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Does importing more inputs raise exports? Firm level evidence from France

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NON-TECHNICAL SUMMARY

The globalization process is characterized by a significant increase in world imports of intermediate goods. In this work, we investigate how imported inputs affect firm's export performance. This question does not lack of political relevance. A positive impact of an increased used of imported inputs on export scope would mitigate the negative effect of outsourcing on employment and play in favor of targeted import/export policies.

Robust empirical works using micro-level data recently confirmed a positive relationship between imported inputs and firm productivity. Since foreign inputs improve firms' productivity, they should also be an important asset for exporting activities. The main contribution of this work to the existing literature is to bridge the gap between two distinct lines: the first one focuses on the determinants of firms' export patterns ignoring the use of imported inputs in production, the second one investigates the impact of importing inputs on firms productivity but does not look at export scope. In this work, we develop a framework in which firms boost their efficiency gains by sourcing their intermediate goods from abroad and thereby are able to bear the cost of entering and surviving in export markets. In this case, expected export revenues and the number of exported varieties per firm are explained by firm productivity which is determined by the firm level of imported inputs.

In our empirical exercise, we use a unique firms' level database of imports at the product (HS6) level provided by French customs for the 1995-2005 period where varieties of inputs are defined as a product-country pair. We also aim at distinguishing the different channels through which an increase in imported inputs affects firm productivity and exports. The first mechanism is the variety/complementarity channel. By accessing to new imported varieties of intermediate good, firms expand the set of inputs used in production and therefore reach a better complementarity. Resulting gains in productivity allow entering more export markets. The second mechanism is related to transfer of technology embodied in imported inputs. We test for these different mechanisms by distinguishing the origin of imports (developing vs. developed countries).

Our results highlight that imported inputs have positive effects on both firm productivity and firms' export performance. First, we find strong empirical evidence of the positive effect of an increased use of foreign intermediate goods on firms' productivity. We find support for both the complementarity and technology arguments for imports. While doubling the number of varieties of foreign inputs increases TFP by 4%, importing inputs from developed countries increases firms' TFP from 20% to 60% more than importing inputs from less developed economies. We posit that these more productive firms are also likely to export more products as they are able to bear the export fixed costs and survive on competitive export markets. We do find empirical support for this conjecture. Firms using more imported inputs and/or a more diversified set of these inputs sell a larger number of varieties on export markets. This effect is larger for inputs imported from developed countries that have a more advanced technological

content. The observed 1995-2005 average increase in imported inputs from the most developed countries raises the number of exported varieties by 12% whereas the impact of increased imports from developing countries on export scope is economically and statistically insignificant.

ABSTRACT

Why would an increase in imported inputs rise exports? We argue that importing more varieties of intermediate inputs increases firm's productivity and thereby makes the firm able to overcome the export fixed costs. Whereas the literature evidences the positive effect of an increase in imported inputs on firms' productivity and shows that only the most productive firms export, the link between imported intermediate inputs and export scope has not been made. This paper bridges the gap by studying the impact of imported inputs on the margins of exports. We use a firms' level database of imports at the product (HS6) level provided by French Customs for the 1995-2005 period. Access to new varieties of inputs may increase productivity, and thereby exports, through better complementarity of inputs and transfer of technology. We test for these different mechanisms by distinguishing the origin of imports (developing vs. developed countries). We find a significant impact of higher diversification and increased number of imported inputs varieties on firm's TFP and export scope. Both the complementarity and transfer of technology mechanisms seem to matter.

JEL Classification: F10 and F12

Keywords: Firm heterogeneity, imported inputs, TFP, export scope, varieties, firm-level data.

L'importation des biens intermédiaires favorise-t-elle l'exportation? Le cas des entreprises françaises.

Résume non technique

Les échanges de biens intermédiaires occupent une place de plus en plus importante dans le commerce mondial. De nombreux travaux empiriques utilisant des bases des données au niveau de la firme ont confirmé une relation positive entre les importations de biens intermédiaires et la productivité des entreprises. Notre objectif est ici d'étudier l'effet des biens intermédiaires importés sur la performance à l'exportation des entreprises. Le thème est important dans la mesure où il peut éclairer le débat sur les délocalisations : si l'utilisation de biens intermédiaires importés permet d'améliorer les performances à l'exportation, elle est susceptible de compenser les effets des délocalisations sur l'emploi.

L'une des contributions de notre papier est de faire le lien entre deux branches de la littérature : la première se concentre sur les déterminants de la décision d'exporter des entreprises, mais ignore l'utilisation de biens intermédiaires importés ; la deuxième étudie les effets de l'importation de biens intermédiaires sur la productivité des entreprises, mais ignore les déterminants des exportations. Nous développons un cadre théorique dans lequel les entreprises augmentent leur productivité grâce à l'utilisation de biens intermédiaires importés et peuvent alors supporter les coûts fixes d'entrée sur les marchés d'exportation. Les revenus des exportations et le nombre des variétés exportées sont ainsi expliqués par la productivité de l'entreprise, elle même influencée par le niveau d'importation de biens intermédiaires.

Notre exercice empirique utilise une base de données d'importation au niveau entreprise-produit (HS6) fournie par les Douanes françaises pour la période 1995-2005. Une " variété " de bien intermédiaire importé est définie comme la combinaison d'un produit et d'un pays d'origine. Nous distinguons deux mécanismes par lesquels une augmentation du nombre de variétés de biens intermédiaires importés affecte la productivité et les exportations des entreprises. Le premier est celui de la complémentarité : l'accès à de nouvelles variétés de biens intermédiaires permet aux entreprises d'obtenir une meilleure complémentarité de leurs intrants. Cela engendre des gains de productivité et permet à davantage d'entreprises de devenir exportatrices. Le deuxième mécanisme est lié au transfert de technologie à travers l'importation de biens intermédiaires. Nous testons ces deux mécanismes en distinguant l'origine des importations (pays en développement / pays développés).

