-to-production ratio. Where the highest values at the right tail of the distribution of the latter should particularly reflect those cases in which a single firm imports goods for the whole group and that we are not able to identify from our current data. Table 5.3 displays the relevant statistics for these variables based on the whole sample of *surviving importers* that were left after the data cleaning. Outliers were defined for values being below the 1st and above the 95th percentiles of the distribution of each of these variables. The figures show that there is extreme heterogeneity across observations, specially for employment growth, where the standard deviation for the whole sample is on average 35 times larger than the mean value. At this point it is worth noting that a possible explanation for these unreasonable numbers in terms of employment growth can be

outlier	variable	mean	sd	min	p1	p50	p99	max	N
0	Employment growth	-1.67	12.08	-50	-40.00	0.00	26.53	30.00	72988
	Imports/production	0.12	0.14	0.00	0.00	0.07	0.56	0.61	72988
1	Employment growth	35.92	238.92	-99.70	-87.50	20.00	333.33	12500	8455
	Imports/production	0.69	1.90	0.00	0.00	0.50	3.94	65.23	8455
Total	Employment growth	2.22	78.52	-99.70	-50.00	0.00	83.33	12500	81443
	Imports/production	0.18	0.65	0.00	0.00	0.07	1.46	65.23	81443

Source: BRN, French Customs. Units: employment given in num. of employees, production and trade credit in Euros.

**Table 5.3:** Descriptive statistics: Outliers definition

linked to the fact that a company can acquire one or several firms from one year to another, but we don't observe these mergers and acquisitions transactions in our data.<sup>22</sup> Motivating, therefore, the exclusion of extreme observations from the analysis in order to avoid that these observations drive the results. In this sense, all the following statistics are presented among the selected sub-sample excluding these outliers.

Now, why are only importers kept in the sample? An overall comparison between importers and non-importers is given in Table 5.4, where it can be seen that importers are on average much bigger in terms of employment and sales, as well as more productive. Furthermore, employment and sales fell much more among importers than among non-importers during the crisis, suggesting that the transmission of global shocks was more important for strongly internationally active firms. It should be reminded that even if importer and exporter status are tightly linked (with a correlation of 0.6), our definition of non-importers is not mutually exclusive with exporter status, where the former can be exporters as well but they just source their goods domestically. These big differences among importers and other firms, motivates our sample selection based on importer status. For instance one could argue that keeping other firms in the analysis could provide a control group for the econometric analysis when assessing the exposure effects during the crisis. Nonetheless, the two groups of firms

<sup>22</sup>However, this issue can easily be solved with the LIFI database, which we will be able to use in the near future.

	Non-Importers					Importers				
	Emp.	Sales	Prod.	Emp. % $\Delta$	Sales % $\Delta$	Emp.	Sales	Prod.	Emp. % $\Delta$	Sales % $\Delta$
2005	12	1,305	49.72	0.54	5.55	91	22,642	61.08	0.53	6.98
2006	12	1,377	51.51	0.69	6.48	90	24,076	63.84	0.77	9.20
2007	12	1,482	54.05	0.79	7.09	90	25,491	66.25	1.09	8.82
2008	12	1,589	55.14	0.60	4.44	92	26,655	67.40	0.51	4.19
2009	11	1,431	52.04	-2.09	-6.67	88	23,063	64.88	-3.24	-8.31

Source: BRN, French Customs. Units: Employment given in num. of employees, Sales in Euros and Productivity is the ratio of employment to value added.

**Table 5.4:** Comparison among Importers and Non-Importers

	mean	sd	min	p1	p50	p99	max	N
<b>Crisis measure</b>								
Growth Index	0.07	0.09	0.00	0.00	0.04	0.37	2.35	72988
Credit Index	0.09	0.11	0.00	0.00	0.06	0.43	3.39	72988
SDR Index	0.04	0.05	0.00	0.00	0.02	0.18	1.35	72988
Equity Index	0.08	0.10	0.00	0.00	0.05	0.39	3.16	72988
Rating Index	0.13	0.15	0.00	0.00	0.08	0.56	4.57	72988
Resilience Index	0.09	0.11	0.00	0.00	0.06	0.43	3.54	72988
<b>Trade Credit measure</b>								
Trade credit/total inputs	0.24	0.15	0.00	0.05	0.23	0.61	15.37	72988

Source: Own calculations using data from World Bank, Rose and Spiegel (2012), French Customs and BRN.

**Table 5.5:** Des. stat.: Imports-Exposure-to-Crisis and Trade Credit-Inputs ratio

significantly differ before the crisis and the way they face the shocks is certainly related to these differences (for example, productivity can be a strong determinant of how a firm reacts to shocks). Additionally, one of the interests of the Imports-Exposure-to-Crisis measure is its continuous nature, in which case the "control group" are the years prior to the crisis provided that the exposure variable is randomly assigned among importers.

Finally, Table 5.5 presents relevant statistics for our main variables of interest, Imports-Exposure-to-Crisis and Trade Credit intensity among the sub-sample of firms that were kept for the econometric analysis.

### 5.3 Empirical analysis

As mentioned above, our empirical strategy exploits exogenous variation in cross-country resilience during the financial crisis at varying levels of firm-level exposure to the shocks in order to study the link between the global financial shocks and firm's employment. Conditional on pre-crisis firm-level characteristics the firm's exposure is pre-determined and thus, it isolates the ability of the firm to switch to healthier partners according to the severity of the crisis shocks.

Nevertheless, before presenting the equations that will be estimated, it is convenient presenting some clarifications on the particular choice of our empirical strategy. We are interested in the transmission of the financial shock in the supplier's country where we use the health of financial system to make conjectures about its ability to extend trade credit to its client. In other words, we explore the transmission of the global financial shock due to the exposure to these given international sourcing structure of the firm. Thus, we don't aim at evaluating the direct effect of the variation in imports, in which case the use of an instrumental regression methodology would be required. On top of this, we analyse the yearly growth rate of employment and not the level of employment given that we are analyzing a short term variation due to a financial shock and our aim is not to determine any effect on a long-term level of employment of the firm.

#### 5.3.1 Financial crisis and Imports-Exposure-to-crisis

Our hypothesis is that firms that had stronger pre-crisis relations with suppliers from countries where the global financial crisis was less severe, were more able to maintain employment during the crisis if they could implicitly borrow from their suppliers by delaying their imports payments.

The argument is as follows: if a supplier had established ties with the importer and it is in a good financial shape, then it will more easily grant Trade Credit to its client. This in turn, allows the importer overcoming its financial constraints due to the domestic banking credit contraction if the firms are able to substitute short-term banking finance with trade credit. We therefore begin our analysis by evaluating how shocks in suppliers' countries were transmitted to French importers given their exposure to these shocks which we measure using pre-crisis sourcing relations with each country. In a second step we evaluate whether the effects are stronger among firms that had higher levels of accounts payable before the crisis.

We rely on a panel data model with firm and year fixed effects. Our identification lies in the assumption that the intensity of the exposure variable is randomly assigned among firms. In other words, we assume that conditional on gravity variables and firms' characteristics, the geographical international sourcing strategy is technologically determined and so is the exposure to shocks in suppliers' countries. Therefore, the exposure is exogenous from the point of view of the firm provided that it was not able to anticipate the global crisis; that is to say that  $E(\epsilon_{ft}|Z_{ft}, \delta_f, \delta_t) = 0$ . In this sense, we perform the following OLS regression where given the firm fixed effects, the identification comes from pure time variation within a given firm,

$$\begin{aligned} Emp\ Growth_{fit} = & \beta_1 Imports\ Exposure\ Crisis_f \times Crisis_t \\ & + \alpha_1 Z_{ft} + \delta_f + \delta_t + \epsilon_{ft} \end{aligned} \quad (5.3)$$

where  $Emp\ Growth_{fit}$  is employment growth for firm  $f$ , pertaining to industry  $i$  in year  $t$ ,  $Crisis_t = 1[\text{year}=2009]$  is a dummy that takes the value of one in 2009 and zero otherwise,  $Z_{ft}$  is a set of time-varying firm-level characteristics used as control variables: size (measured by total sales)



and exporter status during the crisis.<sup>23</sup> The latter being an important control since importer and exporter status are highly correlated and we would not like the negative effects of the Trade Collapse to be captured by our coefficient of interest.<sup>24</sup>

*Imports Exposure Crisis<sub>f</sub>* is the exposure measure and it represents the degree to which the firm is vulnerable to global financial shocks given its pre-crisis international sourcing structure. As explained earlier, it is constructed using the six different indexes reflecting the severity of the crisis in the suppliers' country by focusing on one measure at a time. Note that given the fixed-effects estimator, the main effect of this variable is not identified provided that it is constant over time. Nevertheless, since it is constructed in the spirit of a treatment effect, it does not really make sense interpreting it in a different context than the crisis. The double interaction *Imports Exposure Crisis<sub>f</sub> × Crisis<sub>t</sub>* provides the effect of interest since it captures the realization of the crisis and how the shocks are transmitted given the ex-ante exposure. More precisely,  $\beta_1$  estimates the differential effect of crisis across sourcing partners and across firms with varying levels of exposure to these shocks. Since a higher value of the exposure measure reflects stronger input reliance on more resilient countries, we expect the sign of this coefficient to be positive. In other words, we expect to find a more adverse effect of the global financial shocks among firms whose pre-crisis ties with countries that were severely hit by the crisis were stronger.

Equation 5.3 is estimated using the fixed-effect estimator,  $\delta_f$ , which allows

<sup>23</sup>Note that the period in under analysis for the growth regressions starts in 2005 given that the first year that is evaluated is 2004.

<sup>24</sup>Note that even though firm-level productivity should be an important determinant of employment growth, it is not included in the current analysis given that the standard and easily computable proxy, which is apparent labor productivity, requires using the dependent variable in order to be computed (productivity = value added/employees). Which in turn generates an endogeneity problem. In future work, an alternative way of controlling for this variable could be including a more complex measure such as the firm's Total Factor Productivity.

accounting for time-invariant sources of firm heterogeneity that affects the average pattern of employment growth across firms. In particular, this controls for firm-level size, productivity and firms' characteristics that might influence the firms' ability to face the crisis. Most importantly, this allows accounting for the initial level of employment which can be a great source of employment growth heterogeneity across firms. Additionally, we include time dummies,  $\delta_t$ , in order to account for year-specific aggregate shocks and trends that are common to all firms. Nevertheless, it could be argued that some sectors suffered a larger drop in demand and therefore, employment was more vulnerable during the crisis in some specific industries. Thus, we alternatively include firm and 4 digits industry-year pair fixed effects ( $\delta_{it}$ ) in order to control for sector-level heterogeneity varying over time. Particularly, this accounts for the demand drop during the crisis that was particularly severe for some sectors.<sup>25</sup> The results for this alternative specification are reported in Appendix C.3. It should be noted that the interest of reporting estimation results with time effects instead of industry-time effects, lies in the fact that we want to recover the average main effect of the crisis which allows computing the total average effect conditional on exposure (given by equation 5.5, as described in the next section). Finally, in order to allow for correlation of errors at the level of the firm we report standard errors that are clustered at the firm-level.

With this strategy, we assess the transmission of international financial shocks given the firm's exposure to the crisis and its effects on employment growth. Now, what are the channels through which these shocks are transmitted across borders? This paper argues that a better financial health in the supplier's country makes it is more likely that the importer receives Trade Credit from its partner, which in turn will help the firm face the adverse effects of the lack of short-term liquidity due to the crisis. Thus, we next examine the Trade Credit channel and expect the effect to

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<sup>25</sup>For instance, Eaton et al. (2011) and Levchenko et al. (2009) analyse the disproportionate drop in durable goods sectors during the crisis, those that contribute the most to international trade.

be concentrated among firms that heavily rely on Trade Credit.

### 5.3.2 Is the effect conditional on the use of Trade Credit?

We now extend the regression specification by allowing the employment effect of Imports-Exposure-to-Crisis to vary with the firms' technological use of Trade Credit. We do this by interacting the Imports-Exposure-to-Crisis measure with the average use of Trade Credit over total imports during the years prior to the global crisis and the crisis dummy. We basically re-estimate equation 5.3 augmented by this interaction term as follows,

$$\begin{aligned}
 Emp\ Growth_{fit} = & \beta_1 Imports\ Exposure\ Crisis_f \times Crisis_t \\
 & + \beta_2 Trade\ Cred_f \times Crisis_t \\
 & + \beta_3 Imports\ Exposure\ Crisis_f \times Trade\ Cred_f \times Crisis_t \\
 & + \alpha_1 Z_{ft} + \delta_f + \delta_t + \epsilon_{ft}
 \end{aligned}
 \tag{5.4}$$

where the same control variables as before ( $Z_{ft}$ ) and firm and time effects are kept and errors are clustered at the level of the firm.  $Trade\ Cred_f$  is constant at the firm-level, thus, given the fixed-effects estimator it is only possible identifying its effect conditional on a variable that changes over time. That is, its interactions with the crisis dummy. In this way,  $Trade\ Cred_f \times Crisis_t$  establishes whether firms strongly relying on Trade Credit were more vulnerable during the crisis period. Note that the double interaction between Trade Credit and Imports-Exposure-to-Crisis as well as the main effect of this variable are absorbed by the firm-effects.

The triple interaction  $Imports\ Exposure\ Crisis_f \times Trade\ Cred_f \times Crisis_t$

is our main effect of interest. Our assumption is that a firm's supplier was more willing or better able to extend trade credit to its client, the less severe the financial shock in its country was. This can't be directly tested without observing the proportion of trade credit coming from each country but  $\beta_3$  provides an alternative way of evaluating this conjecture as it allows establishing whether the effect of the global crisis was lessened for firms that were less exposed given their sourcing strategy and whether this effect was concentrated among firms having a greater propensity to use inter-enterprise credit with their suppliers. Since  $\beta_3$  tests whether the effect was stronger for the most trade-credit intensive firms, we expect this coefficient to be positive.

As for  $\beta_2$ , we do not have any particular expectation in terms of the direction of its sign. One could argue that higher reliance on trade credit helps firms facing the crisis - through short term liquidity provision- but it could also be the case that this makes them more vulnerable to unexpected shocks. Especially, in the case where their partners are severely hit by the shock and thus not able to grant any trade credit. This particular argument is what is taken into account in the triple interaction term, that is, the health of the firm's (potential) lender and how strongly they were attached through commercial ties.

## 5.4 Results and discussion

This section presents the main empirical findings. We start with our baseline specifications where the transmission of the firms suppliers' financial shock is analysed using different measures of resilience to crisis in section 5.4.1. Next, we present the results of this effect conditional on the firm's reliance on trade credit in order to assess our main empirical question in subsection 5.4.2.

### 5.4.1 Baseline specification: Imports-Exposure-to-Crisis

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_t$	-4.64 <sup>a</sup> (-15.04)	-4.63 <sup>a</sup> (-14.95)	-4.61 <sup>a</sup> (-14.88)	-4.61 <sup>a</sup> (-14.90)	-4.63 <sup>a</sup> (-14.92)	-4.62 <sup>a</sup> (-14.93)
$Crisis_t \times Exposure_f \text{ Index 1}$	5.59 <sup>a</sup> (3.75)					
$Crisis_t \times Exposure_f \text{ Index 2}$		3.95 <sup>a</sup> (3.23)				
$Crisis_t \times Exposure_f \text{ Index 3}$			8.60 <sup>a</sup> (2.96)			
$Crisis_t \times Exposure_f \text{ Index 4}$				4.30 <sup>a</sup> (3.05)		
$Crisis_t \times Exposure_f \text{ Index 5}$					2.83 <sup>a</sup> (3.14)	
$Crisis_t \times Exposure_f \text{ Index 6}$						3.87 <sup>a</sup> (3.17)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.291	0.291	0.291	0.291	0.291	0.291
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	261.96	261.26	261.08	261.24	261.19	261.30

t statistics in parentheses.  
All regressions include firm and time F.E., errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.6:** Baseline regressions

How does the crisis transmission vary at different levels of firm-exposure to the shocks? The coefficient estimate of the interaction term in equation 5.3 assesses this effect on the firm's employment growth. Estimation results are reported in Table 5.6, where each column displays one of the 6 alternative measures for the severity of shocks, as described above in section 5.2.1. If it is the case that sourcing ties with more resilient partners contribute to relaxing a firm's financial constraints, we expect to find a positive coefficient for all measures with the exception of the exchange rate index (SDR).

The sign and significance of most of the coefficients confirm our hypothesis. The estimates suggest that firms facing a lower pre-crisis exposure to global shocks given the geographical composition of their sourcing strategies tend to have higher employment growth during the crisis period ( $\hat{\beta}_1 > 0$ ). The effect is positive and significant at the highest levels regardless of the resilience measure used. Nonetheless, we can't exclude

the possibility that this positive effect reflects the direct relation between labor and imports. Even if the exposure measure has been constructed in such a way that it reflects cross-country shocks during the crisis, it could also be capturing the direct effect that international sourcing can have on employment changes regardless of the crisis shocks, which can be either positive or negative depending on whether imports substitute or complement with labor.<sup>26</sup> For this reason, it is important evaluating the exposure effect conditional on the use of trade credit in order to better identify the impact that we intend to capture.