Nos résultats mettent en lumière les effets positifs des biens intermédiaires importés sur la productivité ainsi que sur la performance à l'exportation des entreprises et valident les deux mécanismes de complémentarité et de transfert de technologie. Doubler le nombre de variétés de biens intermédiaires importés augmente, toutes choses égales par ailleurs, la productivité de 4% en moyenne (lorsque les importations proviennent de pays développés, l'effet est 60% plus important que lorsqu'elles proviennent de pays en développement). Utiliser une quantité plus importante de biens intermédiaires importés et/ou avoir des importations plus diversifiées permet aux entreprises d'exporter un nombre plus élevé de variétés : sur la période 1995-2005, l'augmentation moyenne de biens intermédiaires importés en provenance des

pays développés augmente le nombre de variétés exportées de 12% (s'agissant des biens intermédiaires importés des pays en développement l'impact est non significatif).

RÉSUMÉ COURT

De nombreux travaux empiriques soulignent l'effet positif de l'utilisation de biens intermédiaires importés sur la productivité des entreprises ; d'autres travaux montrent que seules les entreprises les plus productives exportent. Mais le lien entre biens intermédiaires importés et performance à l'exportation n'a pas été démontré. Notre hypothèse est qu'en important plus de variétés de biens intermédiaires, les entreprises accroissent leur productivité ce qui leur permet de supporter le coût fixe de l'exportation. Pour tester cette hypothèse, nous utilisons une base de données provenant des Douanes françaises qui fournit les importations au niveau entreprise-produit (HS6) sur la période 1995-2005. Nous distinguons deux mécanismes par lesquels une augmentation du nombre de variétés de biens intermédiaires importés affecte la productivité et les exportations des entreprises : l'accès à de nouvelles variétés de biens intermédiaires permet aux entreprises d'obtenir une meilleure complémentarité de leurs inputs d'une part et, d'autre part, de bénéficier du transfert de technologie incorporé aux biens intermédiaires importés. Nous testons ces deux mécanismes en distinguant les importations selon qu'elles proviennent de pays développés ou de pays en développement. Nous trouvons un impact significatif d'une augmentation du nombre de variétés de biens intermédiaires importés sur la productivité des entreprises et sur le nombre de produits exportés. Les mécanismes de complémentarité et de transfert de technologie sont tout deux validés par nos résultats.

Classification JEL : F10 et F12

Mots clés : Hétérogénéité des entreprises, biens intermédiaires importés, productivité, variétés exportées, données d'entreprises.

DOES IMPORTING MORE INPUTS RAISE EXPORTS? FIRM LEVEL EVIDENCE FROM FRANCE [1]

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1. INTRODUCTION

Should policy fight or promote imports of intermediate inputs? While several studies evidenced the recent increase in imports of intermediate goods (Hummels et al., 2001; Yi, 2003; or Strauss-Kahn, 2004), their role in shaping domestic economies is not yet completely understood. A very large literature focuses on the impact of imported intermediate inputs on employment and inequality and concludes on the existing (although limited) role of outsourcing in explaining job losts and wages decrease (see e.g., Feenstra and Hanson 1996 for the U.S.; Hijzen et al. 2005 for the U.K. or Biscourp and Kramarz 2007 for France). [2] By contrast, the literature on endogenous growth provides theoretical grounds for the role of these foreign inputs in enhancing efficiency gains and economic growth at the aggregate level (e.g., Romer, 1987 or Rivera-Batiz and Romer 1991). At the firm level, most gain is measured in terms of productivity growth realized through, better complementarity of inputs, lower input prices, access to higher quality of inputs and access to new technologies embodied in the imported varieties (see Ethier, 1982; Markusen, 1989 or Grossman and Helpman, 1991 for a theoretical background). Robust empirical works using micro-level data recently confirmed a positive relationship between imported inputs and firm productivity (e.g., Halpern et al., 2009 for Hungary or Kasahara and Rodrigue 2008 for Chile). [3]

Another strand of literature focuses on firms' exports. In the specifications proposed by Melitz (2003) and Bernard et al. (2003), firms are heterogeneous in productivity levels, and only a

1. We have benefited from discussions with Matthieu Crozet, Sandra Poncet, Andrew Bernard and Tibor Besedes. We also thank seminar participants at the ETSG 2010 in Lausanne, CEPII and FREIT/EITI 2011 in Tokyo for useful comments. We are responsible for any remaining errors.

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2. Note that our focus is on intermediate inputs (i.e., intermediate goods which are transformed domestically.) We thus differ from the above cited studies which encompasse imported intermediate goods that are in their final comsumption form. Imports of these proceed inputs impact domestic employment significantly whereas the effect of intermediate inputs on employment is more limited

3. Muendler (2004) stands as an exception. He does not find a significant effect of firm productivity growth through importing inputs for Brazil.

subset of them - the most productive - become exporters. Several empirical studies confirmed this export pattern (e.g., Roberts and Tybout, 1997; Clerides et al., 1998; Bernard and Jensen, 1999, or Alvarez and Lopez, 2005). Further work on multiproduct firms (e.g., Bernard, Redding and Schott, forthcoming, or Mayer, Melitz and Ottaviano, 2010) strenghten these findings by showing that the most productive firms export more products and to more destinations. The underlined idea is that firms productivity level must be high enough to bear the fixed cost associated with entry in export markets. Thus, exporting status and productivity are correlated at the firm level. Most heterogeneous firms' models stayed however silent on the determinant of firms' heterogenous productivity level which is considered exogenous. [4]

This paper studies the role of imported inputs on firm's export performance. Since foreign inputs improve firms' productivity, they should also be an important asset for exporting activities. Firms boost their efficiency gains by sourcing their intermediate goods from abroad and thereby are able to bear the cost of entering and surviving in export markets. In this case, the export selection process is explained by firm productivity which is determined by the firm level of imported inputs. We thus bridges the gap between two distinct lines of literature: the first focuses on firms' export ignoring the use of imported inputs in production, the second investigates the impact of importing inputs on firms productivity but does not look at export scope. This exercise does not lack political relevance. A positive impact of an increased used of imported inputs on export scope would mitigate the negative effect of outsourcing on employment and play in favor of targeted import/export policies. We use a firms' level database of imports at the product (HS6) level provided by French customs for the 1995-2005 period where varieties of inputs are defined as a product-country pair. One important concern that arises when addressing this question is how to deal with potential reverse causality between imports of intermediate goods and firms' export behavior. We deal with this issue by using lagged explanatory variables and relying mainly on GMM estimates. We also aim at distinguishing the different channels through which an increase in imported inputs affects firm productivity and exports.

The first mechanism is the variety/complementarity channel. By accessing to new imported varieties of intermediate good, firms expand the set of inputs used in production and therefore reach a better complementarity. Resulting gains in productivity allow entering more export markets. We explore such eventuality by testing for the impact of an increase in the number of imported input varieties on firms' TFP and export scope. Halpern at al. (2009) examine the variety channel (imported inputs are assumed imperfect substitutes to domestic inputs) through which imports affect firm productivity. They find that imported inputs lead to significant productivity gains, of which two thirds are attributed to the complementarity argument and the

4. Few theoretical exceptions introduce endogenous productivity gains determined by R&D investments: Costantini and Melitz (2007), Atkeson and Burstein (2010), Aw, Roberts and Xu (2009) and Bustos (2010). The most recent literature extends the source of heterogeneity to characteristics other than just productivity; for instance, several recent papers consider the ability to deliver quality (e.g., Verhoogen 2008, Kugler and Verhoogen 2008 or Hallak and Sivadasan (2009)).

remainder to a quality argument. Similarly, Goldberg et al. (2009) find that an increase in imported input varieties contribute to the expansion in firms' product scope. We depart from their works by exploring the impact of the complementarity channel on firms' export performance.

The second mechanism is related to technology transfer. One of the channels through which international trade promotes economic growth is indeed associated with the diffusion of modern technologies embodied in imported intermediate inputs. Empirical works using aggregate cross-country data have emphasized this effect (e.g., Coe and Helpman, 1995; Coe and Helpman, 1997, or Keller, 2002). More recently, Smeets and Warzynski (2010) investigate the effect of importing inputs of different origins on firm TFP using product-firm level dataset from Denmark. They distinguish imports of intermediate goods from OECD countries and from low-wage countries and found that both types of foreign inputs are associated with positive productivity improvements.

Two theoretical papers, Kasahara and Lapham (2006) and Bas (2009) extend Melitz (2003) model to incorporate imported inputs. In their model, productivity gains from importing intermediates goods allow some importers to start exporting. Importantly, because import and export are complementary, Kasahara and Lapham (2006) argue that import protection acts as export destruction. To the best of our knowledge, our study is the first to empirically put together the two following arguments: firms that have access to a larger variety of imported inputs increase their productivity and firms with high productivity levels export more varieties. [5]

This paper provides new insight on the role of imported inputs in shaping firms' export performance. The main results are as follows. Using a semi-parametric estimation of total factor productivity based on the methodology of Olley and Pakes (1996) and Ackerberg et al. (2007), we find strong empirical evidence of the positive effect of an increased use of foreign intermediate goods on firms' productivity. We find support for both the complementarity and technology arguments for imports. While doubling the number of varieties of foreign inputs increases TFP by 4%, importing inputs from developed countries increases firms' TFP from 20% to 60% more than importing inputs from less developed economies. We posit that these more productive firms are also likely to export more products as they are able to bear the export fixed costs and survive on competitive export markets. We do find empirical support for this conjecture. Fims using more imported inputs and/or a more diversified set of these inputs sell a larger number of varieties on export markets. This effect is larger for inputs imported from developed countries that have a more advanced technological content. The observed 1995-2005 average increase in imported inputs from the most developed countries raises the number of exported varieties

5. Bas (2009) tests for the relationship between imported inputs and export scope for the case of Chile and Argentina. We add to her paper by looking at the countries of origin of imports and thereby distinguishing the channels through which imported inputs impact firms TFP and export scope.

by 12% whereas the impact of increased imports from developing countries on export scope is economically and statistically insignificant.

The paper is organized as follow. Section 2 presents data and evidence on the increase in imported inputs for France. Section 3 develops the theoretical background. Section 4 shows that firms' TFP is positively affected by an increase in imported inputs and explores the complementarity and technology channels. Section 5 presents on the main empirical results of this paper: the positive impact of an increase in imported inputs on firms' export scope. Section 7 concludes.