Perhaps, the most adequate way of interpreting the estimates is by analyzing the marginal effects for those firms reporting the highest and lowest exposure level in our sample as well as for the average firm exposure. Before doing this, however, it is convenient discussing the coefficient sign of exposure-to-crisis when the SDR index is used, reported in column (3). Given that a higher value for the SDR index indicates a greater exchange rate depreciation, which in itself is considered as one of the manifestations of the severity of the crisis, the coefficient on this measure was expected to be negative. Surprisingly, it turns out to be positive, statistically significant at the 1-percent level and the one with the highest magnitude across all measures. We believe that a possible explanation behind this result could be the fact that a currency depreciation translates into more competitive prices for the exporter, which might in turn provide an incentive for the supplier to extend trade credit by the anticipation of higher future payments. Conversely, a currency appreciation translates into sudden lower revenues for the exporter, which in turn might leave her illiquid and less able to accept delayed payments. Particularly, the supplier can be strongly discouraged to allow delayed payments if she anticipates further currency appreciation, in which case her expected income is lower and decreases proportionally with time.

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<sup>26</sup>See Biscourp and Kramarz (2007) for a discussion on the effects of imports on domestic French employment.

The main message that can be drawn from the results in Table 5.6 is that, not surprisingly, the average effect of the crisis is strongly negative, statistically significant at the highest levels and very stable across the alternative specifications. Conditional on the highest exposure to the crisis (that is, when *Imports Exposure Crisis<sub>f</sub>* is zero) on average, firms experienced a 4.6 percentage drop in employment growth with respect to 2005.<sup>27</sup> Additionally, the exposure-effect is always positive and also statistically significant at the 1-percent level, albeit very small (evaluated at the mean value of the exposure measure) for the six specifications. Given that all variables are introduced in levels, our coefficients of interest are interpreted as marginal effects. In this sense, the effect of the exposure-to-crisis variable, given by  $\beta_1$  can be interpreted as the change in employment growth for a given firm in 2009 (relative to 2005) at different levels of exposure, holding everything else constant. Thus, the total employment effect of the crisis is given by:

$$E ( Emp Growth_{fit} | 1[year = 2009] ) = \hat{\delta}_{t=2009} + \hat{\beta}_1 \times Imports Exposure Crisis_f \quad (5.5)$$

Now, we turn to the estimates interpretation focusing on one exposure-measure at a time beginning with column 1 which reports the results using the Growth index. As mentioned above, for the highest exposure value (that is when the measure takes the value of 0) the employment consequence of the crisis is -4.6 percent, represented by the coefficient on the crisis year. The effect evaluated at the mean value of exposure is not sizeably different from the latter, provided that the magnitude of average value of the indexes in very is very small. Nevertheless, when the effect is evaluated at the firm displaying the lowest exposure value (hence, the maximum level of the index) a positive total employment effect

<sup>27</sup>Where the interpretation of the crisis effect is made with respect to employment growth in 2005, the latter being the year dummy that was dropped, hence the reference year.

arises, 8.5 percent.<sup>28</sup> Thus, the exposure effect largely counterbalances the strong negative effect of the main coefficient on crisis. Nonetheless, these results evaluated at the maximum values of the exposure variable (i.e., the most resilient ones) are to be interpreted with caution given the extreme heterogeneity of our observations. For illustration, Figures C.4 and C.5 in Appendix C.1.2 plot the distribution of the exposure measure using the Growth Index, the first with all the observations and the second without the relatively few extreme values of these. More precisely, the negative effect of the crisis can only be counterbalanced by the positive effect due to  $\beta_1$  for the 194 firms at the right tail of the distribution. Given that it would require a value of the index of 0.8 in order to offset the negative effect of the crisis, the total effect of the crisis remains negative at the 99th percentile of the distribution, where the effect is equal to -2.6 percent.

In the same way, given the size of  $\hat{\beta}_1$  and the mean value of the rest of the exposure measures, the effects evaluated at the sample mean will not significantly differ from the main crisis effect provided by  $\hat{\delta}_{t=2009}$ . We will therefore comment uniquely the effects evaluated at the lowest levels of exposure for each measure. Keeping in mind that this concerns only the very few firms at the 100th percentile of the distribution of each index. Column 2 reports estimates using the Credit index, the total employment effect for the least exposed firm in this case is a 8.4 percentage growth. Column 3 reports estimates for the SDR currency index, which as already explained, is different from what we were expecting: a negative sign. The results suggest that the total effect of the crisis for the firm having the strongest sourcing ties with the country that suffered the greatest currency depreciation was a 7 percent employment growth. Turning to the effects using the Equity Market Index in column 4, the total effect is 9 percent, while for the alternative measure using the Rating Index as a proxy for the severity of the crisis in column 5, the effect is 8.5 percent. Finally, the Resilience Index, which summarizes the severity of shocks by averaging

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<sup>28</sup>Table 5.5 provides the mean, maximum and minimum values for all indexes.



the GDP growth, national stock markets and the country's creditworthiness indexes provides an average total effect of the crisis on employment of 9.1 percent for the least exposed firm.

Therefore, almost invariably, our results always imply that when firms have stronger pre-crisis ties with suppliers in countries that were less affected by the global crisis, employment growth performs better. Where results suggest that the interaction term softens the negative main effect of the crisis for those with the strongest ties with more resilient countries. The exception to this are the results given by the SDR measure, which for the reasons provided above, we interpret as a possible willingness from the supplier to allow delayed payments given the better terms of trade due to the currency depreciation. At the same time, it is also true that this measure differs from the other ones in the sense that European partners share the same currency shocks as French firms, however we are not sure about the implications that this could have on our estimates when using this index.

Finally, we alternatively estimate a more stringent version of equation 5.3 where time dummies are dropped and instead industry-time effects are included ( $\delta_{it}$ ) to account for time-varying effects specific to each 4-digits industry  $i$  as given by the firm's principal activity (NAF). The results are displayed in Table C.2 in Appendix C.3 and we find that the main effect of the crisis becomes positive and its magnitude is extremely high, but it is not significant anymore at any acceptable level. Which we don't find surprising given that demand, productivity and financial shocks during the crisis should have very different effects across different sectors. Concerning the coefficients of interest, their magnitude decreases across all measures and remain significant at the 5-percent level.

Next section presents the estimations of crisis exposure conditional on

trade credit intensity in order to assess whether these findings are concentrated among firms that ex-ante were more reliant on trade credit.

#### 5.4.2 Is Trade Credit the channel of transmission?

Is the employment effect of importing from more resilient countries conditional on the existence of trade credit? In order to assess this question we examine pre-crisis firm-level reliance on trade credit and interact it with our measure of *Imports-exposure-to-crisis* and the crisis indicator variable. In order to do so, we estimate equation 5.4, where  $\beta_3$  tests whether the effect was concentrated on the firms that were the most trade-credit intensive. Results from this procedure are reported in Table 5.7.

As anticipated, we find that the exposure-to-crisis effect is intensified significantly for trade credit intensive firms ( $\hat{\beta}_3$  is positive and statistically significant at the highest levels for all measures). This means that stronger pre-crisis sourcing ties with more resilient countries during the crisis, had a positive impact on firms' employment provided that they extensively used trade credit before the crisis. This suggests, therefore, that trade credit can soften the firm's short-term credit constraints if the supplier is able to allow a delayed payment. Nevertheless, strongly relying on trade credit can in it-self translate into higher vulnerability to unanticipated shocks. This is confirmed by the negative and highly significant coefficient of trade credit during the crisis ( $\hat{\beta}_2 < 0$ ). Hence, the main effect of the crisis can either be softened or aggravated by the firm's average reliance on trade credit, depending on the behavior of the supplier during the crisis. Which clearly has opposite consequences when the firm is under financial stress. This behavior is precisely what the triple interaction term captures: the extent to which suppliers continued extending trade credit. Where we assume that the suppliers' ability to lend goods during the crisis depended on the severity of shocks that took place in their respective country.

Interestingly, the effect of exposure-to-crisis lower in magnitude and loses some statistical significance across all the alternative crisis measures (5-percent level for the Growth and Credit indexes and 10-percent level for the rest). Additionally, its magnitude is considerably lower relative to the estimates obtained without conditioning the effect on trade credit use. These results point strongly to our hypothesis concerning the coefficients given above. Where our exposure measure might also be capturing the direct relationship between imports and employment, which should be negative if domestic labor and imports are substitutes. Although the coefficients remain positive, this potential substitutability emerges only once the positive effects of resilience are purged out by the triple interaction. Explaining the smaller magnitude of the new coefficients on exposure-to-crisis during the crisis.

A negative impact of international sourcing on employment, is in line with the findings in Biscourp and Kramarz (2007), who, using French firm-level data show that increasing imports (in particular, of finished goods) is strongly correlated with job destruction. Nonetheless, it should be kept in mind that providing evidence of the direct relationship between imports and employment is beyond the scope of our analysis. In which case, a clean analysis would require accounting for different dimensions, such as the different types of imported goods, their country of origin and the type of workers involved.<sup>29</sup>

Now, we turn to the quantification the total crisis effect, conditional on trade credit intensity and crisis exposure given the sourcing ties with each country. This effect is given by the following expression:

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<sup>29</sup>In this line, a new paper by Harrigan et al. (2016) studies the employment polarization in France due to trade conditional on technological change.

$$\begin{aligned}
E ( Emp Growth_{fit} | 1[year = 2009] ) &= \hat{\delta}_{t=2009} \\
&+ \hat{\beta}_1 \times Imports Exposure Crisis_f \\
&+ \hat{\beta}_2 \times Trade Cred_f \\
&+ \hat{\beta}_3 \times Imports Exposure Crisis_f \times Trade Cred_f
\end{aligned} \tag{5.6}$$

This estimated effect is summarized in table 5.8. It displays employment growth impact in 2009 conditional on different values for trade credit intensity and exposure-to-crisis, across the alternative exposure measures. Both, Trade Credit and the Exposure Indexes are evaluated at their mean, minimum, median, 99th percentile and maximum values. Where the different values taken by Trade Credit are reported in rows, while those for the Exposure Indexes are reported in columns. While we don't find it surprising that some firms grow exponentially, even in times of crisis, the total effect for its maximum values provide unreasonably big numbers for employment growth (ranging between -45 to 132 percent). Perhaps, in future work, this motivates performing an analysis accounting for this extreme heterogeneity with the help of quintile regression methods.

The first finding that arises is that when both variables are evaluated at the mean (the green shaded area in the column (1)), the total effect is stronger than the main effect of the crisis. This means that at the average firm, the negative effect of the crisis was magnified by the trade credit channel due to a sudden unavailability of this type of short-term financing. Or alternatively, out of the two competing effects of trade credit during the crisis (i.e.,  $\beta_2$  vs.  $\beta_3$ ), the negative effect dominated on average.

In order to examine these figures, it is convenient evaluating the effects relative to the main effect of the crisis which ranges between -3.93 and -3.97 across the alternative specifications. These are the grey shaded cells, reported in column (2). That is, when both trade credit and exposure take

the value of zero, so that only the main effect of the crisis is accounted for in expression 5.6. This is precisely the total impact for firms for whom trade credit is not usually a source of short-term financing. It can be seen that the exposure to international shocks is relatively less relevant for these firms than for the more trade credit intensive ones. In this sense, the total effect among different exposure levels ranges between -4 percent and 4.5 percent for the firms relying the least on trade credit, while it ranges between -5 and 6.2 for the median value of trade credit intensity and between -45 and 132 in the most extreme cases (the ones at the maximum level of trade credit usage). This smaller range of the total effect of the crisis is due to the fact that trade credit intensity has completely opposite effects depending on the exposure to international shocks.

In this sense, taking the main effect of the crisis as a reference, the more the firm is connected with more resilient countries (moving towards the right of the table) the more the impact of the crisis is softened due to the positive effect of  $\beta_2$  in 5.6. Additionally, the more the firm relies on trade credit (moving towards the bottom of the table) the main effect of the crisis is either softened or aggravated, depending on the extent to which the firm is tied to more or less resilient countries, respectively.

Thus, when trade credit happens to be a source of finance for the firm, the exposure measure begins to matter and becomes a strong determinant of the total crisis effect. Where the main message drawn from this table is that strong reliance on trade credit amplifies the adverse impact of the crisis, notably when the firm's suppliers faced a severe shock or a large currency appreciation (that is, the lowest value for the exposure index). These are the red figures and they suggest an average 0.6 percent exacerbation of the crisis impact (across all exposure indexes) for firms at the 99th percentile of the distribution of trade credit intensity. While the exacerbation on the most extreme values of trade credit reliance attains 40 percent on average. On the contrary, when suppliers were located in countries more resilient to the crisis (or with a large currency depreciation)

and the firm had stronger ties with these, a strong reliance on trade credit softened the negative effects of the crisis. These figures are the blue figures, where the positive effect of the interaction largely counterbalances the direct negative impact of the crisis and trade credit intensity during the crisis. While these extreme values are illustrative, perhaps, the mean and median values are more informative.

When both measures are evaluated at the median, the total effect results in a larger employment drop relative to the main effect of the crisis. As we have seen, this is also the case with the average total effect displayed in green. This suggests, therefore, that the impact of the crisis was exacerbated by stronger reliance on trade credit and stronger ties with suppliers subject to more severe shocks during the crisis (or experiencing a stronger currency appreciation).

Finally, we alternatively estimate a more stringent version of equation 5.4 where time dummies are dropped and instead 4 digits industry-time effects are included. The results are displayed in Table C.3 in the Appendix. As it was the case for the baseline regressions with imports-exposure-crisis, we find that the main effect of the crisis dummy is again positive, very big and insignificant. In the same vein, the coefficient of the interaction between crisis and trade credit becomes very small and is not significant anymore at any level of acceptance. While the estimates of exposure-to-crisis decrease moderately in magnitude but are not anymore estimated with precision (being only significant for the Growth Index at the 10-percent level).

We believe that this should be explained by the fact that firms inside the same sector should have both similar trade credit intensity determined by technological characteristics of each specific sector, as argued by Fisman and Love (2003), and similar sourcing strategies (e.g., countries have comparative advantages). Therefore, when firm heterogeneity is accounted for as well, very little variation in the data should be left. This is particularly

true when there are very few firms within an industry.<sup>30</sup> The lack of significance of these coefficients suggests that there is no overall effect of trade credit intensity during the crisis, given that it crucially depends on whether suppliers continued extending trade credit or not. Nevertheless, our coefficients of interest, those of the triple interaction term, are slightly altered in terms of magnitude and remain significant at the highest level of acceptance. However, with the inclusion of less stringent effects, that is, by defining the industry at the 2-digits level, all results on the double interaction term remain significant at the 5 and 10-percent level as the benchmark results. Where the coefficients are very similar to the the ones found with the 4-digits industry-year fixed effects.<sup>31</sup>

Summing up, our estimates across 5 of our alternative measures of severity of crisis show that the global downturns over 2008-2009 differently affected firms with varying levels of interconnectedness to these shocks, given their different international sourcing strategies. Additionally, we find heterogeneous effects of these transmission across firms differing in their average usage of Trade Credit in production: firms who don't usually use trade credit as a source of finance, are marginally affected by their international sourcing ties. On the other hand, the effect is dramatically different for firms who rely on trade credit depending on the level of exposure. Trade credit mitigates the drop in employment for firms with strong relations with more resilient partners. While with strong relations with countries where the incidence of the crisis was higher intensifies the drop in employment. Nevertheless, when the severity of crisis is measured by the country's currency depreciation, the results point in the same direction as the resilience measures: stronger ties with countries under strong currency depreciation tempered the adverse effects of the crisis for trade credit intensive firms.

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<sup>30</sup>Table C.1 in the Appendix C.2 summarises the number of observations in each of the 2-digits industry in our sub-sample.

<sup>31</sup>Table not reported but available upon request.

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_t$	-3.97 <sup>a</sup> (-9.85)	-3.96 <sup>a</sup> (-9.79)	-3.93 <sup>a</sup> (-9.68)	-3.93 <sup>a</sup> (-9.69)	-3.95 <sup>a</sup> (-9.74)	-3.94 <sup>a</sup> (-9.73)
$Crisis_t \times Trade Cred_f$	-2.70 <sup>b</sup> (-2.53)	-2.70 <sup>b</sup> (-2.51)	-2.72 <sup>b</sup> (-2.50)	-2.72 <sup>b</sup> (-2.51)	-2.71 <sup>b</sup> (-2.51)	-2.72 <sup>b</sup> (-2.51)
$Crisis_t \times Exposure_f Index 1$	3.61 <sup>b</sup> (2.39)					
$Crisis_t \times Exposure_f Index 2$		2.47 <sup>b</sup> (2.09)				
$Crisis_t \times Exposure_f Index 3$			4.80 <sup>c</sup> (1.69)			
$Crisis_t \times Exposure_f Index 4$				2.47 <sup>c</sup> (1.79)		
$Crisis_t \times Exposure_f Index 5$					1.71 <sup>c</sup> (1.95)	
$Crisis_t \times Exposure_f Index 6$						2.30 <sup>c</sup> (1.93)
$Crisis_t \times Trade Cred_f \times Exposure_f Index 1$	4.36 <sup>a</sup> (3.39)					
$Crisis_t \times Trade Cred_f \times Exposure_f Index 2$		3.08 <sup>a</sup> (3.53)				
$Crisis_t \times Trade Cred_f \times Exposure_f Index 3$			8.29 <sup>a</sup> (4.07)			
$Crisis_t \times Trade Cred_f \times Exposure_f Index 4$				3.50 <sup>a</sup> (4.32)		
$Crisis_t \times Trade Cred_f \times Exposure_f Index 5$					2.32 <sup>a</sup> (3.61)	
$Crisis_t \times Trade Cred_f \times Exposure_f Index 6$						3.06 <sup>a</sup> (4.03)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.291	0.291	0.291	0.291	0.291	0.291
Adjusted $R^2$	0.097	0.097	0.097	0.097	0.097	0.097
F	205.19	204.78	205.15	206.12	204.79	205.56

*t* statistics in parentheses.

All regressions include time-varying firm level controls, firm and time F.E..

Errors clustered at firm level. <sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.7:** Baseline Trade Credit



Trade Credit	Exposure Index					
		mean (1)	min (2)	p50 (3)	p99 (4)	max (5)
<b>at mean</b>	Growth Index	-4.29	-4.62	-4.43	-2.90	6.31
	Credit Index	-4.31	-4.60	-4.41	-3.22	6.27
	SDR Index	-4.31	-4.58	-4.45	-3.36	4.58
	Equity Index	-4.32	-4.58	-4.42	-3.29	5.87
	Rating Index	-4.31	-4.60	-4.42	-3.33	5.74
	Resilience Index	-4.32	-4.59	-4.41	-3.29	6.16
<b>at min</b>	Growth Index	-3.72	-3.97	-3.82	-2.63	4.50
	Credit Index	-3.73	-3.96	-3.81	-2.89	4.41
	SDR Index	-3.74	-3.93	-3.84	-3.07	2.55
	Equity Index	-3.73	-3.93	-3.80	-2.97	3.87
	Rating Index	-3.73	-3.95	-3.81	-3.00	3.85
	Resilience Index	-3.73	-3.94	-3.80	-2.95	4.21
<b>at median</b>	Growth Index	-4.27	-4.59	-4.41	-2.89	6.24
	Credit Index	-4.29	-4.58	-4.39	-3.21	6.19
	SDR Index	-4.29	-4.56	-4.42	-3.35	4.50
	Equity Index	-4.29	-4.55	-4.39	-3.28	5.79
	Rating Index	-4.28	-4.57	-4.39	-3.32	5.66
	Resilience Index	-4.30	-4.57	-4.39	-3.27	6.07
<b>at p99</b>	Growth Index	-5.18	-5.62	-5.37	-3.30	9.10
	Credit Index	-5.21	-5.60	-5.34	-3.73	9.14
	SDR Index	-5.20	-5.59	-5.39	-3.82	7.72
	Equity Index	-5.22	-5.59	-5.36	-3.79	8.96
	Rating Index	-5.20	-5.60	-5.35	-3.86	8.66
	Resilience Index	-5.22	-5.60	-5.35	-3.81	9.15
<b>at max</b>	Growth Index	-40.59	-45.53	-42.70	-19.40	120.42
	Credit Index	-40.91	-45.39	-42.41	-23.98	123.41
	SDR Index	-40.40	-45.69	-43.05	-21.89	132.84
	Equity Index	-41.29	-45.79	-42.98	-23.84	132.14
	Rating Index	-40.72	-45.57	-42.59	-24.67	125.05
	Resilience Index	-41.25	-45.69	-42.73	-24.50	128.74

Total crisis effect based on OLS estimates of equation (5.4) when  $1[year = 2009]$  evaluated at different values of Trade Credit Intensity and Exposure-to-Crisis.

**Table 5.8:** Total crisis effect conditional on exposure and trade credit intensity

## 5.5 Robustness and future work

### 5.5.1 Placebo Tests

For the sake of robustness, in this section we re-estimate equation 5.4 by setting the crisis dummy equal to one for each of the years different from 2009 at a time (i.e., a separate analysis for each of the following years: 2008, 2007 and 2006, where 2005 is kept as the base year as in the benchmark regressions). The interest of this strategy is to perform a placebo test, where we hypothetically assume that the crisis occurred in another year. In case the estimated coefficients were similar or point in the same direction as our benchmark regressions, it would mean that our "treatment" variable fails to capture the effects of the crisis on employment.

These estimations are presented in Tables 5.9 - 5.12. The results from this strategy show that no significant effects concerning the triple interaction term arises in any of these regressions. Hence, the mechanism put forward in this analysis is only at play in the year 2009, where the transmission of shocks across borders was more pronounced for firms that strongly relied on trade credit before the crisis. Therefore, providing a strong support for the hypothesis that financial shocks suffered by trading partners had an employment consequence on importers in our sample. Additionally, the negative effects of the crisis (provided by the coefficient on the year dummy in the two specifications) begun to appear in 2008, although the size of the coefficient is smaller with respect to 2009 (from the benchmark results).

Finally, one additional interesting result arises at the beginning of the financial crisis. The coefficient on the interaction term between trade credit intensity and the year 2008 (i.e.,  $Crisis_t \times Trade\ Cred_f$ ) in Table 5.14 turns out to be positive and significant at the highest levels. One

possible explanation for this is that by the end of 2008, the crisis was beginning to emerge and probably few firms started to be credit rationed at this point. While among those firms that begun being affected, the ones usually relying more on trade credit were able to partly finance their activity by relying on the short-term financing provided by their suppliers. This is in sharp contrast with the coefficient results for this variable in 2009 (Table 5.7) where the coefficient is negative and significant. Suggesting therefore, that with respect to 2008, suppliers' ability to provide trade credit was significantly reduced in 2009.

Now, the following sections 5.5.3 and 5.5.2 provide a discussion about the limits of our this analysis, additional extensions in which we are currently working on and possible future research paths in sections.

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{t=2006}$	0.32 (1.17)	0.31 (1.11)	0.28 (1.02)	0.30 (1.08)	0.29 (1.06)	0.30 (1.08)
$Crisis_t \times Exposure_f Index 1$	0.51 (0.41)					
$Crisis_t \times Exposure_f Index 2$		0.66 (0.68)				
$Crisis_t \times Exposure_f Index 3$			2.57 (1.06)			
$Crisis_t \times Exposure_f Index 4$				0.93 (0.85)		
$Crisis_t \times Exposure_f Index 5$					0.63 (0.88)	
$Crisis_t \times Exposure_f Index 6$						0.80 (0.83)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.290	0.290	0.290	0.290	0.290	0.290
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	257.29	257.40	257.51	257.37	257.51	257.41

*t* statistics in parentheses.

All regressions include firm and time F.E., errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.9:** Placebo Crisis Year 2006: Baseline regressions

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{t=2007}$	0.32 (1.16)	0.33 (1.17)	0.28 (1.02)	0.30 (1.09)	0.31 (1.12)	0.31 (1.10)
$Crisis_t \times Exposure_f Index 1$	-0.08 (-0.06)					
$Crisis_t \times Exposure_f Index 2$		-0.14 (-0.14)				
$Crisis_t \times Exposure_f Index 3$			1.45 (0.62)			
$Crisis_t \times Exposure_f Index 4$				0.34 (0.29)		
$Crisis_t \times Exposure_f Index 5$					0.07 (0.10)	
$Crisis_t \times Exposure_f Index 6$						0.21 (0.20)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.290	0.290	0.290	0.290	0.290	0.290
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	257.95	257.95	258.11	257.97	257.96	257.96

*t* statistics in parentheses.

All regressions include firm and time F.E., errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.10: Placebo Crisis Year 2007: Baseline regressions**

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{t=2008}$	-1.58 <sup>a</sup> (-4.85)	-1.59 <sup>a</sup> (-4.87)	-1.57 <sup>a</sup> (-4.80)	-1.57 <sup>a</sup> (-4.82)	-1.58 <sup>a</sup> (-4.82)	-1.57 <sup>a</sup> (-4.81)
$Crisis_t \times Exposure_f Index 1$	-2.86 <sup>b</sup> (-2.00)					
$Crisis_t \times Exposure_f Index 2$		-1.93 <sup>c</sup> (-1.71)				
$Crisis_t \times Exposure_f Index 3$			-5.40 <sup>b</sup> (-2.03)			
$Crisis_t \times Exposure_f Index 4$				-2.69 <sup>b</sup> (-2.11)		
$Crisis_t \times Exposure_f Index 5$					-1.53 <sup>c</sup> (-1.84)	
$Crisis_t \times Exposure_f Index 6$						-2.28 <sup>b</sup> (-2.05)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.291	0.290	0.291	0.291	0.290	0.291
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	258.16	258.00	258.20	258.22	258.11	258.19

*t* statistics in parentheses.

All regressions include firm and time F.E., errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.11: Placebo Crisis Year 2008: Baseline regressions**

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{t=2006}$	0.09 (0.27)	0.06 (0.19)	0.03 (0.08)	0.06 (0.18)	0.04 (0.14)	0.05 (0.17)
$Crisis_t \times Trade Cred_f$	1.00 <sup>c</sup> (1.68)	1.03 <sup>c</sup> (1.73)	1.06 <sup>c</sup> (1.76)	1.02 <sup>c</sup> (1.71)	1.05 <sup>c</sup> (1.74)	1.03 <sup>c</sup> (1.72)
$Crisis_t \times Exposure_f Index 1$	0.50 (0.36)					
$Crisis_t \times Exposure_f Index 2$		0.72 (0.66)				
$Crisis_t \times Exposure_f Index 3$			2.89 (1.07)			
$Crisis_t \times Exposure_f Index 4$				0.98 (0.78)		
$Crisis_t \times Exposure_f Index 5$					0.71 (0.88)	
$Crisis_t \times Exposure_f Index 6$						0.85 (0.78)
$Crisis_t \times Trade Cred_f \times Exposure_f Index 1$	0.02 (0.04)					
$Crisis_t \times Trade Cred_f \times Exposure_f Index 2$		-0.16 (-0.42)				
$Crisis_t \times Trade Cred_f \times Exposure_f Index 3$			-0.68 (-0.71)			
$Crisis_t \times Trade Cred_f \times Exposure_f Index 4$				-0.14 (-0.31)		
$Crisis_t \times Trade Cred_f \times Exposure_f Index 5$					-0.16 (-0.56)	
$Crisis_t \times Trade Cred_f \times Exposure_f Index 6$						-0.14 (-0.36)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.290	0.290	0.290	0.290	0.290	0.290
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	200.64	200.79	200.90	200.75	200.88	200.78

*t* statistics in parentheses.

All regressions include time-varying firm level controls, firm and time F.E..

Errors clustered at firm level. <sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.12:** Placebo Crisis Year 2006: Trade Credit

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_t=2007$	0.05 (0.15)	0.13 (0.36)	0.07 (0.19)	0.12 (0.32)	0.08 (0.22)	0.10 (0.26)
$Crisis_t \times Trade Cred_f$	1.11 (1.15)	0.81 (0.82)	0.89 (0.90)	0.77 (0.77)	0.96 (0.97)	0.87 (0.87)
$Crisis_t \times Exposure_f Index 1$	1.01 (0.47)					
$Crisis_t \times Exposure_f Index 2$		0.02 (0.01)				
$Crisis_t \times Exposure_f Index 3$			2.13 (0.45)			
$Crisis_t \times Exposure_f Index 4$				0.36 (0.14)		
$Crisis_t \times Exposure_f Index 5$					0.42 (0.31)	
$Crisis_t \times Exposure_f Index 6$						0.48 (0.24)
$Crisis_t \times Trade Cred_f \times Exposure_f Index 1$	-4.23 (-0.57)					
$Crisis_t \times Trade Cred_f \times Exposure_f Index 2$		-0.42 (-0.06)				
$Crisis_t \times Trade Cred_f \times Exposure_f Index 3$			-2.16 (-0.12)			
$Crisis_t \times Trade Cred_f \times Exposure_f Index 4$				0.18 (0.02)		
$Crisis_t \times Trade Cred_f \times Exposure_f Index 5$					-1.23 (-0.25)	
$Crisis_t \times Trade Cred_f \times Exposure_f Index 6$						-0.88 (-0.12)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.290	0.290	0.290	0.290	0.290	0.290
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	200.83	200.85	200.98	200.89	200.85	200.87

*t* statistics in parentheses.

All regressions include time-varying firm level controls, firm and time F.E..

Errors clustered at firm level. <sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.13:** Placebo Crisis Year 2007: Trade Credit

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_{t=2008}$	-2.31 <sup>a</sup> (-5.45)	-2.33 <sup>a</sup> (-5.39)	-2.30 <sup>a</sup> (-5.32)	-2.30 <sup>a</sup> (-5.45)	-2.31 <sup>a</sup> (-5.34)	-2.30 <sup>a</sup> (-5.41)
$Crisis_t \times Trade Cred_f$	3.00 <sup>a</sup> (2.67)	3.08 <sup>a</sup> (2.60)	3.03 <sup>a</sup> (2.58)	3.01 <sup>a</sup> (2.71)	3.02 <sup>a</sup> (2.58)	3.02 <sup>a</sup> (2.68)
$Crisis_t \times Exposure_f Index 1$	-1.62 (-0.86)					
$Crisis_t \times Exposure_f Index 2$		-0.88 (-0.53)				
$Crisis_t \times Exposure_f Index 3$			-2.94 (-0.76)			
$Crisis_t \times Exposure_f Index 4$				-1.57 (-0.93)		
$Crisis_t \times Exposure_f Index 5$					-0.84 (-0.72)	
$Crisis_t \times Exposure_f Index 6$						-1.30 (-0.87)
$Crisis_t \times Trade Cred_f \times Exposure_f Index 1$	-3.69 (-1.06)					
$Crisis_t \times Trade Cred_f \times Exposure_f Index 2$		-3.43 (-0.82)				
$Crisis_t \times Trade Cred_f \times Exposure_f Index 3$			-8.02 (-0.80)			
$Crisis_t \times Trade Cred_f \times Exposure_f Index 4$				-3.37 (-1.22)		
$Crisis_t \times Trade Cred_f \times Exposure_f Index 5$					-2.14 (-0.75)	
$Crisis_t \times Trade Cred_f \times Exposure_f Index 6$						-2.96 (-1.06)
Observations	72988	72988	72988	72988	72988	72988
$R^2$	0.291	0.291	0.291	0.291	0.291	0.291
Adjusted $R^2$	0.096	0.096	0.096	0.096	0.096	0.096
F	201.39	201.18	201.32	201.51	201.24	201.40

*t* statistics in parentheses.

All regressions include time-varying firm level controls, firm and time F.E..

Errors clustered at firm level. <sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table 5.14:** Placebo Crisis Year 2008: Trade Credit

### **5.5.2 Sensitivity analysis: Are there any other mechanisms consistent with our results?**

We aim at testing a mechanism that links ex-ante geographical ties to transmission of ex-post shocks. However, our results could also be consistent with an alternative hypothesis, which is that shocks in the country of either (and mostly) the parent of the firm or one of its affiliates could also be transmitted to the firm during the crisis. This particular mechanism is studied by Kolasa et al. (2010) and Alfaro and Chen (2010). The former use Polish firm-level data and find that foreign ownership resulted in a higher degree of resilience to the crisis, which was possibly due to intra-group lending supporting affiliates' problems of external credit availability. Similarly, Alfaro and Chen (2010) explore the role of FDI in helping affiliates facing credit constraints during the crisis using a firm-level worldwide dataset. It closely relates to our analysis in the sense that they explore financial linkages among groups conditional on the incidence of the crisis in the host and home countries. Their findings suggest that multinationals whose headquarters are located in countries with a greater incidence of the crisis, performed worse than their local competitors.

In this sense, ruling out this alternative explanation is of particular importance given that intra-group loans can directly affect firms' financial constraints, which is central to the mechanism explored in this paper. Therefore, we are currently working on this robustness check with the help of FDI firm-level data from Banque de France.

### **5.5.3 Future work**

As it was mentioned above, the current data at our disposal limits the scope of our analysis in some dimensions. Nevertheless, in the near future



we plan to extend our analysis when access to new data is obtained: an extension of the data we currently use (BRN beyond 2008), as well as access to the Financial linkages French data (LIFI) and the employment base DADS (Déclaration Annuelle des Données Sociales). In this sense, we plan to extend our study to account for financial constraints and specific employment categories effects as explained in the following subsections.