2. Data, facts and trends

2.1. Data

Our dataset is a panel of French manufacturing firms for the period 1995-2005. Importantly, services (in particular wholesalers) firms are excluded from the database. We thus rule out the possibility of capturing firms which activity consists on importing goods in order to re-sale them on domestic or foreign markets. [6] The database comprises firm level characteristics such as sales, employment, wages, capital, input cost as well as trade information on firms' exports and imports. This dataset was built from two sources. Trade data comes from the French Customs which provides annual imports and exports data for French manufacturing firms over the 1995-2005 period. [7] The customs data is at the product level (6-digit Harmonized System (HS6), i.e., 5349 categories) and specifies the country of origin (destination) of imports (exports). This is a unique feature of our database which allows distinguishing imported inputs from different sources, namely developed and developing countries. [8] Data on firms' level characteristics come from the Annual French Business Surveys (EAE) available from the INSEE (French Institute of Statistics) and include French firms with more than 20 employees. In both databases, individual firms are assigned a specific code, the so-called "siren" code, which allows matching information from the two sources. Unfortunately, whereas the Customs data encompasse most trade flows in and out France over the period (representing trade activity of about 120,000 firms per year), the EAE database is quite restrictive (the number of firms is of about 20,000 per year). The EAE database is however of great value to us as it includes data on capital and thereby allows calculation of total factor productivity. After merging these two databases, we work with an unbalanced panel of about 21,000 firms or 230,000 observations

6. We may still encounter the issue of carry along trade revealed by Bernard et al., 2010. As shown in section 5.3, our results are robust to the exlusion of French multinational firms. If we do not account for trade with subsidiaries, carry along trade corresponds to firms importing more inputs than they use as intermediate goods and exporting the excess to independent firms abroad. Such trade is likely negligable in our database

7. This database is quite exhaustive. Although reporting of firms with trade values below 250,000 Euros (within the EU) or 1,000 Euros (rest of the world) is not mandatory, we observe many observations below these thresholds

8. Developing countries correspond to non high-income countries, defined by the World Bank as countries with 2007 per-capita GNIs under $11,456 computed in U.S. dollars using the Atlas conversion factor.

over the sample period. Nominal variables are in million euros and are deflated using 2-digit industry-level prices indices provided by the INSEE. [9]

Table 1 reports information on the number of firms by trade status. Interestingly, 70% of our French firms are exporters. This feature is at odds with previous studies which evidenced the small share of firms that export (see for example, Bernard and Jensen (1995) for the US, Aw, Chung and Roberts (2000) for Korea and Taiwan or Eaton, Kortum and Kramartz (2004) for France) and is a consequence of the selection bias of our EAE database. By restricting our database to the biggest firms (i.e., firms with more than 20 employees), we also capture more exporters. [10] As our aim is to test for the impact of importing more varieties on export margins, such bias in the database does not seem inappropriate. Importantly, most exporters (i.e., 86% of them) are also importers.

Table 1 – Descriptive statistics number of firms by trade status

	1995-2005	
	N	Percentage
Domestic	50737	0,22
Only exporter	23797	0,10
Only importer	19879	0,09
Exporter-importer	137576	0,59

Notes: N is the total number of observations over the period. Percentage is the fraction of firms by trade status over total firms.

Imported input variety is a key variable in this paper. As common in the literature (e.g., Feenstra (1994) or Broda and Weinstein (2006)), we define a variety as a product-country pair. A product corresponds to a 6-digit HS category and a variety to the import of a particular good from a particular country. For example, wire of silico-manganese steel (i.e., HS 722920) is a product while wire of silico-manganese steel from Italy is a variety. In 1995, French firms imported

9. We used different specific deflators at the 2-digit level for added value, materials and capital goods.

10. The studies cited above as well as many others (e.g., Clerides et al. (1998) or Delgado et al.(2002)) show that exporters are larger, more productive and more capital intensive. More specifically, several European based studies (e.g., Andersson et al. (2007) for Sweden, Muuls and Pisu (2007) for Belgium or Castellani et al. (2010) for Italy) found that relying on a restricted number of firms (the largest ones) increases drastically the share of exporters. By contrast, Eaton et al. (2004) which use an exhaustive database of French companies and work with more than 200,000 firms find that a small share of firms export.

four different varieties of wire of silico-manganese steel. Our Customs dataset does not specify whether firm's imports are final or intermediate inputs. Following Feenstra and Hanson (1996), we thus consider that imports from the same HS4 category as the firm main sector of activity (at the HS4) are final goods whereas imports from any other category are intermediate inputs. In order to shed more light on our measure of intermediate inputs, Table 10 in the appendix reports imported intermediate inputs and imported final goods for two firms of distinct sectors calculated using the above definition. As shown in the Table, this method allows capturing intermediate inputs accurately.[11] Table 2 shows the average number of varieties imported as intermediate inputs (henceforth imported inputs) by a firm per year. Two broad facts emerge: First, most imported inputs come from developed countries. Second, exporters are the biggest importers.

Table 2 – Descriptive statistics by trade status

	Only importer	Exp-imp
Number of imported varieties	8 (13)	35 (68)
Number of imported varieties from DC	7 (12)	31 (57)
Number of imported varieties from LDC	1 (1.6)	4 (11)

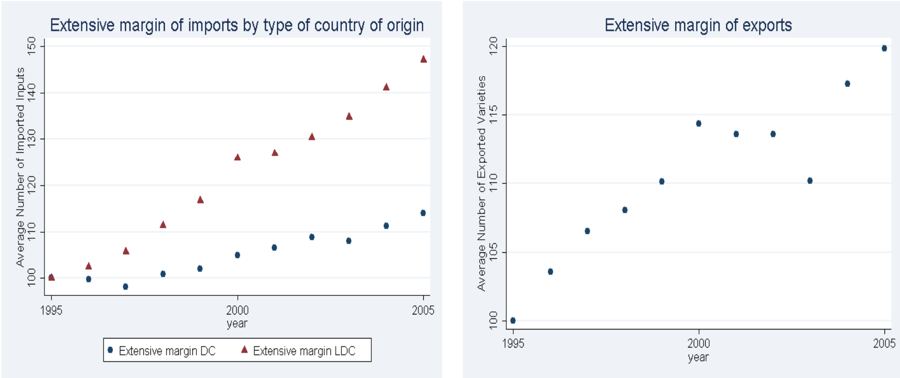
Notes: Mean values and standard errors in parentheses are reported.