**Are financial constraints the channel of transmission?** Given that the mechanism that we explore assumes a relaxation of the firm's financial constraints, it is then convenient testing whether the existence of financial constraints is the relevant channel of transmission of the shocks. However, as it was already mentioned, the balance-sheet data at our disposal at the moment is only available until 2008 and this limits the scope of our analysis, particularly, testing whether financial constraints are responsible for the results presented in this paper. Nonetheless, these data does exist and we will have access to the years 2009-2010. In this sense, we plan to directly introduce a variable reflecting the firm's credit constraints during the crisis and evaluate how these related to its employment growth during the crisis and expect the effect of exposure to crisis during the financial crisis to become insignificant. More precisely, we anticipate that if the financial constraints channel is really the mechanism behind our results, then by re-estimating equation 5.3 and 5.4 with the introduction an interaction term between the firm's financial constraint proxy and the crisis dummy our results should become irrelevant.

**Robustness with respect to Trade Credit measure** Our analysis focuses on the propagation of financial shocks through inter-enterprise financing between firms across borders. Therefore, this channel is only relevant for foreign inter-enterprise credit. In this sense, the main shortcoming with the trade credit measure used in this analysis is that we are not able to distinguish payables that are related to imports from those related to domestic purchases. This could turn out to be problematic in cases where

a firm receives only trade credit from domestic suppliers (which we do not observe), at the same time as we observe an important amount of trade credit and a low exposure to crisis -due to sourcing from a more resilient partner. In this sense, we could falsely interpret these cases as evidence supporting our hypothesis. In future work, a possibility to circumvent this problem could be to rely on proxies for the use of open account contracts based on country, sector and firm-level characteristics, that have been put forward by recent studies on trade finance.<sup>32</sup>

**Are the effects heterogeneous among different types of employees?**

Our current analysis provides an employment average effect at the firm-level. However, one could think that the effects are certainly not the same among different types of employees. Notably if they are more or less substitutable with capital (the collateral channel implies that firms use more capital at the expense of labor) and also depending on the type of contract with the firm. French institutions are known for protecting employees in several ways, hence one could think that part-time jobs as well as the "interim" ones might be more affected when the firm faces a financial shock given that these are less subject to regulation. Additionally, the number of hours worked provides an additional information allowing to assess how firms adjust employment, both at the intensive and extensive margins.

In this way, a decomposition of the firm-level employment effects could be done with the help of the DADS database (where we will observe our period of interest). This database is based on mandatory annual reports filled by all firms with employees; it contains annual hours paid in a firm, as well as number of workers employed by different socio-professional occupation types. The use of this data is particularly interesting given that for each worker, it provides information on gross and net wages, hours paid, occupation, tenure, gender and age.

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<sup>32</sup>See for instance: Antras and Foley (2015), Demir and Javorcik (2015) and Hoefele et al. (2013).

## 5.6 Conclusion

The dramatic cross-border consequences the Great Recession and the speed at which shocks propagated around the world, raised an increasing need of understanding the implications of living in highly interconnected world. This paper adds to the growing literature aiming at doing so. We use French firm-level data on importers and focus on the role of trade credit (or inter-enterprise credit, which doesn't involve financial intermediaries) in shaping the transmission of global shocks and assess its impact on employment growth.

Given that (at least a part of) firm's capital can be seized by lenders in case of credit default, capital can be pledged as collateral in order to raise external funds. While this is obviously not the case for employment. Thus, the inalienability of human capital implies that when external finance becomes scarce, the need of pledging collateral in order to secure loan repayment provides an incentive for the firm to shift towards a more capital intensive production. On the other hand, suppliers may finance their clients by requiring the importer to pay goods in the future, as they develop a commercial relationship over time. In this sense they substitute to financial institutions as lenders by providing trade credit. Motivated by this, we evaluate how foreign suppliers can alleviate the firm's short-term financial constraints by accepting delayed payments. Which in turn translates into lower pressure on employment when credit from financial institutions is limited.

Without directly observing trade credit from each foreign partner, our econometric analysis is based on the assumption that suppliers' ability to provide trade credit during the global financial crisis depended on the

severity of shocks in each country over 2008-2009 (and pre-established trade relations). Therefore, we exploit cross-country differences in the severity of the crisis and different levels of firm-level exposure to these shocks in order to assess the transmission of these and its impact on employment growth. Next, we evaluate this effect conditional on firm-level technological reliance on trade credit. This allows us uncovering whether the financial health of its foreign suppliers (that we view as potential lenders) helped cushioning the negative effect of the crisis and whether the effect was concentrated among trade credit intensive firms.

Using various measures of the crisis, our findings show that the global downturns over 2008-2009 differently affected firms with varying levels of interconnectedness to these shocks, given their different international sourcing strategies. Where the results point to a particular channel of transmission : trade credit. Our findings summarize as follows, strong pre-crisis sourcing ties with countries that were more resilient to the global crisis, translated into better performance in terms of employment growth over 2008-2009. This effect dramatically varies with trade credit intensity. Strongly relying on trade credit made firms more vulnerable to unanticipated shocks, for whom the adverse impact of the crisis was exacerbated. This effect intensified among firms with important sourcing ties with severely shocked countries. While the negative effect of the crisis was mitigated when sourcing relations with countries subject to milder shocks were stronger. Supporting, therefore, the hypothesis that trade credit was an alternative source of financing for enterprises during the crisis. Where implicitly borrowing from suppliers helped importers overcoming financial constraints.

# 6

## Conclusion

The subject of my doctoral thesis revolves around the analysis of the links between financial and real variables in international economics. In the first chapter, a joint work with Jean-Charles Bricongne and Sebastian Franco-Bedoya, we show that in order to find the substitutability effect of FDI on exports one has to search in the right places. The ones suggested by theory. In the second chapter I provide an empirical analysis into the marginal return to capital in developing and developed countries and its connection with the Lucas' Paradox. I show that aggregate return to capital in developing countries is pinned by financial frictions. Which contributes to the understanding of why capitals don't flow from rich to poor countries. Finally, in the third chapter, in collaboration with Jean-Charles Bricongne and Fabrizio Coricelli, we study the transmission of global shocks during the Great Recession and its impact on French employment. Each of the three chapters of my PhD thesis are summarized in the following.

The first chapter, joint work with Jean-Charles Bricongne and Sebastian Franco-Bedoya, pertains to the pure real-side of international economics: international trade. It revisits the substitutability/complementarity relation between Foreign Direct Investment (FDI) and exports. we show that in order to find the substitutability effect of FDI on exports one has to

search in the right places. Those suggested by existing theory and our theoretical contribution on this relation. Thus, we treat this question both theoretically and empirically. We extend a standard Horizontal FDI model by introducing multi-product firms in order to give a new explanation of the apparent theoretical/empirical mismatch in the literature, where most empirical studies are in favor of a complementarity while theory predicts substitutability when FDI takes place in rich markets. The empirical part makes use of very detailed data on French firms to test the validity of our model. This chapter shows that even though the complementarity effect dominates the net effect of FDI on exports, firms do substitute exports of their best performing products in strong demand markets when the size of the investment is sufficiently high.

The second chapter is more related to Development Economics and International Macroeconomics. It revolves around the question of how capital and trade flows are related to each other in the sense that existing theory suggests that international trade allows a better allocation which shapes the overall return to capital of a country. This, in turn shapes the direction of capital flows. In it, I aim at providing a new explanation of why capitals don't flow from rich to poor countries, which adds to the literature that contributes to explaining the Lucas' Paradox. In order to do so, I make use of the intuition provided by the now growing literature on Misallocation and Financial Frictions. More specifically, I empirically study how differences in financial frictions at the sector and country level interact to determine the Marginal Product of Capital (MPK) and FDI inflows in developing countries. My results suggest that higher production in financially dependent sectors is negatively related to MPK and FDI inflows in developing economies, the effect being particularly strong among those with less financially developed systems.

In the third chapter, joint research with Jean-Charles Bricongne and Fabrizio Coricelli, we study the transmission of global shocks during the Great Recession and its impact on French employment. We empirically assess how employment behaved during the financial crisis among French im-

porters. More specifically, we assess whether employment has been the least affected among firms sourcing inputs from the countries which were the most resilient to the crisis. Where the channel of transmission is to the ability of French firms' suppliers located in the less affected countries to continue extending trade credit to French firms. We argue that given that cross-border goods linkages involve a financial transaction, international trade has implications for the transmission of shocks across countries. This implications may depend on the type of payment contract related in the transaction. Focusing on open account payments, where the importer pays the goods only upon delivery, allows us analysing an additional channel of transmission of shocks across borders given that firms are linked through a short-term financial relation. Thus, credit restrictions from banks to non financial companies in each respective country, alters the ability of a supplier to bear the risk of the transaction and export under open account contracts. Therefore, it adds to the channels through which shocks across countries can be propagated and the debate on the real effects of trade finance during the financial crisis.

# Appendix A

## Horizontal FDI with Multi-Product Firms

### A.1 Theoretical appendix

#### A.1.1 Product optimal price

The firm maximizes:

$$\max_{p_i} \left\{ p_i(\varphi) \times \left( \frac{\tau_{ij} p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} Y_j - \varphi \times \left( \frac{\tau_{ij} p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \right\}$$

where fixed costs at the product level are introduced only to emphasize the fact that when carrying out FDI some additional capacity investment are required and need to be taken into account when making the decision to do FDI. But the presence of additive costs means that firm sales are always



bounded<sup>1</sup>. This maximization problem yields the first order condition:

$$\begin{aligned}
 \frac{\tau_{ij}p_i^*(\varphi) + \eta_j}{P_j} - \sigma p_i^* \frac{\tau_{ij}}{P_j} + \sigma \varphi \frac{\tau_{ij}}{P_j} &= 0 \\
 p_i^*(\varphi) + \frac{\eta_j}{\tau_{ij}} - \sigma p_i^* + \sigma \varphi &= 0 \\
 (\sigma - 1)p_i^* &= \sigma \frac{\eta_j}{\sigma \tau_{ij}} + \sigma \varphi \\
 p_i^* &= \frac{\sigma}{\sigma - 1} \left( \frac{\eta_j}{\sigma \tau_{ij}} + \varphi \right) \\
 p_i^* &= \frac{\sigma}{\sigma - 1} \left( 1 + \frac{\eta_j}{\sigma \tau_{ij} \varphi} \right) \varphi
 \end{aligned}$$

and we arrive to the optimal producer price presented in Equation (3):

$$p_i^*(\varphi) = \frac{\sigma}{\sigma - 1} \left( 1 + \frac{\eta_j}{\sigma \tau_{ij} \varphi} \right) \varphi$$

### A.1.2 Optimal profits

In order to obtain the optimal profits we need to reduce the profit expression:

$$\begin{aligned}
 \pi_i(\varphi) &= \tau_{ij}p_i(\varphi) \times \left( \frac{\tau_{ij}p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} Y_j - \varphi \tau_{ij} \times \left( \frac{\tau_{ij}p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \\
 &= \left\{ p_i(\varphi) \times \left( \frac{\tau_{ij}p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} - \varphi \times \left( \frac{\tau_{ij}p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} \right\} \tau_{ij}Y_j - f_i(\varphi) \\
 &= (p_i(\varphi) - \varphi) \left( \frac{\tau_{ij}p_i(\varphi) + \eta_j}{P_j} \right)^{-\sigma} \tau_{ij}Y_j - f_i(\varphi)
 \end{aligned}$$

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<sup>1</sup>See Irarrazabal et al. (2015) for details.

Then, substitute the optimal price obtained in Appendix A:

$$\begin{aligned}
 \pi_i^*(\varphi) &= \left[ \frac{\sigma}{\sigma-1} \left( 1 + \frac{\eta_j}{\sigma \tau_{ij} \varphi} \right) \varphi - \varphi \right] \left( \frac{\tau_{ij} \frac{\sigma}{\sigma-1} \left( 1 + \frac{\eta_j}{\sigma \tau_{ij} \varphi} \right) \varphi + \eta_j}{P_j} \right)^{-\sigma} \tau_{ij} Y_j - f_i(\varphi) \\
 &= \left[ \frac{\sigma}{\sigma-1} \left( \varphi + \frac{\eta_j}{\sigma \tau_{ij}} \right) - \varphi \right] \left( \frac{\frac{\sigma}{\sigma-1} \left( \tau_{ij} \varphi + \frac{\eta_j}{\sigma} \right) + \eta_j}{P_j} \right)^{-\sigma} \tau_{ij} Y_j - f_i(\varphi) \\
 &= \left[ \frac{\sigma}{\sigma-1} \left( \tau_{ij} \varphi + \frac{\eta_j}{\sigma} \right) - \tau_{ij} \varphi \right] \left( \frac{\frac{\sigma}{\sigma-1} \left( \tau_{ij} \varphi + \frac{\eta_j}{\sigma} \right) + \eta_j}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \\
 &= \frac{\sigma}{\sigma-1} \left( \tau_{ij} \varphi + \frac{\eta_j}{\sigma} - \frac{\sigma-1}{\sigma} \tau_{ij} \varphi \right) \left( \frac{\frac{\sigma}{\sigma-1} \left( \tau_{ij} \varphi + \frac{\eta_j}{\sigma} + \frac{\sigma-1}{\sigma} \eta_j \right)}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \\
 &= \frac{\sigma}{\sigma-1} \left( \frac{\tau_{ij} \varphi + \eta_j}{\sigma} \right) \left( \frac{\frac{\sigma}{\sigma-1} (\tau_{ij} \varphi + \eta_j)}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \\
 &= \frac{\tau_{ij} \varphi + \eta_j}{\sigma-1} \left( \frac{\frac{\sigma}{\sigma-1} (\tau_{ij} \varphi + \eta_j)}{P_j} \right)^{-\sigma} Y_j - f_i(\varphi) \\
 &= \frac{\sigma^{-\sigma} (\tau_{ij} \varphi + \eta_j)^{1-\sigma}}{(\sigma-1)^{1-\sigma} P_j^\sigma} Y_j - f_i(\varphi)
 \end{aligned}$$

### Within-firm product

Given the expression of optimal profits, a product is supplied by doing FDI as long as profits obtained via FDI (left hand side part) are larger than or equal to profits obtained via exports (right hand side part):

$$\frac{\sigma^{-\sigma} (\varphi^* + \eta_j)^{1-\sigma}}{(\sigma-1)^{1-\sigma} P_j^\sigma} Y_j - f_i^{fdi}(\varphi) > \frac{\sigma^{-\sigma} (\tau_{ij} \varphi^* + \eta_j)^{1-\sigma}}{(\sigma-1)^{1-\sigma} P_j^\sigma} Y_j - f_i^x(\varphi)$$

which yields the following condition that defines the cutoff  $\varphi^*$ :

$$(\varphi^* + \eta_j)^{1-\sigma} - (\tau_{ij} \varphi^* + \eta_j)^{1-\sigma} > \frac{f_i^{fdi}(\varphi) - f_i^x(\varphi)}{Y_j} \sigma^\sigma (\sigma-1)^{1-\sigma} P_j^\sigma$$

### A.1.3 Exporter price derivative with respect to the additive trade cost

$$\begin{aligned}
\frac{\partial p_i(\varphi)x_{ij}(\varphi)}{\partial \eta_j} &= x_{ij}(\varphi) \frac{\partial p_i(\varphi)}{\partial \eta_j} + p_i(\varphi) \frac{\partial x_{ij}(\varphi)}{\partial p_i^c(\varphi)} \frac{\partial p_i^c(\varphi)}{\partial \eta_j} \\
&= x_{ij}(\varphi) \frac{\partial p_i(\varphi)}{\partial \eta_j} + p_i(\varphi) \frac{\partial x_{ij}(\varphi)}{\partial p_i(\varphi)} \frac{\partial p_i(\varphi)}{\partial p_i^c(\varphi)} \left( \tau_{ij} \frac{\partial p_i(\varphi)}{\partial \eta_j} + 1 \right) \\
&= x_{ij}(\varphi) \frac{\partial p_i(\varphi)}{\partial \eta_j} + x_{ij}(\varphi) \frac{p_i(\varphi)}{x_{ij}(\varphi)} \frac{\partial x_{ij}(\varphi)}{\partial p_i(\varphi)} \frac{1}{\tau_{ij}} \left( \tau_{ij} \frac{\partial p_i(\varphi)}{\partial \eta_j} + 1 \right) \\
&= x_{ij}(\varphi) \left[ \frac{\partial p_i(\varphi)}{\partial \eta_j} + \frac{p_i(\varphi)}{x_{ij}(\varphi)} \frac{\partial x_{ij}(\varphi)}{\partial p_i(\varphi)} \frac{1}{\tau_{ij}} \left( \tau_{ij} \frac{\partial p_i(\varphi)}{\partial \eta_j} + 1 \right) \right]
\end{aligned}$$

for the sign we focus on the expression within brackets:

$$\begin{aligned}
&= \frac{1}{(\sigma - 1)\tau_{ij}} - \frac{\sigma\tau_{ij} + \frac{\eta_j}{\varphi}}{\tau_{ij} + \frac{\eta_j}{\varphi}} \frac{1}{\tau_{ij}} \frac{\sigma}{(\sigma - 1)} \\
&= \frac{1}{\tau_{ij}(\sigma - 1)} \left( 1 - \frac{\sigma\tau_{ij} + \frac{\eta_j}{\varphi}}{\tau_{ij} + \frac{\eta_j}{\varphi}} \right) \\
&= \frac{1}{\tau_{ij}(\sigma - 1)} \left( \frac{(1 - \sigma)\tau_{ij}}{\tau_{ij} + \frac{\eta_j}{\varphi}} \right) < 0
\end{aligned}$$

given that  $\sigma > 1$  and the result  $\frac{p_i(\varphi)}{x_{ij}(\varphi)} \frac{\partial x_{ij}(\varphi)}{\partial p_i(\varphi)} \frac{1}{\tau_{ij}} = -\frac{\sigma\tau_{ij} + \frac{\eta_j}{\varphi}}{\tau_{ij} + \frac{\eta_j}{\varphi}}$  comes from Berman et al. (2012). This means that  $\frac{\partial p_i(\varphi)x_{ij}(\varphi)}{\partial \eta_j} < 0$ .