2.2. Trend in imported inputs

Imports of intermediate inputs have increased drastically over the period. This is reflected in Figure 1 which plots the extensive margins of imports over the sample period 1995-2005. Firms' average number of imported varieties from developed countries rose by 12% between 1995 and 2005. The increase is even more striking for imported inputs from developing countries with a growth of 48% in the number of varieties. Figure 1 provides similar information for exports and reveals a consequent growth in the number of exported varieties. Fench firms have thus become more internationalized over the period by increasing both their imports and exports of varieties. Whether there is a correlation between the increase in imported inputs and exports is what we ought to investigate.

11. All the main results of this paper have been tested for alternative definition of intermediate inputs (i.e., using the United Nations Broad Economic Categories (BEC) classification). Results are similar to the ones presented here and are available upon request.

Figure 1 – Number of imported and exported varieties



Note: base 100, 1995; simple averages over all firms. Source: Authors calculations based on French firms' customs dataset.

Several studies (e.g., Bernard and Jensen (1999) or more recently De Loecker (2007)) focused in firms' exports pattern and have shown that exporting firms have different characteristics than non-exporting firms. We are interested in the specificities of firms that import inputs and therefore, we run an equivalent import-premia analysis. Such preliminary analysis is given in Table 3 for the full sample and in Table 4 distinguishing for the country of origin of the inputs. Each specification gives OLS estimates of the impact of being an importer of intermediate goods on firms' characteristics such as employment, labor productivity (using value-added per worker as rough measure of productivity), wages or capital and material intensity. There are substantial differences between importers and non-importers. The former are on average larger (61%), more productive (17.7%), pay higher wages (8.6%) and are more capital (45.8%) and materials (96.8%) intensive. In almost all cases, the impact of being an importer on firms' characteristics is stronger if the imports come from developed countries. This effect is reversed for material intensity which may suggest that imports from LDC are highly labor intensive thus increasing the materials/employment ratio.

3. Theoretical Motivation

In this section, we provide a theoretical framework which highlights the mechanisms through which imported inputs affect firms' total factor productivity (TFP) and export scope. We build a simple partial equilibrium model based on Melitz (2003) in order to rationalize the empirical facts described in the previous section and derive a set of testable predictions.

3.1. A simple model

There is a continuum of domestic firms in the economy that supply differentiated final goods under monopolistic competition. Firms differ in their initial productivity draws (φ) which are introduced as in Melitz (2003). In order to produce a variety of final good y, the firm combines

Table 3 – Importer premia

	(1) Employment	(2) VA/employment	(3) Wages	(4) Capital/employment	(5) Materials/employment
importer	0.610***	0.177***	0.086***	0.458***	0.968***
	(0.004)	(0.002)	(0.001)	(0.007)	(0.007)
Size		-0.025***	0.988***	0.126***	-0.061***
		(0.002)	(0.001)	(0.004)	(0.003)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry (2 digit)	Yes	Yes	Yes	Yes	Yes
Observations	228957	228954	228528	170392	225735
R^2	0.228	0.238	0.934	0.270	0.524

Notes: Standard errors are in parentheses. All coefficient are significant at the 1% level. Importer is an import dummy equal to one if the firm imports intermediate inputs in year t and zero otherwise.

Table 4 – Importer premia by country of origin

	(1) Employment	(2) VA/employment	(3) Wages	(4) Capital/employment	(5) Materials/employment
Importer mainly from DC	0.643***	0.174***	0.084***	0.462***	0.937***
	(0.004)	(0.002)	(0.001)	(0.007)	(0.007)
Importer mainly from LDC	0.235***	0.155***	0.069***	0.282***	0.995***
	(0.010)	(0.007)	(0.004)	(0.016)	(0.018)
Size		-0.026***	0.988***	0.121***	-0.063***
		(0.002)	(0.001)	(0.004)	(0.003)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry (2 digit)	Yes	Yes	Yes	Yes	Yes
Observations	228957	228954	228528	170392	225735
R^2	0.237	0.238	0.934	0.270	0.523

Notes: Standard errors are in parentheses. All coefficient are significant at the 1% level. Importers mainly from DC is an import dummy equals to one if the firms imported more than 50% of its intermediate inputs from developed countries and zero otherwise whereas importers mainly from LDC is an import dummy equals to one if the firms imported more than 50% of its intermediate inputs from developing countries and zero otherwise .

three factors of production: labor (L), capital (K) and a range of differenciated intermediate goods, (M_{ij}) produced by industry i, that can be purchased in the domestic or in the foreign market. If the firm sources its inputs internationally, it may import intermediate goods from two different sets of countries distinguished by their levels of development. As traditionally assumed, countries belonging to the North have higher GDP per capita than countries belonging to the South.

The technology is represented by a Cobb Douglas production function with factor shares η

$+\beta + \sum_{i=1}^{I} \alpha_i = 1$:

$$y = \varphi L^{\eta} K^{\beta} \prod_{j \in \{D,N,S\}} \prod_{i=1}^{I} (M_{ij})^{\alpha_i} \quad (1)$$

where $M_{ij} = \left(\sum_{v \in I_{ij}} \chi_{ij} m_{iv}^{\frac{\sigma_i - 1}{\sigma_i}} \right)^{\frac{\sigma_i}{\sigma_i - 1}}$.