## A.2 Data

### A.2.1 Descriptive Statistics

	mean	sd	min	max
<b>OECD</b>				
FDI Stocks	38.38	204.13	0	2645.14
Exports intensive Others	497680	3.90e+06	1	5.20e+08
Exports intensive Core	1.18e+06	2.06e+07	1	8.54e+09
Exports Extensive Others	4.33	10.51	1	432.00
Exports Extensive Core	2.56	3.90	1	123.00
<b>Non-OECD</b>				
FDI Stocks	11.59	19.53	0	128.46
Exports intensive Others	239477	1.60e+06	1	1.40e+08
Exports intensive Core	456676	3.64e+06	1	3.84e+08
Exports Extensive Others	2.96	5.94	1	274.00
Exports Extensive Core	1.91	2	1	68.00

**Table A.1:** Summary statistics by destinations and products

## A.2.2 Definitions and sources of variables

### A.2.3 Comments about FDI Stocks data

These data come from direct surveys made by the regional branches of the Banque de France to the enterprises<sup>2</sup>. These enterprises and their relations with foreign markets are selected under two conditions: first, French enterprises are included if their shares' value in foreign enterprises is greater than 10 million Euros; second, their affiliates in foreign markets are included in the database if their capital times the shares owned by the French enterprise exceeds 5 million Euros. This means that many small affiliates are excluded and this can create a selection bias (vis-à-vis French investment in small markets) in studies using this database. Concerning the construction of the stocks of French FDI, it is important to note that they come from the balance sheet of enterprises, thus they are recorded at book value and they do not take into account the eventual market valuation. Furthermore, this means that stocks of FDI do not correspond to the accumulation of FDI flows observed in the database. On the other hand, regarding the stocks of FDI in French enterprises, they come from the FIBEN database; thus, from French firms' balance sheets and they are recorded at book value. Taking into account that FIBEN concerns most French firms, foreign investment stocks in France are exhaustive (contrary to French investment stocks in foreign markets).

While our current work makes abstraction of economic relations between different firms, in future work we plan to build up the entire economic group by merging our data with the LIFI database for robustness checks<sup>3</sup>.

<sup>2</sup>Interview with Dominique Nivat (Banque de France, Direction Générale des Statistiques (DGS)).

<sup>3</sup>*L'enquête sur les liaisons financières*, which is annually collected by the INSEE under specific criteria and allows identifying economic groups in France with their composition (See INSEE website for details: <http://www.insee.fr/fr/methodes/default.asp?page=sources/sou-enq-lifi.htm>).

It is very important to explore the relation between French enterprises and its entire group, which is not necessarily reflected in the database we have. Our database contains information about the French enterprise and its direct relation with its affiliates, but these affiliates have very often more affiliates around the world. This indirect relation (concerning the affiliates of the affiliates) might be the "final purpose" of the initial French investment but we have very little information about it (none, in the worst cases). This is the reason why it is worth analyzing the intra-group flows in our database as it might give some extra information about the entire group and the final purpose of the investment. For instance, think about a manufacturing French firm that has an affiliate in Luxembourg which is in charge of the whole group's treasury (hence, it does not produce any manufacturing good and does not constitute the final purpose of the FDI); this affiliate has at the same time an affiliate in Poland which is in charge of producing the final goods (i.e. the final purpose of the FDI). In most cases, we can only have information about the relation between France and Luxembourg and not the one between France and Poland. However, this relation might appear in our database if the French parent firm lends capital to the affiliate of its affiliate in Poland.

## A.3 Additional Tables

### A.3.1 Extensive and Intensive Margin FDI

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	0.08 (0.57)	-0.02 (-0.17)	-0.13 (-1.03)	0.03 (0.56)	0.34 (1.63)	0.00 (0.03)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	867236	867237	831632	831634
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.786	0.762	0.732	0.744
F	0.19	0.30	0.35	0.03	0.27	0.65
1[ <i>FDI</i> > 0]	0.13 <sup>b</sup> (2.32)	0.06 <sup>a</sup> (2.73)	0.25 <sup>a</sup> (3.50)	0.06 <sup>a</sup> (2.85)	0.08 (0.89)	0.06 (1.56)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	867236	867237	831632	831634
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.786	0.762	0.732	0.744
F	0.68	1.07	1.54	0.82	0.09	0.91
1[ <i>FDI</i> > 0]	0.13 <sup>b</sup> (2.30)	0.06 <sup>a</sup> (2.79)	0.26 <sup>a</sup> (3.61)	0.06 <sup>a</sup> (2.87)	0.07 (0.80)	0.06 (1.58)
FDI	-0.06 (-0.62)	-0.08 (-1.36)	-0.40 <sup>a</sup> (-4.64)	-0.04 (-1.01)	0.27 (1.46)	-0.06 (-0.55)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	867236	867237	831632	831634
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.786	0.762	0.732	0.744
F	0.36	0.60	1.41	0.43	0.20	0.46

OLS estimations. *t* statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table A.2:** FDI Intensive and Extensive Margin

## A.3.2 Demand in destination market

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.88 <sup>c</sup> (1.66)	0.15 (0.73)	1.57 <sup>a</sup> (2.71)	0.10 (0.55)	0.09 (0.13)	0.24 (0.74)
FDI	-0.02 (-0.20)	-0.08 (-1.25)	-0.34 <sup>a</sup> (-4.18)	-0.03 (-0.94)	0.27 (1.44)	-0.05 (-0.45)
$1[FDI > 0] \times \ln GDP$	-0.08 (-1.43)	-0.01 (-0.42)	-0.14 <sup>b</sup> (-2.33)	-0.00 (-0.24)	-0.00 (-0.03)	-0.02 (-0.55)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1725471	1725474	867236	867237	831632	831634
adj. <i>R</i> <sup>2</sup>	0.755	0.750	0.786	0.762	0.732	0.744
<i>F</i>	0.71	1.00	2.49	0.70	0.33	0.80

OLS estimations. *t* statistics in parentheses  
 All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

Table A.3: Is the destination important?

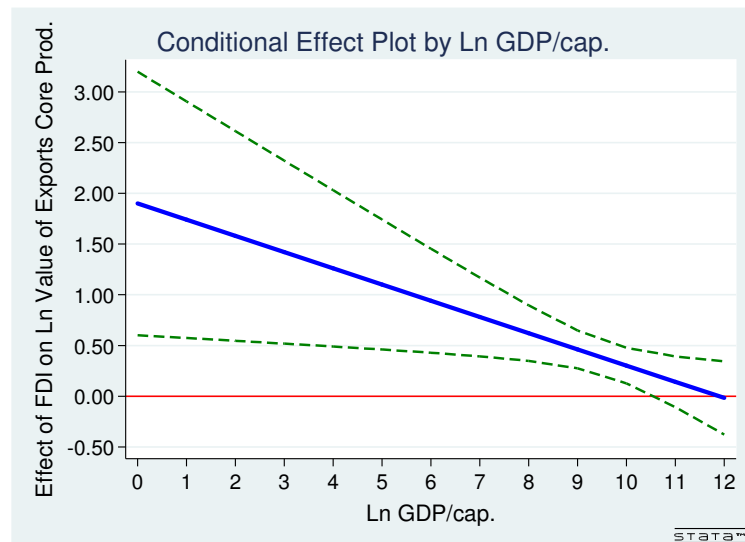


Figure A.1: Conditional Effect of FDI



## A.3.3 Productivity: any role?

Dependent Variable: Ln Exports (in values and number product lines)								
Sample: Firms below Median Productivity								
VARIABLES	OECD Countries				Non-OECD Countries			
	Core prod.		Other prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$1[FDI > 0]$	0.00 (0.03)	0.04 (0.83)	0.16 (0.67)	-0.03 (-0.30)	0.36 (1.14)	0.14 (1.63)	0.36 (1.08)	0.40 <sup>c</sup> (1.87)
FDI	-0.90 (-0.24)	-2.11 (-1.62)	6.80 <sup>c</sup> (1.65)	3.18 (1.57)	-5.95 (-1.13)	-2.16 (-1.16)	-2.42 (-0.38)	-5.62 (-0.94)
Firm-Dest FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	225806	225806	225001	225001	124528	124528	109607	109607
adj. <i>R</i> <sup>2</sup>	0.800	0.805	0.752	0.773	0.704	0.594	0.641	0.599
F	0.09	0.29	1.24	0.39	0.16	0.43	0.40	0.42
Sample: Firms above Median Productivity								
VARIABLES	OECD Countries				Non-OECD Countries			
	Core prod.		Other prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$1[FDI > 0]$	0.11 (1.21)	0.04 (1.58)	-0.00 (-0.03)	0.01 (0.28)	0.54 <sup>a</sup> (3.61)	0.06 (1.38)	0.14 (0.93)	0.02 (0.24)
FDI	-0.32 <sup>a</sup> (-3.80)	0.05 (1.58)	0.26 <sup>b</sup> (2.46)	-0.04 (-0.79)	-4.44 (-1.03)	0.37 (0.22)	-1.55 (-0.20)	3.64 (0.88)
Firm-Dest FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	244459	244459	243451	243451	223151	223151	189438	189438
adj. <i>R</i> <sup>2</sup>	0.827	0.843	0.784	0.819	0.749	0.676	0.682	0.659
F	1.80	0.71	0.95	0.43	1.44	0.42	0.08	0.12

OLS estimations. *t* statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ 

Table A.4: The role of productivity

## A.3.4 Trade Collapse

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.15 <sup>b</sup> (2.48)	0.07 <sup>a</sup> (2.59)	0.24 <sup>a</sup> (3.18)	0.07 <sup>a</sup> (2.78)	0.11 (1.33)	0.06 (1.44)
FDI	-0.13 <sup>b</sup> (-2.06)	-0.09 <sup>c</sup> (-1.69)	-0.33 <sup>a</sup> (-3.94)	-0.03 (-0.94)	0.10 (0.84)	-0.08 (-0.97)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N$	1305236	1305237	656355	656356	628332	628332
adj. $R^2$	0.773	0.759	0.800	0.770	0.748	0.751
F	0.67	1.08	1.99	0.72	0.65	0.92

OLS estimations.  $t$  statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ 

Table A.5: Trade Collapse: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)												
VARIABLES	OECD Countries						Non-OECD Countries					
	All prod.		Core prod.		Other prod.		All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$1[FDI > 0]$	0.08 (1.05)	0.04 (1.46)	0.09 (1.24)	0.05 <sup>b</sup> (1.98)	0.11 (1.04)	0.03 (0.60)	0.34 <sup>a</sup> (3.04)	0.10 <sup>b</sup> (2.06)	0.58 <sup>a</sup> (3.66)	0.09 <sup>b</sup> (2.02)	0.13 (0.83)	0.10 (1.34)
FDI	-0.06 (-0.82)	-0.04 (-1.15)	-0.28 <sup>a</sup> (-4.28)	0.01 (0.32)	0.14 (1.25)	-0.05 (-0.92)	-3.60 (-0.64)	0.64 (0.23)	-4.76 (-1.10)	-0.03 (-0.02)	-2.68 (-0.34)	1.63 (0.34)
Sample	OECD	OECD	OECD	OECD	OECD	OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	768875	768876	373245	373246	375908	375908	519216	519216	271600	271600	233622	233622
adj. <i>R</i> <sup>2</sup>	0.800	0.809	0.828	0.829	0.782	0.805	0.714	0.649	0.744	0.649	0.675	0.636
<i>F</i>	0.15	0.41	2.35	0.56	0.68	0.62	0.95	0.63	1.33	0.84	0.14	0.28

OLS estimations. *t* statistics in parentheses  
 All regressions include time-varying firm-destination controls. Errors clustered at firm level.  
<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table A.6:** Trade Collapse: Is the destination important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All countries		OECD		Non OECD	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.15 <sup>b</sup> (2.48)	0.07 <sup>a</sup> (2.59)	0.08 (1.05)	0.04 (1.46)	0.34 <sup>a</sup> (3.06)	0.09 <sup>b</sup> (2.01)
FDI	0.02 (0.21)	-0.06 (-0.69)	0.11 (0.97)	-0.01 (-0.18)	-7.12 (-0.68)	1.80 (0.35)
FDI $\times$ Core	-0.31 <sup>b</sup> (-1.98)	-0.07 (-1.16)	-0.33 <sup>a</sup> (-2.66)	-0.06 (-1.41)	5.98 (0.61)	-1.98 (-0.43)
Sample	Whole sample	Whole sample	OECD	OECD	Non-OECD	Non-OECD
Firm-Dest-Prod FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1305236	1305237	768875	768876	519216	519216
adj. <i>R</i> <sup>2</sup>	0.773	0.759	0.800	0.809	0.714	0.649
F	1.28	1.47	0.92	0.87	0.90	0.59

OLS estimations. *t* statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table A.7:** Trade Collapse: Is the product category important?

Dependent Variable: Ln Exports (in values and number product lines)						
VARIABLES	All prod.		Core prod.		Other prod.	
	Values	Num Products	Values	Num Products	Values	Num Products
	(1)	(2)	(3)	(4)	(5)	(6)
$1[FDI > 0]$	0.89 <sup>c</sup> (1.85)	0.26 (1.20)	1.57 <sup>a</sup> (2.58)	0.15 (0.80)	-0.06 (-0.09)	0.39 (1.23)
FDI	-0.10 (-1.45)	-0.09 (-1.46)	-0.27 <sup>a</sup> (-3.63)	-0.03 (-0.80)	0.09 (0.77)	-0.07 (-0.76)
$1[FDI > 0] \times \ln GDP$	-0.08 (-1.53)	-0.02 (-0.87)	-0.14 <sup>b</sup> (-2.25)	-0.01 (-0.45)	0.02 (0.25)	-0.04 (-1.04)
Sample	All products	All products	Core products	Core products	Other products	Other products
Firm-Dest-Prod FE	Yes	Yes	No	No	No	No
Firm-Dest FE	No	No	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	1305236	1305237	656355	656356	628332	628332
adj. <i>R</i> <sup>2</sup>	0.773	0.759	0.800	0.770	0.748	0.751
F	0.90	1.16	2.24	0.71	0.61	0.98

OLS estimations. *t* statistics in parentheses

All regressions include time-varying firm-destination controls. Errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table A.8:** Trade Collapse: Is the destination important?

## A.3.5 Dynamic effects of FDI

	(1) All countries	(2) OECD	(3) Non OECD
1[ $FDI > 0$ ]	0.39 <sup>a</sup> (0.10)	0.35 <sup>a</sup> (0.11)	0.42 <sup>a</sup> (0.13)
First FDI	-0.37 <sup>a</sup> (0.09)	-0.45 <sup>a</sup> (0.10)	-0.13 (0.21)
Second FDI	-0.19 <sup>c</sup> (0.11)	-0.36 <sup>a</sup> (0.13)	0.23 (0.24)
Third FDI	-0.04 (0.13)	-0.22 (0.13)	0.38 (0.23)
Inward FDI	0.26 (0.37)	0.17 (0.37)	
Productivity	0.09 <sup>a</sup> (0.03)	0.08 <sup>b</sup> (0.03)	0.09 (0.06)
Observations	10,146	7,209	2,937
R-squared	0.62	0.65	0.66
Firm F.E.	Yes	Yes	Yes
Time-country F.E.	Yes	Yes	Yes

Notes: Standard errors in parentheses (clustered at country level).

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

OLS reg. Dependent var.: Ln of the value of exports at firm level.

All regressions include firm fixed effects (F.E.), and country-year F.E..

**Table A.9:** Dynamic FDI effects: OECD vs Non OECD

	All countries		OECD		Non OECD	
	Core	Others	Core	Others	Core	Others
	(1)	(2)	(3)	(4)	(5)	(6)
1[ $FDI > 0$ ]	0.37 <sup>a</sup> (0.09)	0.23 <sup>a</sup> (0.07)	0.28 <sup>a</sup> (0.10)	0.20 <sup>b</sup> (0.10)	0.49 <sup>a</sup> (0.11)	0.35 <sup>a</sup> (0.10)
First FDI	-0.23 <sup>a</sup> (0.09)	-0.13 (0.10)	-0.26 <sup>a</sup> (0.09)	-0.19 <sup>c</sup> (0.10)	-0.11 (0.15)	-0.09 (0.20)
Inward FDI	0.14 (0.34)	0.72 (0.54)	0.07 (0.36)	0.70 (0.50)	(omitted)	(omitted)
Productivity	0.10 <sup>a</sup> (0.03)	0.01 (0.04)	0.10 <sup>a</sup> (0.03)	-0.03 (0.05)	0.06 (0.05)	0.10 (0.06)
Observations	9600	8040	6828	5791	2772	2249
R-squared	0.63	0.61	0.67	0.67	0.66	0.66
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time-country F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses (clustered at country level).

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ .

OLS reg. Dependent var.: Ln of the value of exports at firm level.

All regressions include firm fixed effects (F.E.), and country-year F.E..

**Table A.10:** Dynamic FDI effects: Core vs Others

## Appendix B

# MPK and FDI under Financial Frictions

### B.1 Caselli and Feyrer's Proper MPK measure

Assuming a constant return-production function (not necessarily a Cobb-Douglas -assumed here for illustration purposes) and perfect competition conditions in domestic capital markets, the marginal product of capital equalizes the rental rate of capital,

$$\begin{aligned} Y_{it} &= \left( K^\alpha L^{1-\alpha} \right)_{it} \\ \frac{\partial Y_{it}}{\partial K_{it}} &= r_{it} = MPK_{it} \\ MPK_{it} &= \left( \alpha K^{\alpha-1} L^{1-\alpha} \right)_{it} = \left( \alpha \frac{Y}{K} \right)_{it} \end{aligned}$$

where  $\alpha_k$  is an estimate of **reproducible-capital share** in income,

$$\alpha_k = \frac{P_k \times K}{W} \times (1 - LaborShare)$$

And accounting for relative price of final-to-capital goods (which matters

in a two or multi-sector model),

$$MPK_{it} = \overbrace{\left[ \frac{P_k \times K}{W} \times (1 - Labor\ Share) \right]}^{\alpha_k}_{it} \times \left[ \frac{P_c \times GDP}{P_k \times K} \right]_{it}$$

Where  $\frac{P_k \times K}{W}$  is the share of reproducible capital in the total wealth of the country,  $W$ , defined as the sum of **Produced Capital** and **Natural Capital**, both recovered from the World Bank's Changing Wealth of Nations. The latter defined as:

Natural Capital = Timber + Non Timber Forest Resources + Protected Areas + Crop Land + Pasture.

The rest of the variables, *Labor Share* and  $\frac{P_c \times GDP}{P_k \times K}$  are recovered from the PWT 8.0. It is worth mentioning that the literature has raised concerns about the correct way of estimating labour share in income given that the "naive" measure does not account for the labor income of self-employed workers, which is not directly observable. The estimate of *Labor Share* in this PWT 8.0 version treats this issue, which is adjusted (methods discussed in Feenstra et al. (2015)) in order to account for self-employment.<sup>1</sup> See Feenstra et al. (2015) for more details on the construction of these variables.

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<sup>1</sup>This issue was first raised by Gollin (2002), who discusses different methods for estimating the labor compensation of self-employed workers.



## B.2 External Financial Dependence

ISIC	Industry	External dependence
15	Food products and beverages	0.1809
16	Tobacco products	0.9445
17	Textiles	0.2615
18	Wearing apparel, dressing and dyeing of fur	0.1743
19	Leather, leather products and footwear	0.0981
20	Wood and products of wood and cork (except furniture)	0.156
21	Pulp, paper and paper products	0.1233
22	Publishing, printing and reproduction of recorded media	0.0959
23	Coke, refined petroleum products and nuclear fuel	-0.0439
24	Chemicals and chemical products	0.7905
25	Rubber and plastics products	0.2995
26	Other non-metallic mineral products	-0.1205
27	Basic metals	0.1468
28	Fabricated metal products, except machinery and equipment	0.1664
29	Machinery and equipment, n.e.c.	0.0765
30	Office, accounting and computing machinery	0.5015
31	Electrical machinery and apparatus, n.e.c.	0.1373
32	Radio, television and communication equipment	0.3276
33	Medical, precision and optical instruments, watches and clocks	0.6425
34	Motor vehicles, trailers and semi-trailers	0.3943
35	Other transport equipment	0.1235
36	Furniture, manufacturing n.e.c.	0.3761

ISIC Industries Rev. 3 (excluding recycling, code 37)

**Table B.1:** Industry-level External dependence from Klapper et al. (2006)

This proxy for each industry's external financial dependence is calculated by Klapper et al. (2006) and was recovered from Maskus et al. (2012). It follows the methodology in Rajan and Zingales (1998) and is calculated based on data from U.S. companies over 1990-1999 using Compustat database from Standard and Poor's. Specifically, it is computed as the industry-level median (across firms) of the ratio of capital expenditures minus cash flow (summed over all years) over capital expenditures (summed over all years).

### B.2.1 Is the measure adequate?

The time variation of this index arises in large part because of changes in industrial environment between the two periods in the US; some sectors

that were booming in the 1980's were shrinking in the 1990's. For instance, Biotech did not exist in the 1980's and became a big part of US industry by the end of the 1990's. However, when Klapper et al. (2006) compute the financial dependence index using their approach for the 1980's, the correlation with the original Rajan and Zingales (1998) index is very high, which gives comfort that there is no methodological issue. Nonetheless, one could argue that there might be concerns related to the fact that we assume that sector-level external financial dependence is constant across countries while it varies over time within the US (benchmark country). On the one hand, it should not be surprising that the measure varies over time within the same country given that the structure of the economy should also change over time. On the other hand, there is hardly a better alternative measure than this one in order to proxy for financial frictions at the sector level. Following the literature, one could think of using the tangibility measure from Braun (2005) but the same concern would arise given that it follows the same methodology where US data is used as a proxy for the rest of the countries. In this sense, besides the difficulty of having sector level data for financial dependence in each country, the advantage of using US data as a proxy is that it is undoubtedly an exogenous measure for the rest of the countries.

Additionally, as argued by Rajan and Zingales (1998), the US provides a good proxy of firms' technological demand for external finance given that capital markets in the US are one of the closest to a theoretical perfect capital market where supply of capital to firms is perfectly elastic (hence, firms get the desired amount of funds). In this sense, large publicly traded firms in the US face the least frictions in accessing external funds among most firms in the world. Therefore, the amount of external finance used by large firms in the US is likely to reflect the desired capital that foreign firms in a given industry would have liked to raise if they worked under more developed financial markets.

**B.2.2 Production in Financially Intensive Sectors**

	Dependent Variable: Ln External dependence Production	
	Whole sample (1)	Excluding Nat Res. Intensive (2)
External dependence Demand	0.04 <sup>c</sup> (1.89)	0.04 <sup>b</sup> (2.10)
Trade openness	-0.04 (-0.50)	-0.05 (-0.50)
$1[Dev_i = 1] \times \text{Trade openness}$	0.29 <sup>b</sup> (2.16)	0.28 <sup>b</sup> (2.12)
<i>Controls</i>	Yes	Yes
Country F.E.	Yes	Yes
Year F.E.	Yes	Yes
Observations	437	392
$R^2$	0.901	0.886
Adjusted $R^2$	0.883	0.863
F	3.06	3.87

*t* statistics in parentheses. Errors clustered at country level.

OLS regressions. Time-varying country level controls in logs, except PRS indexes.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table B.2:** Production in financially intensive sectors (whole sample)

### B.3 Descriptive Statistics

Income Group	Year	K/L	Naive MPK	Proper MPK	External Dep.	Credit	Total Cap.
High: OECD	1995	45,645.44	17.57	11.82	0.26	61.84	112.23
	2000	51,905.12	16.25	11.25	0.26	72.98	143.30
	2005	61,346.53	17.65	12.18	0.25	77.59	147.33
	2008	114,380.65	12.50	10.76	0.26	138.62	200.19
High: nonOECD	1995	45,645.44	17.57	11.82	0.26	61.84	112.23
	2000	51,905.12	16.25	11.25	0.26	72.98	143.30
	2005	61,346.53	17.65	12.18	0.25	77.59	147.33
	2008	114,015.82	20.25	19.26	0.28	143.91	372.77
Lower middle	1995	45,645.44	17.57	11.82	0.26	61.84	112.23
	2000	51,905.12	16.25	11.25	0.26	72.98	143.30
	2005	61,346.53	17.65	12.18	0.25	77.59	147.33
	2008	15,367.10	21.13	8.71	0.22	39.70	114.36
Upper middle	1995	45,645.44	17.57	11.82	0.26	61.84	112.23
	2000	51,905.12	16.25	11.25	0.26	72.98	143.30
	2005	61,346.53	17.65	12.18	0.25	77.59	147.33
	2008	41,513.71	19.40	12.54	0.22	53.51	84.43

K/L is capital per worker, Naive MPK is marginal product of capital corrected by relative capital prices but not accounting for the importance of non-reproducible capital (or natural capital) in total production, Proper MPK accounts for non-reproducible capital, External Dep. is the measure of external financial dependence weighted by the share of each sector in a country's manufacturing production, Credit is total private credit as a share of GDP, Total Cap. is total capitalization as a share of GDP which includes credit and capitalization of the stock market.

**Table B.3:** Key variables evolution: 1995-2008 averages by income group

	Variable	Mean	Std. Dev.	Min	Max	Observations
PMPKL <sub>i</sub>	overall	11.54	4.81	2.13	33.80	N = 654
	between		4.57	2.39	25.02	n = 60
	within		1.60	6.10	20.31	T-bar = 10.9
External Dependence <sub>i</sub>	overall	0.25	0.06	0.06	0.52	N = 654
	between		0.06	0.10	0.45	n = 60
	within		0.02	0.15	0.33	T-bar = 10.9

PMPKL is the *proper* MPK measured. External Dependence corresponds to the country's manufacturing sector's external financial needs.

**Table B.4:** Panel statistics: within and between variation

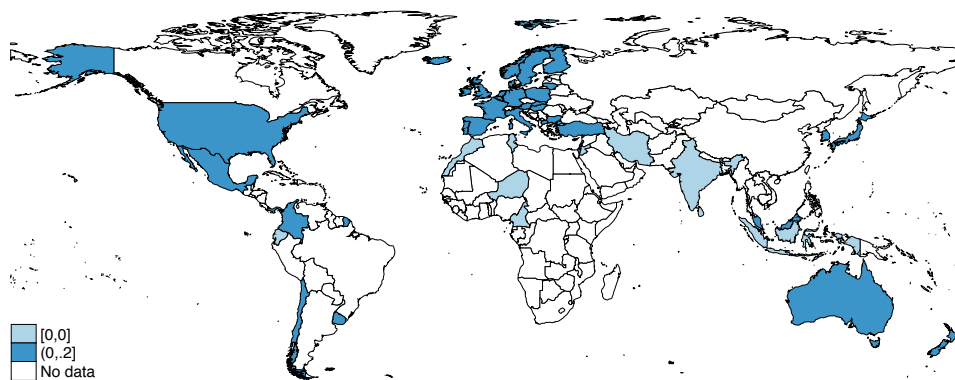


Figure B.1: Cross-country MPK, averages 1995-2009

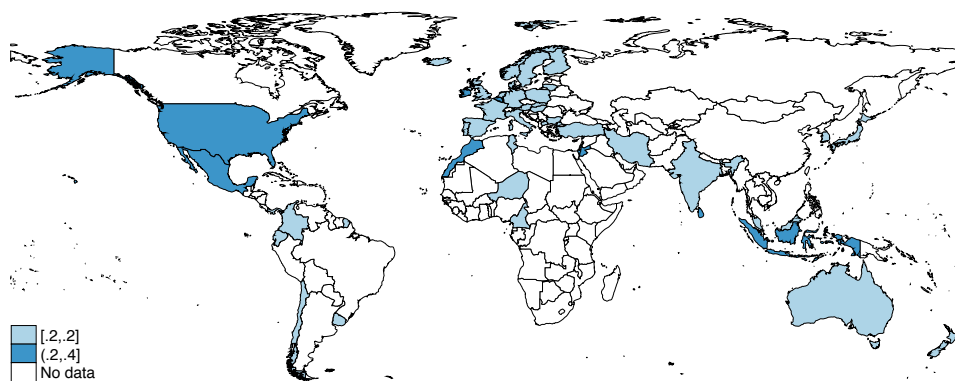


Figure B.2: Cross-country External Dependence Manuf., averages 1995-2009

Country	PMPKL	PMPKN	MPKN	External Dep.	Credit/GDP	Total Cap./GDP	obs.
Azerbaijan	9.18	31.09	34.11	0.11	9.13	.	9
Bolivia	4.46	22.23	28.08	0.10	50.89	53.44	4
Botswana	14.78	23.50	38.95	0.24	10.65	19.07	2
Bulgaria	12.09	22.82	22.06	0.25	24.38	33.85	12
Cameroon	5.88	17.57	26.61	0.22	7.63	.	8
Colombia	8.41	18.96	17.04	0.25	27.44	42.66	11
Cote d'Ivoire	6.56	16.64	26.85	0.26	17.78	25.28	3
Ecuador	6.56	26.74	20.59	0.13	26.38	33.28	14
Egypt, Arab Rep.	19.28	43.19	54.22	0.26	48.52	87.54	6
Gabon	7.63	15.73	42.76	0.17	7.17	.	1
India	8.01	23.63	24.52	0.29	29.83	75.91	14
Indonesia	8.87	21.14	21.98	0.34	26.57	51.71	13
Iran, Islamic Re	6.71	17.80	19.67	0.25	28.27	42.36	13
Jordan	10.00	13.66	12.03	0.31	74.90	190.44	15
Latvia	10.18	14.27	17.70	0.19	52.68	62.49	13
Lithuania	13.08	17.95	23.43	0.21	29.75	48.88	10
Malaysia	11.54	18.82	12.30	0.26	115.60	272.40	13
Mexico	14.39	20.70	25.31	0.31	19.18	44.51	13
Moldova	2.39	5.24	8.34	0.16	23.14	.	9
Morocco	10.99	16.46	14.62	0.31	49.12	88.05	14
Nigeria	3.38	23.84	29.02	0.36	8.79	16.66	2
Panama	19.66	34.27	36.44	0.19	80.47	103.94	6
Peru	15.27	23.80	18.81	0.19	15.95	35.58	2
Philippines	10.34	22.31	20.92	0.27	40.40	93.09	9
Poland	8.66	13.67	14.44	0.24	25.03	41.78	13
Romania	9.30	16.38	15.72	0.20	14.38	24.09	14
Sri Lanka	5.72	11.32	13.21	0.30	27.48	41.77	10
Thailand	14.42	25.84	13.58	0.25	151.63	196.68	2
Tunisia	11.85	17.78	16.46	0.22	62.86	74.82	12
Turkey	20.17	33.12	33.32	0.23	17.69	39.30	14
Uruguay	12.33	20.39	15.45	0.23	32.24	29.19	12
Total	10.38	20.41	20.98	0.24	37.36	72.69	11.5

Source: sample\_it.dta

**Table B.5:** Summary Statistics Developing Countries: averages 1995-2009

Country	PMPKL	PMPKN	MPKN	External Dep.	Credit/GDP	Total Cap./GDP	obs.
Australia	8.54	11.82	12.35	0.22	84.01	181.12	11
Austria	8.85	9.72	10.62	0.22	105.90	131.95	14
Belgium	11.08	11.78	11.36	0.31	79.82	148.48	10
Cyprus	10.94	13.25	11.29	0.22	202.12	247.52	15
Czech Republic	9.43	11.11	12.56	0.22	45.23	68.52	12
Denmark	8.86	10.36	10.86	0.25	111.19	167.93	14
Finland	9.41	12.01	10.87	0.22	64.26	175.80	15
France	9.09	10.19	12.28	0.27	87.43	164.77	12
Germany	9.38	10.05	11.37	0.27	112.82	162.61	11
Greece	13.23	15.15	13.74	0.20	53.39	97.22	9
Hong Kong SAR, C	20.75	20.75	15.94	0.21	147.23	494.62	15
Hungary	8.68	10.69	13.48	0.26	40.03	64.11	12
Iceland	8.08	9.10	7.74	0.19	91.50	146.33	11
Ireland	24.01	28.42	26.67	0.45	122.68	183.01	15
Israel	17.58	19.41	14.42	0.33	76.54	134.04	12
Italy	12.67	13.95	11.62	0.22	76.51	116.22	15
Japan	12.17	12.50	11.62	0.28	196.53	271.59	13
Korea, Rep.	16.09	17.05	15.58	0.28	81.01	132.98	14
Malta	14.18	15.44	14.38	0.28	101.65	139.13	14
Netherlands	9.45	10.73	13.23	0.28	138.08	241.55	14
New Zealand	9.50	17.46	20.88	0.17	110.33	150.21	13
Norway	11.69	17.64	18.43	0.22	77.95	118.91	14
Portugal	9.76	10.69	9.04	0.20	137.91	179.48	11
Singapore	25.02	25.02	16.86	0.37	104.06	273.18	15
Slovak Republic	9.36	11.58	13.89	0.22	41.51	47.33	15
Spain	8.68	9.76	10.13	0.23	116.17	187.30	15
Sweden	11.71	14.08	15.05	0.27	95.49	195.66	14
United Kingdom	13.55	14.75	16.43	0.27	140.58	275.76	15
United States	10.39	11.96	12.47	0.31	171.88	302.84	13
Total	12.42	14.30	13.80	0.26	106.07	184.57	13.4

Source: sample\_it.dta

**Table B.6:** Summary Statistics Developed Countries: averages 1995-2009

### B.3.1 Countries included in analyses

#### List of FDI Host countries (developing)

Albania, Bulgaria, Colombia, Egypt, India, Jordan, Latvia, Lithuania, Malaysia, Mexico, Morocco, Panama, Philippines, Poland, Romania, Sri Lanka, Tunisia, Turkey, Uruguay.