The range of domestic and imported (South and North) varieties of intermediate goods of industry i are aggregated by CES functions M_{iD}, M_{iS} and M_{iN} respectively, where $I_D = \{1, ..., M_d\}$, $I_N = \{1, ..., M_N\}$, $I_S = \{1, ..., M_S\}$, $I = I_D \cup I_S \cup I_D$ and the elasticity of substitution across varieties of industry i is $\sigma_i > 1$. In this setting, firms might improve their efficiency by sourcing intermediate inputs from abroad. Thanks to an increase in productivity or a fall in inputs prices, firms may indeed lower their marginal cost. Importing intermediate goods implies paying a fixed importing cost (F_m) and is therefore not optimal for all firms. The technology transfer parameter, χ_{ij}, captures the fact that imported inputs may enhance firm efficiency differently depending on their origin. χ_{ij} is greater than one for inputs sourced from the most developed countries (M_{iN}). With this set up, each foreign country may produce one variety of inputs per industry, we thus match our empirical framework where a variety is defined as a product-country pair.

Considering that intermediate inputs are symetrically produced at a level $\overline{m}$, it can be shown that

$$M_{iD} = N_{iD}^{\frac{\sigma_i}{\sigma_i - 1}} \overline{m}_D, \quad M_{iS} = N_{iS}^{\frac{\sigma_i}{\sigma_i - 1}} \overline{m}_S \text{ and } M_{iN} = (N_{iN} \chi_i)^{\frac{\sigma_i}{\sigma_i - 1}} \overline{m}_N \quad (2)$$

where N_{iD}, N_{iS} and N_{iN} are the number of domestic and imported (from the South or the North) varieties of intermediate goods. The production function for a variety of final good (Equation (1)) can thus be rewriten as:

$$y = \varphi L^{\eta} K^{\beta} \prod_{j \in \{D,N,S\}} \prod_{i=1}^{I} \overline{M}_{ij}^{\alpha_i} (N_{ij} \chi_{ij})^{\frac{\alpha_i}{\sigma_i - 1}} \quad (3)$$

where $\overline{M}_{ij} = N_{ij} \overline{m_j}$. We now make the simplifying assumption that firms either source their inputs domestically or internationally (from both the North and the South). [12] As common in

12. We make such assumption in order to keep our model the simplest and the closest to our empirical analysis knowing that (i) our interest lies imports and (ii) we do not have reliable data on domestic inputs. Kasahara and Rodrigue (2008) also makes this assumption.

the literature, the first-order condition is such that prices reflect a constant mark-up, $\rho = \frac{\phi-1}{\phi}$, over marginal costs, $p = \frac{MC}{\rho}$, where the marginal cost of production is determined by MC_D if the firm sources its inputs domestically and MC_F if it does it on foreign markets. [13]

$$MC_D = \frac{p_k^{\beta} w^{\eta} \prod_{i=1}^{I} p_{iDm}^{\alpha_i}}{\varphi \prod_{i=1}^{I} \ N_{iD}^{\frac{\alpha_i}{\sigma_i-1}}} \tag{4}$$

$$MC_F = \frac{p_k^{\beta} w^{\eta} \prod_{i=1}^{I} p_{ijm}^{\alpha_i}}{\varphi \prod_{i=1}^{I} \ (N_{iN}\chi_{iN})^{\frac{\alpha_i}{\sigma_i-1}} \ (N_{iS})^{\frac{\alpha_i}{\sigma_i-1}}} \tag{5}$$

where w is the wage, p_k is the price of capital goods and p_{ijm} is the price of inputs. [14] Combining the demand faced by each firm, $q_j(\varphi) = \left(\frac{P}{p_j(\varphi)}\right)^{\phi} C$ - where P is the aggregate final goods price index and C is the aggregate expenditure on varieties of final goods -, and the price function, $p_j(\varphi) = \frac{MC_j}{\rho}$, revenues are given by $r_j(\varphi) = q_j(\varphi)p_j(\varphi)$:

$$r_j(\varphi) = \left(\frac{P}{p_j}\right)^{\phi-1} R,$$

where $R = PC$ is the aggregate revenue of the industry which is considered exogenous to the firm. Firm profit thus simplifies to $\pi_j = \frac{r_j}{\phi} - F$, where F is the fixed production cost. [15]

Firms' decisions: Only those firms with enough profits to afford the fixed production cost (F) will be able to survive and produce for the domestic market using only domestic intermediate inputs. The zero cutoff profit condition implies that profits of the marginal firm are equal to zero: $\pi_d\left(\varphi_d^*\right) = 0$, where the value φ_d^* represents the productivity value of the marginal firm producing for the domestic market only.

Once they have decided to stay and produce, firms may also decide to import intermediate goods in order to reduce their marginal costs either through an increae in productivity (imports for the

13. Consumer preferences are represented by a standard CES utility function $C^{\frac{\phi-1}{\phi}} = \sum_{k\in\Omega_d} C_{dk}^{\frac{\phi-1}{\phi}}$ where $\phi > 1$ is the elasticity of substitution across final consumption goods. Results follow.

14. We assume that $p_{iDm} = p_{iNm} > p_{iSm}$ as factors of production are expectedly cheaper in the South.

15. Recall: $\pi = r - wl - p_k k - \prod_{i=1}^{I} p_{ijm} M_{ij} - F$.

North) or a decrease in inputs prices (imports form the South). Import decision is endogenously determined by the initial productivity draw (φ). Firms with a more favorable productivity draw have a higher potential payoff from sourcing their inputs from abroad and hence are more likely to find incurring the fixed importing cost worthwhile. The increase in revenues due to the use of foreign inputs enables them to pay the fixed importing cost. The indifference condition for the marginal firm to import is given by: $r_f\left(\varphi_f^*\right) - r_d\left(\varphi_f^*\right) = \phi F_m$, where the value φ_{xf}^* represents the productivity cutoff to import intermediate goods.