#### List of FDI Home countries (developed and developing)

Albania, Algeria, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Bosnia and Herzegovina, Brazil, Brunei, Darussalam, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Côte d'Ivoire, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Germany, Greece, Guatemala, Guinea, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Korea (Republic of), Kuwait, Kyrgyzstan, Latvia, Lebanon, Liberia, Lithuania, Luxembourg, Macedonia (FYR), Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova (Republic of), Morocco, Netherlands, New Zealand, Nicaragua, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Syrian Arab Republic, Thailand, Tunisia, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam.



## B.4 Data sources and variable definitions

### B.4.1 Variable Sources and Definition

Table B.7: Variable Sources and Definition

Trade openness, Fin. Development, Natural Resources	From the WDI World Bank. (1) <i>De facto</i> Trade openness defined as Total Trade (Exports + Total Imports) as a % of GDP. (2) Two alternative measures Financial Development: Total Credit to Private sector as a % of GFP and Total Capitalization = Total Credit to Private sector + Market Capitalization)/GDP. (3) Natural Resources Rents as % of GDP.
Capital flows.	From IFS IMF. Total capital inflows (excluding official flows). Comprises FDI Portfolio Equity (% GDP). Definition BOP5,6.
Value Added <sub>ikt</sub>	From the Industrial Statistics database UNIDO. Industry-country Value Added (ISIC Rev. 3).
Consumption <sub>kit</sub>	From the Industrial Demand-Supply database UNIDO. Industry-country Apparent Consumption (ISIC Rev. 3). Computed as: Domestic output + Total imports - Total exports.
Total Wealth (W)	From the WB "Changing Wealth of Nations". Country level Total Wealth is defined as Natural Capital + Reproducible Capital.
Capital (K)	From the PWT. Country level capital stocks are estimated based on cumulating and depreciation past investments using the perpetual inventory method (PIM).
Labour Share	From the PWT. Computed using National Accounts data on compensation of employees, GDP and mixed income. Adjustments are made accounting for self-employed.
$GDP, P_k, P_c$	From the PWT. (1) GDP in PPP (2) Investment Prices. (3) Consumption Prices.
Chinn-Ito index	The KAOPEN index is an index measuring a country's degree of capital account openness. The index is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)
Government Stability	A measure of both of the government's ability to carry out its declared program(s), and its ability to stay in office. The risk rating assigned is the sum of three subcomponents: Government Unity, Legislative Strength, and Popular Support

Table B.7 – Continued on next page

Table B.7 – Continued from previous page

Internal Conflict	From PRS. A measure of political violence in the country and its actual or potential impact on governance. The risk rating assigned is the sum of three subcomponents: Civil War/Coup Threat, Terrorism/Political Violence, and Civil Disorder.
Law and Order	From PRS. Two measures comprising one risk component. Each sub-component equals half of the total. The "law" sub-component assesses the strength and impartiality of the legal system, and the "order" sub-component assesses popular observance of the law. Higher score: lower risk
Investment Profile	From PRS. Factors affecting the risk to investment that are not covered by other political, economic and financial risk components. The risk rating assigned is the sum of three subcomponents: Contract Viability/Expropriation, Profits Repatriation, and Payment Delays. Higher score: lower risk
Corruption	From PRS. Corruption within the political system that is a threat to foreign investment by distorting the economic and financial environment, reducing the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and introducing inherent instability into the political process. Higher score: lower risk
Democracy Acc.	Democracy Accountability from PRS Group. A measure of, not just whether there are free and fair elections, but how responsive government is to its people. The less responsive it is, the more likely it will fall. Even democratically elected governments can delude themselves into thinking they know what is best for the people, regardless of clear indications to the contrary from the people. Higher score: lower risk
Bilateral Trade Costs <sub>ijt</sub>	From the World Bank-UNESCAP. Bilateral trade costs in agriculture and manufactured goods. Symmetric bilateral trade costs are computed using the Inverse Gravity Framework (Novy 2009), which estimates trade costs for each country pair using bilateral trade and gross national output. Trade costs are available for two sectors: trade in manufactured goods, and agriculture.

Table B.7 – Continued on next page

Table B.7 – *Continued from previous page*

$FDI_{ijt}$	From the World Bank-UNESCAP. Bilateral Inward FDI flows. Data are in principle collected from national sources. In order to cover the entire world, where data are not available from national sources, data from partner countries (mirror data) as well as from other international organizations have also been used.
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## B.4.2 Links to data websites

- World Bank Changing Wealth of Nations:  
<http://data.worldbank.org/data-catalog/wealth-of-nations>
- Penn World Tables 8.0:  
<http://www.rug.nl/research/ggdc/data/pwt/pwt-8.0>
- World Bank World Development Indicators (WDI) :  
<http://data.worldbank.org/data-catalog/world-development-indicators>
- PRS Group:  
<http://epub.prsgroup.com/list-of-all-variable-definitions>
- UNCTAD Bilateral FDI: <http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx>
- World Bank-UNESCAP Trade costs:  
<http://data.worldbank.org/data-catalog/trade-costs-dataset>
- International Financial Statistics database IMF:  
<http://data.imf.org/?sk=5DABAFF2-C5AD-4D27-A175-1253419C02D1>
- Chinn-Ito Index (KAOPEN):  
[http://web.pdx.edu/~ito/Chinn-Ito\\_website.htm](http://web.pdx.edu/~ito/Chinn-Ito_website.htm)
- Industrial Statistics database UNIDO:  
<http://www.unido.org/resources/statistics/statistical-databases/indstat2-2015-edition.html>
- Industrial Demand-Supply Balance database UNIDO:  
<http://www.unido.org/resources/statistics/statistical-databases/idsb-2015-edition.html>

## B.5 Additional tables

### B.5.1 Natural Resources

Country	Average	Frequency	Percent
Azerbaijan	54.60	8	11.76
Cameroon	12.12	5	7.35
Ecuador	16.64	12	17.65
Egypt, Arab Rep.	23.9	2	2.94
India	10.91	1	1.47
Indonesia	14.38	9	13.24
Iran, Islamic Rep.	30.40	13	19.12
Malaysia	15.72	9	13.24
Norway	16.45	9	13.24

**Table B.8:** Natural Resources Intensive countries

Natural Resources intensity defined as rents above 10 percent of GDP, where the sample average is 4.1 percent and the median value is only 0.95 percent.

	mean	min	p50	max	sd
Natural Resources rents (% of GDP)	4.09	.00	.95	68.35	8.7

**Table B.9:** Natural Resources Rents Statistics

Dependent Variable: ln PMPKL						
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
External dependence	-0.03 (-0.19)	-1.69 <sup>a</sup> (-2.89)	0.38 <sup>a</sup> (3.63)	-0.30 (-0.49)	-0.35 (-1.40)	-3.18 <sup>a</sup> (-3.72)
Fin. Development		0.52 <sup>a</sup> (3.21)	-0.04 (-0.91)	0.14 (0.83)	0.07 (1.45)	1.22 <sup>a</sup> (3.49)
External Dep. × Fin. Development		0.38 <sup>a</sup> (3.33)		0.13 (1.10)		0.83 <sup>a</sup> (3.28)
<b>Controls</b>						
Natural Resources	-0.02 (-1.11)	-0.04 <sup>c</sup> (-1.99)	-0.03 (-1.50)	-0.03 (-1.54)	-0.06 (-1.06)	-0.11 <sup>c</sup> (-2.06)
Trade openness	0.12 (0.59)	0.12 (0.66)	0.10 (0.82)	0.11 (0.84)	0.05 (0.19)	0.06 (0.30)
Chinn-Ito index	0.02 (0.20)	0.05 (0.54)	0.10 (1.11)	0.10 (1.18)	-0.08 (-0.71)	-0.04 (-0.33)
Democracy Acc.	0.02 (1.33)	0.02 (1.10)	0.04 <sup>c</sup> (2.00)	0.03 <sup>c</sup> (1.94)	-0.03 (-0.92)	-0.02 (-0.84)
Government Stability	-0.00 (-0.36)	-0.00 (-0.46)	0.01 (1.02)	0.01 (1.09)	-0.01 (-0.43)	-0.01 (-0.78)
Law and Order	0.03 (0.89)	0.02 (0.92)	0.01 (0.30)	0.01 (0.35)	0.09 (1.42)	0.08 (1.58)
Internal Conflict	-0.00 (-0.15)	0.00 (0.01)	-0.01 (-0.52)	-0.01 (-0.57)	-0.02 (-0.77)	-0.02 (-0.71)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	522	522	323	323	199	199
$R^2$	0.924	0.930	0.958	0.958	0.925	0.934
Adjusted $R^2$	0.912	0.919	0.950	0.951	0.905	0.916
F	3.68	7.16	15.17	8.94	6.20	9.27

*t* statistics in parentheses

All regressions include time-varying country level controls, country and time F.E., errors clustered at country level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table B.10:** Exclusion Natural Resources Intensive Countries

## B.5.2 Alternative Financial Development

Dependent Variable: ln PMPKL						
	All countries		High Income		Low & Mid. Income	
	(1)	(2)	(3)	(4)	(5)	(6)
External dependence	-0.02 (-0.13)	-1.66 <sup>a</sup> (-3.43)	0.36 <sup>a</sup> (4.28)	0.65 (0.79)	-0.25 (-1.40)	-1.95 <sup>a</sup> (-3.44)
Fin. Development	0.06 (1.20)	0.56 <sup>a</sup> (4.49)	-0.06 (-0.95)	-0.13 (-0.62)	0.12 <sup>c</sup> (2.04)	0.75 <sup>a</sup> (3.55)
External dependence × Fin. Development		0.35 <sup>a</sup> (4.02)		-0.05 (-0.34)		0.43 <sup>a</sup> (3.04)
<b>Controls</b>						
Natural Resources	-0.02 (-1.03)	-0.04 <sup>b</sup> (-2.03)	-0.02 (-1.00)	-0.02 (-0.95)	-0.08 (-1.27)	-0.11 <sup>c</sup> (-1.85)
Trade openness	0.12 (0.69)	0.12 (0.76)	0.03 (0.19)	0.03 (0.17)	0.05 (0.28)	0.09 (0.48)
Chinn-Ito index	0.02 (0.26)	0.04 (0.45)	0.11 (1.16)	0.11 (1.17)	-0.08 (-0.75)	-0.06 (-0.55)
Democracy Accountability	0.02 (1.11)	0.02 (1.27)	0.04 <sup>c</sup> (1.85)	0.04 <sup>c</sup> (1.84)	-0.02 (-0.99)	-0.02 (-0.76)
Government Stability	-0.00 (-0.62)	-0.00 (-0.49)	0.00 (0.40)	0.00 (0.34)	-0.00 (-0.21)	-0.00 (-0.06)
Law and Order	0.03 (0.93)	0.03 (1.03)	0.01 (0.46)	0.01 (0.43)	0.08 (1.67)	0.08 <sup>c</sup> (1.85)
Internal Conflict	-0.00 (-0.27)	-0.00 (-0.23)	-0.01 (-0.64)	-0.01 (-0.64)	-0.03 (-1.25)	-0.03 (-1.27)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	563	563	331	331	232	232
$R^2$	0.893	0.900	0.947	0.947	0.872	0.878
Adjusted $R^2$	0.878	0.886	0.938	0.937	0.844	0.851
F	4.40	11.23	17.30	18.87	9.22	9.72

*t* statistics in parentheses. Errors clustered at country level.

OLS regressions. Time-varying country level controls in logs, except PRS indexes.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table B.11:** Alternative Financial Development

# Appendix C

## Employment and Financial Crisis

### C.1 Descriptive Statistics

#### C.1.1 Alternative Severity of Crisis Indexes

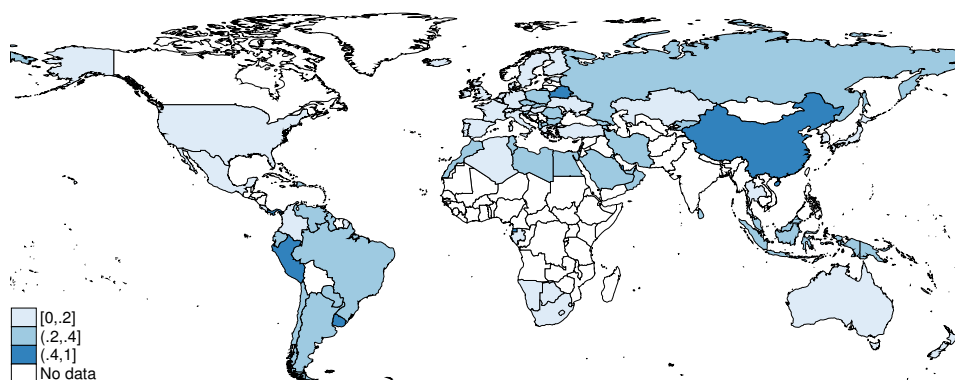
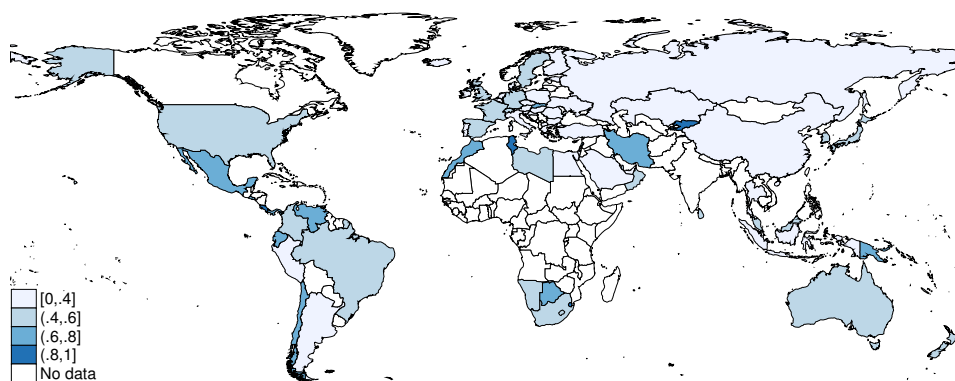
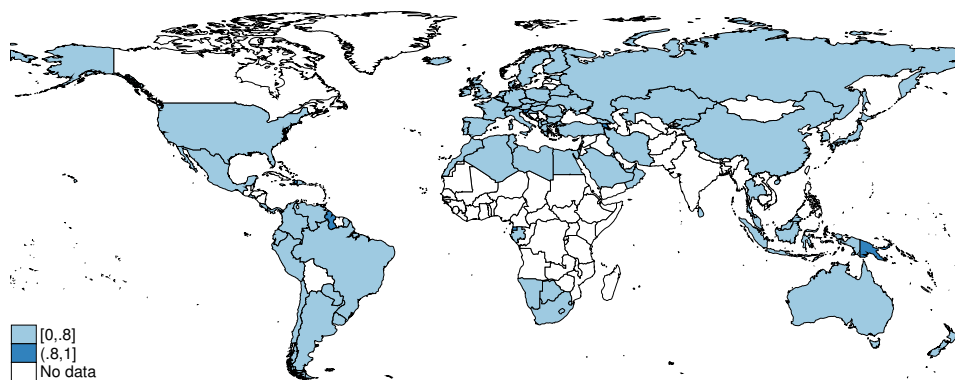


Figure C.1: Cross-country Crisis as measured by: Growth Index



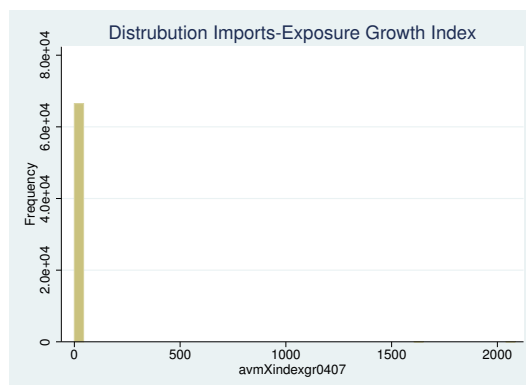


**Figure C.2:** Cross-country Crisis as measured by: Equity Index

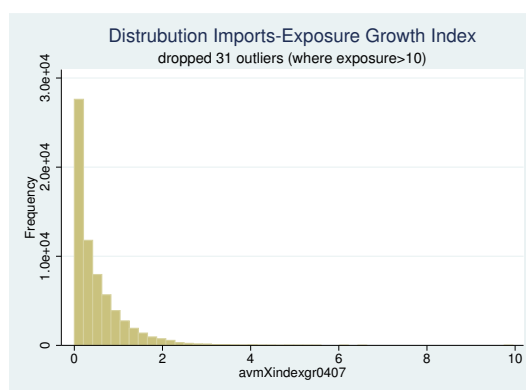


**Figure C.3:** Cross-country Crisis as measured by: Rating Index

### C.1.2 Outliers



**Figure C.4:** Growth Index including outliers



**Figure C.5:** Growth Index excluding outliers

Division Code	Heading	N
2	Forestry and logging	78
5	Mining of coal and lignite	4
6	Extraction of crude petroleum and natural gas	18
7	Mining of metal ores	6
8	Other mining and quarrying	552
10	Manufacture of food products	7113
11	Manufacture of beverages	846
12	Manufacture of tobacco products	11
13	Manufacture of textiles	2489
14	Manufacture of wearing apparel	1913
15	Manufacture of leather and related products	773
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3148
17	Manufacture of paper and paper products	1955
18	Printing and reproduction of recorded media	2436
19	Manufacture of coke and refined petroleum products	87
20	Manufacture of chemicals and chemical products	2961
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	690
22	Manufacture of rubber and plastic products	5529
23	Manufacture of other non-metallic mineral products	2796
24	Manufacture of basic metals	1136
25	Manufacture of fabricated metal products, except machinery and equipment	10954
26	Manufacture of computer, electronic and optical products	2727
27	Manufacture of electrical equipment	2070
28	Manufacture of machinery and equipment n.e.c.	5965
29	Manufacture of motor vehicles, trailers and semi-trailers	1657
30	Manufacture of other transport equipment	678
31	Manufacture of furniture	1807
32	Other manufacturing	2386
33	Repair and installation of machinery and equipment	3623
Total		66408

Note: 2-digits Industry NAF (Nomenclature d'Activité Française) division codes and headings.

**Table C.1:** NAF 2 digits industries included in the analysis

## C.2 Definitions and sources of crisis variables used in the analysis

### Data from World Bank

**Credit Measure:** Percentage change over 2007-2009 in Domestic credit to private sector by banks (% of GDP).

### Data from Rose and Spiegel (2012)

**Growth Measure:** Real GDP growth over 2008, as estimated by the Economic Intelligence Unit (EIU) in early March 2009.

**Equity Measure:** Percentage change in the national stock market over the 2008 calendar year (collected from national sources)

**SDR Measure:** Percentage change in the SDR exchange rate over 2008, measured as the domestic currency price of a Special Drawing Right and taken from the IMF's International Financial Statistics

**Rating Measure:** Change in the country credit rating from Institutional Investor. The latter are ratings created by Institutional Investor that rank 177 countries on a scale between 0 and 100 where 100 represents the least likelihood of default.

### List of suppliers' countries kept

Argentina, Austria Australia, Barbados, Belgium, Bulgaria, Bahrain, Brazil, Bahamas, Botswana, Switzerland, Chile, China, Colombia, Costa Rica, Cyprus, Czech Republic, Germany, Denmark, Estonia, Egypt, Spain, Finland, UK, Greece, Hong Kong, Croatia, Hungary, Ireland, Israel, Iceland, Italy, Jamaica, Japan, Kyrgyz Republic, Korea, Kazakhstan, Lebanon, Sri Lanka, Morocco, Macedonia (FYR), Malta, Mauritius, Mexico, Malaysia, Namibia, Netherlands, New Zealand, Oman, Panama, Peru Papua New Guinea Poland Portugal Romania Russia Sweden Singapore Slovenia Slovakia El Salvador Swaziland Thailand, Tunisia, Turkey, Trinidad & Tobago, Ukraine, United States, Venezuela and South Africa.

### C.3 Additional tables

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_t$	165.83 (0.00)	164.39 (0.00)	157.09 (0.00)	168.97 (0.00)	163.43 (0.00)	168.13 (0.00)
$Crisis_t \times Exposure_f \text{ Index } 1$	4.64 <sup>a</sup> (2.77)					
$Crisis_t \times Exposure_f \text{ Index } 2$		3.15 <sup>b</sup> (2.30)				
$Crisis_t \times Exposure_f \text{ Index } 3$			6.55 <sup>b</sup> (2.01)			
$Crisis_t \times Exposure_f \text{ Index } 4$				3.70 <sup>b</sup> (2.33)		
$Crisis_t \times Exposure_f \text{ Index } 5$					2.35 <sup>b</sup> (2.33)	
$Crisis_t \times Exposure_f \text{ Index } 6$						3.28 <sup>b</sup> (2.39)
Observations	72963	72963	72963	72963	72963	72963
$R^2$	0.312	0.312	0.312	0.312	0.312	0.312
Adjusted $R^2$	0.105	0.105	0.105	0.105	0.105	0.105
F	1.95	1.60	1.43	1.62	1.62	1.66

t statistics in parentheses

All regressions include time-varying firm controls, firm and 4 digits industry-time F.E., errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ 

Table C.2: Alternative F.E.: Baseline

Dependent Variable: Yearly employment growth						
Crisis resilience measure:	Growth Index	Credit Index	SDR Index	Equity Index	Rating Index	Resilience Index
	(1)	(2)	(3)	(4)	(5)	(6)
$Crisis_t$	1923.15 (0.00)	1899.11 (0.00)	1864.49 (0.00)	1924.60 (0.00)	1898.40 (0.00)	1921.46 (0.00)
$Crisis_t \times Trade Cred_f$	-0.93 (-1.48)	-0.92 (-1.46)	-0.95 (-1.50)	-0.93 (-1.48)	-0.92 (-1.47)	-0.93 (-1.48)
$Crisis_t \times Exposure_f Index 1$	2.80 <sup>c</sup> (1.71)					
$Crisis_t \times Exposure_f Index 2$		1.70 (1.34)				
$Crisis_t \times Exposure_f Index 3$			2.89 (0.94)			
$Crisis_t \times Exposure_f Index 4$				1.92 (1.27)		
$Crisis_t \times Exposure_f Index 5$					1.28 (1.35)	
$Crisis_t \times Exposure_f Index 6$						1.78 (1.36)
$Crisis_t \times Trade Cred_f \times Exposure_f Index 1$	3.82 <sup>a</sup> (3.13)					
$Crisis_t \times Trade Cred_f \times Exposure_f Index 2$		2.77 <sup>a</sup> (3.45)				
$Crisis_t \times Trade Cred_f \times Exposure_f Index 3$			7.53 <sup>a</sup> (4.16)			
$Crisis_t \times Trade Cred_f \times Exposure_f Index 4$				3.09 <sup>a</sup> (4.17)		
$Crisis_t \times Trade Cred_f \times Exposure_f Index 5$					2.04 <sup>a</sup> (3.41)	
$Crisis_t \times Trade Cred_f \times Exposure_f Index 6$						2.69 <sup>a</sup> (3.85)
Observations	72963	72963	72963	72963	72963	72963
$R^2$	0.312	0.312	0.312	0.312	0.312	0.312
Adjusted $R^2$	0.105	0.105	0.105	0.105	0.105	0.105
F	3.06	3.03	3.61	4.54	3.03	3.89

*t* statistics in parentheses

All regressions include time-varying firm controls, firm and 4 digits industry-time F.E., errors clustered at firm level.

<sup>c</sup>  $p < 0.10$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$

**Table C.3:** Alternative F.E.: Trade Credit

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# **Essais en Commerce International, Flux de Capitaux et Frictions Financières**

## **Résumé**

Cette thèse aborde différents sujets ayant trait aux liens entre l'économie réelle et l'économie financière au sein de l'économie internationale. Trois essais abordent ces liens selon différentes perspectives aussi bien micro que macro-économiques.

Le premier chapitre, co-écrit avec Jean-Charles Bricongne et Sebastian Franco-Bedoya, évalue l'arbitrage proximité-concentration avec des entreprises multi-produits afin d'identifier le type de lien (complémentarité ou substituabilité) entre les exportations et les IDE. Tandis que les modèles d'IDE horizontal prédisent qu'IDE et exportations se substituent du fait de l'arbitrage proximité-concentration, une majorité d'études empiriques met en évidence leur complémentarité. Notre analyse apporte un nouvel éclairage théorique et empirique sur ce point. Pour ce faire, nous développons un modèle d'IDE horizontal avec des firmes multi-produits, susceptible de générer une complémentarité avec certains biens finaux produits dans le pays d'origine en réduisant les coûts additifs d'exportation. Dans ces conditions, complémentarité et substituabilité peuvent coexister au sein d'une même firme. Enfin, nous testons empiriquement la validité de notre modèle en se fondant sur des données de firmes françaises. Nos résultats empiriques confirment les prédictions du modèle où les exportations des biens les plus performants de la firme sont négativement liées à l'investissement dans un pays à forte demande.

Le deuxième chapitre examine empiriquement le rôle du développement financier dans l'évolution du produit marginal du capital (MPK) dans 50 pays et sa relation avec leurs besoins de finance externe, en lien avec leur production manufacturière durant la période 1995-2008. En

se fondant sur des données sectorielles au niveau des pays, les résultats de ce chapitre montrent que la spécialisation dans des secteurs intensifs en finance externe contribue de manière positive au MPK des pays développés et de manière négative dans les pays en développement. Cette relation devient légèrement positive uniquement lorsque le système financier est suffisamment développé dans ces derniers ; ces pays étant généralement caractérisés par des systèmes financiers largement moins efficaces en comparaison avec des pays développés. Cela se traduit par un désavantage comparatif en termes de production dans des secteurs qui, par leur technologie, nécessitent beaucoup de financement externe. Enfin, en se fondant sur des données bilatérales des IDE entrants durant la période 2001-2010, j'examine la façon dont le développement financier et la production dans les secteurs intensifs en financement externe contribuent à l'évolution des IDE entrants dans les pays en développement. Encore une fois, les résultats suggèrent que la spécialisation des pays en développement dans des secteurs intensifs en finance externe décourage l'entrée des IDE et cette relation devient positive uniquement lorsque le système financier est suffisamment développé. Cette analyse met en avances l'existence des frictions financières pour contribuer à la littérature qui explique les déséquilibres mondiaux et le Paradoxe de Lucas (1990)- sur la tendance très modeste des capitaux allant des économies développées aux économies en développement. Par ailleurs, nos résultats sont en conformité avec la littérature récente sur les frictions financières et l'affectation des ressources où le sous-développement financier entraîne une perte de productivité.

Le troisième chapitre, co-écrit avec Jean-Charles Bricongne et Fabrizio Coricelli étudie la transmission des chocs mondiaux pendant la Grande Récession et son impact sur l'emploi français. En particulier, nous examinons le rôle du crédit commercial (ou inter-entreprises) dans la propagation des chocs transfrontaliers. En se fondant sur un sous-échantillon des entreprises importatrices économiquement actives sur la période 2004-2009, nos résultats suggèrent que des entreprises ayant de forts liens commerciaux avant la crise avec les pays qui ont le mieux résisté aux

chocs économiques, ont eu une meilleure performance au niveau de la croissance de l'emploi entre 2008 et 2009. Cet effet varie considérablement en fonction de l'intensité du crédit commercial. Une forte dépendance au crédit commercial avant la crise s'est traduite par une vulnérabilité plus forte aux chocs imprévus pour les entreprises, pour lesquelles l'impact négatif de la crise a été exacerbé. Cet effet a été intensifié pour les entreprises ayant des liens commerciaux importants avec les pays les plus affectés par des chocs. A l'inverse, l'effet négatif de la crise a été atténué lorsque les relations commerciales étaient plus fortes avec des pays où les chocs ont été les moins sévères. Suggérant par conséquent, que le crédit commercial a été une source alternative de financement pour les entreprises françaises importatrices lors de la crise, du moment où leurs fournisseurs internationaux leur ont permis de surmonter les contraintes financières liées aux choc imprévus en leur accordant un délai de paiement plus important. Les résultats de cette analyse contribuent au débat dans la littérature sur le rôle du financement du commerce international dans le ralentissement de l'activité économique réelle à travers les frontières.

**Mots-clefs:** Commerce international, Flux de capitaux, Fric-tions financières, Mondialisation.

# **Essays on International Trade, Capital Flows and Financial Frictions**

## **Abstract**

Two particular concerns in international economics motivate this research: I. How are real and financial activities related to each other in a globalized economy? II. What role do financial frictions play in this relationship? Three essays look at these questions from different perspectives.

The first chapter, in collaboration with Jean-Charles Bricongne and Sebastian Franco-Bedoya, revises the old question on the relation between FDI and exports on French firms, where theory seems to be at odds with empirical findings. Most FDI and most trade take place between rich markets, where the horizontal investment type is expected to happen. In this sense, empirical studies have almost invariably found a complementarity relation while standard Horizontal FDI models predict substitutability between FDI and exports given the proximity-concentration trade-off. In these models, foreign investment is an alternative way to serve a sufficiently strong foreign demand when exports costs become important. We therefore, develop a simple theoretical framework which allows reconciling this apparent empirical and theoretical mismatch. Abstracting from vertical linkages, which partly explain the positive relation between exports and FDI in strong demand markets, we show that by introducing multi-product firms in these models, FDI and exports can coexist. Meaning that a complementarity arises even at the firm level. This set-up shows that the question of whether FDI and exports are complements or substitutes depends on whether the product belongs to the core competency of the firm and the demand size in the destination market. Thus, providing guidance for the empirical analysis by pointing the places where the substitutability should occur. The empirical analysis makes use of highly detailed French firm-level data that allows disentangling the competing relations between FDI and exports according to the destination market and the different products

of the firm. This analysis brings new evidence on the substitutability effect, which takes place in the best performing products of the firm when in strong demand markets the investment is sufficiently large.

The second chapter empirically examines how external financial needs- measured at the sector level- and financial development at the country level interact to shape the aggregate marginal product of capital of a country (MPK) and its foreign direct investment inflows (FDI). First, using new available data we construct annual aggregate MPK for 50 developing and developed countries during 1995-2008; we use industry-level data to construct an annual country-level measure of external financial dependence and assess its effects on MPK conditional on the level of financial development. Our findings imply that financial development seems to be a necessary condition -and certainly not a sufficient one- in order for production in financially dependent sectors to positively affect aggregate MPK in developing countries. Second, using bilateral FDI inflows in developing countries between 2001 and 2010, we analyze how external financial dependence and financial development determine FDI inflows in developing countries. We find that these are strongly discouraged by the existence of financial frictions. Again, when we allow the effect of producing in financially intensive sectors to depend on financial development, our results suggest that the effect is only positive when a sufficiently developed financial intermediation in the recipient country is achieved. Thus, echoing the existing literature that points that financial underdevelopment can be one of the reasons explaining the existence of global imbalances and the "up-hill" trend of capitals. This analysis contributes to explain the Lucas' Paradox of why capitals don't flow from rich to poor countries in the ways predicted by theory.

The third chapter, joint research with Jean-Charles Bricongne and Fabrizio Coricelli, studies the transmission of global shocks during the Great Recession and its impact on French employment. Particularly, we explore

the role of trade credit in the propagation of cross-border shocks. Using a sub-sample of importing enterprises that were active over 2004-2009, our findings imply that strong pre-crisis sourcing ties with countries that were more resilient to the global crisis, translated into better performance in terms of employment growth over 2008-2009. This effect dramatically varies with trade credit intensity. Strongly relying on trade credit made firms more vulnerable to unanticipated shocks, for which the adverse impact of the crisis was exacerbated. This effect intensified among firms with important sourcing ties with severely shocked countries. While the negative effect of the crisis was mitigated when sourcing relations with countries subject to milder shocks were stronger. Supporting, therefore, the hypothesis that trade credit was an alternative source of financing for enterprises during the crisis, where implicitly borrowing from suppliers helped importers overcoming financial constraints. Our contribution to the literature adds to the debate on the role of trade finance in explaining the real economic downturn across borders.

**Keywords:** International trade, Capital flows, financial frictions, globalization.