Finally, the most productive firms may also chose to export. The tradability condition in this case is given by: $\frac{r_x(\varphi_x^*)}{\phi} = F_x$, where φ_x^* is the productivity of the marginal firm serving the export market and F_x the export fixed costs. In the spirit of Matsuyama (2007), we believe that this fixed cost may depend on information technologies, countries regulations, business language, foreign consumer culture gap and/or foreign network accessibility. While the export condition depends on the firm productivity draw, we will show that the number and quality of imported inputs also matters.

3.2. Testable predictions

3.2.1. Imported inputs and firm productivity

In this section, we derive a set of testable predictions for firms using foreign intermediate goods. From the production function in equation (3) we can derive the total factor productivity (A) of each firm as a Solow residual:

$$A = \frac{y}{L^\eta K^\beta \prod_{i=1}^{I} \overline{M}_{iF}^{\alpha_i}} = \varphi \prod_{i=1}^{I} \left(N_{iN}\chi_{iN}\right)^{\frac{\alpha_i}{\sigma_i - 1}} \left(N_{iS}\right)^{\frac{\alpha_i}{\sigma_i - 1}} \tag{6}$$

Firm' TFP is an increasing function of the initial firm productivity draw - proxied by the unobserved heterogeneity shock, φ, the number of foreign input varieties imported from the North, N_{iN}, or the South, N_{iS}, and the foreign technology transfer parameter (χ_i). As mentioned above, the value of this technology parameter depends on the country of origin of imports. It is greater than one for inputs sourced from the North. Importing intermediates goods thus impact productivity more importantly if the inputs come from the most developed countries. This specification allows us to disentangle two channels through which imported intermediate goods affect firm TFP: (1) the variety/complementarity channel and (2) the technology transfer.

Testable prediction on TFP: *The larger the range of imported input varieties, the higher firm TFP. This effect is stronger for firms sourcing their inputs from the most developed countries.*

3.2.2. Imported inputs and export patterns

Using the price and the revenue function defined in the previous section, we can derive the following expression for firms' export revenues: [16]

$$r_x = \Phi \left(\frac{\varphi \prod_{i=1}^{I} \left(N_{iF}\chi_{iN}\right)^{\frac{\alpha_i}{\sigma_i - 1}} \left(N_{iS}\right)^{\frac{\alpha_i}{\sigma_i - 1}}}{\prod_{i=1} p_{ifm}^{\alpha_i}} \right)^{\phi - 1} \tag{7}$$

where $\Phi = P^{\phi-1} R \left(\rho^{-1} \left(1+\tau\right) p_k^{\beta} w^{\eta}\right)^{1-\phi}_{,}$ with τ the variable export cost, P the aggregate price index of final goods and R aggregate revenue of the industry, all exogenous to the firm. An increase in the number of imported varieties N_{iN} or N_{iS} raises firms' export revenues. Once again the effect is stronger if the inputs come from the North as the effect is magnified by the technology transfer parameter ,χ_i, embodied in imported varieties. The increase in the expected export revenues allows the firm to bear the fixed cost of exporting and thus sell on export markets. Melitz (2003) shows that firm TFP determines export revenues. In our setting, the export selection process is thus reinforced by the different mechanisms through which importing intermediate goods determine firm TFP (the variety and technology transfer channel).

***Testable prediction on export varieties**: Importing more varieties of foreign inputs increases export profits allowing more firms to export and sell their varieties on export markets. This effect is more pronounced for firms importing intermediate goods with higher technological content from developed countries.*

A rise in firms productivity enhances firms revenue. Importing varieties may also boost export profits, and consequently expand export scope, through its effect on export fixed costs as import activities may lead to a better knowledge of foreign markets and improved foreign networks.

4. IMPORTED INPUTS AND FIRM' TOTAL FACTOR PRODUCTIVITY

4.1. Empirical specification

Why would an increase in the number of varieties of imported inputs used in production rise the number of exported varieties? We argue that importing more intermediate inputs increases firm's productivity and thereby makes the firm able to overcome the export fixed costs. As shown by the model, using more varieties of intermediate goods should fulfill firms needs for complementarity inputs (or love for varieties) and thereby enhance their technology. In this

16. Note that the price set by an exporting firm is given by $p_x = p_d\left(1+\tau\right)$, where τ is the export variable cost.

section, we test for the validity of such argument by estimating the impact of an increase in imported inputs on total factor productivity (TFP).

We use several measure of imported inputs as regressors: the number of imported inputs, the value of imported inputs and the import status of the firm (i.e., a dummy that takes a value of one if the firm imports intermediate inputs). We also use a measure of imported inputs concentration, the Theil's entropy index (Theil 1972). Such measure captures the level of diversification of intermediate inputs at the firm level. For each firm, f, we compute the concentration in imported varieties across potential importers of product i as given by:

$$T_{fi} = 1/n \sum_{k=1}^{n} (x_{fik}/\mu) \ln(x_{fik}/\mu), \;\; with \;\; \mu = \sum_{k=1}^{n} (x_{fik}/n)$$

where x_{fik} is the import value of variety k of product i by firm f and n is the number of potential importer. We thus have a Theil concentration index for each product the firm imports. At the firm level, the Theil concentration index is measured as the import weighted average of products Theils. [17]

We get estimates of the production function by relying and building on Olley and Pakes (1996) (henceforth OP) extended by Ackerberg, Caves and Frazer (2007) (henceforth ACF). The OP method allows controlling for simultaneity bias which are most likely to be present in our specifications. Simultaneity arises because input demand and unobserved productivity are positively correlated. Firm specific productivity is indeed known by the firm but not by the econometrician and firms respond to expected productivity shocks by modifying their purchases of inputs. OLS estimates on capital (labor) thus tend to be downwardly (upwardly) biased. [18] Olley and Pakes (1996) propose a three-stage methodology to control for the unobserved firm productivity. They deal explicitly with investment behavior. The rationale is to reveal the unobserved productivity through the investment behavior of the firm in $t-1$, which in turns theoretically depends on capital and productivity. The OP estimation is further described in the appendix. Note that the OP specification performs better than fixed-effect specifications because the unobserved individual effect (productivity) is not constrained to be constant over time. Moreover, approaches based on instrumental variables can be limited by the instruments availability. Finally, OP methodology does not assume restrictions on the parameters.

Ackerberg et al. (2007) reveal an indentification issue on the labor coefficient of the OP model. They evidence significant collinearity between labor and unobserved productivity in the first

17. We also use alternative measures of concentration such as the Herfindahl index. Results are similar and available upon request.

18. Coefficients that are most responsive to productivity shocks tend to be upwardly biased. Moreover, if capital is positively correlated with profits, firms with larger capital stock will decide to stay in the market even for low realizations of productivity shocks. This implies a potential source of negative correlation in the sample between productivity shocks and capital stock, which translates into a downward bias in capital elasticity estimates.

stage of the OP method. Ackerberg et al. (2007) propose an alternative method that modifies OP in order to account for these collinearity problems. The main technical difference lies in the timing of labor input decision. Whereas in the OP method, labor is a freely variable input and is chosen in t, the ACF method assumes that labor is chosen at the sub-period $t - b$ $(0 < b < 1)$, after capital is known in $t - 1$, and before investment is made in t. Decision on labor input is thus unaffected by unobserved productivity shocks between $t - b$ and t . Firms' investment decision in the ACF methodology thus depends on capital and productivity but also on labor inputs. In contrast with the OP method, this implies that the coefficients of capital, the number of imported inputs and labor are all estimated in the second stage. Further explanations on the ACF method are given in the appendix.

We rely on the OP/ACF method modified to account for the fact that investment decisions depend also on the importing inputs behavior of the firm. [19] As shown in Section 2.2, importing firms differ greatly from non-importing firms in all means including their capital intensity and sales. Importantly, firms that import inputs from different countries face different market structures and factor prices when they make their investment and exit decisions. Modifying the OP/ACF estimation by incorporating imported inputs behavior does not therefore lack relevance. Following De Loecker (2007) and Kasahara and Rodrigue (2008), we thus include an additional state variable in the OP/ACF estimation which captures the imported inputs behavior of firms. [20]

We estimate the following specification of a Cobb-Douglas production function:

$$y_{ft} = \beta_0 + \beta_l l_{ft} + \beta_k k_{ft} + \beta_m m_{ft} + \beta_i Imp_{ft} + \omega_{ft} + \eta_{ft} \tag{1}$$

All variables are expressed in natural logs. y_{ft} is the total production of firm f at time t, l_{ft} is labor, m_{ft} is materials, k_{ft} stands fo capital stock and Imp_{ft} corresponds to the different proxies of imported inputs. [21] The error term can be decomposed into an intrinsical transmitted component ω_{jt} (productivity shock), which is observable to firms but not to the econometrician, and an i.i.d. component η_{ft}. Standard errors are obtained by bootstrap.

19. Like almost all previous empirical works that estimate production functions using firm level data, we do not observe prices neither physical output at the firm level. The OP/ACF methodology thus faces the traditional concerns that productivity estimates may just capture differences in prices, mark-ups and demand variations and not actual physical productivity (Erdem and Tybout (2003), Katayama et al. (2005) and De Loecker (2007)).

20. De Loecker (2007) studies learning by exporting and includes export status as a state variable in the Olley and Pakes estimation whereas Kasahara and Rodrigue (2008) adds imported inputs status as state variable of their study of the effect of imported inputs on productivity using Chilean plant level data.

21. The number of imported inputs explanatory variable includes zero observations (non-importer). We deal with this issue by considering the $\ln(x + 1)$ variable instead. These zero observations will be explicitly taken into account in Section 5.2.

4.2. From importing inputs to increased TFP: the channels of transmissions

We explore the channels through which access to foreign inputs affects firms' TFP focusing on the main mechanisms pointed out in the literature: (i) access to higher number of varieties of inputs through imports (the complementarity/love for varieties assumption) and (ii) availability of better inputs with higher level of technology. By reaching a better complementarity of inputs, firms increase their productivity and consequently increase the number of varieties they export. We first test for this complementarity argument for an increase in TFP.

Table 5 presents the results of the impact of variations in the number of imported inputs and in the diversity of imported inputs on firms' TFP. We also estimate production function using the less accurate OLS and Within estimates as well as the OP method, results are in the same vein as the one presented here and are available upon request.

The OP/ACF estimates imply that a firm using only domestic inputs can increase its TFP by 5.7% if it starts importing its inputs. Said differently, a doubling of the number of imported inputs raises TFP by 4%. These results are significant as in average each year 440 firms start importing while 1550 firms double or more than double the number of varieties they import. Similarly, the average firm increased its use of imported inputs by 6.5 units between 1995 and 2005 which lead to a increase in TFP of 1.5%.[22] The OP/ACF estimates on the Theil index of diversification also suggests a significant impact of imported inputs diversity on productivity. If the Theil index doubles (i.e., imports become twice more concentrated), TFP decreases by almost 20%. In line with theoretical evidence on the impact of an increase in imported inputs on productivity (e.g., Ethier, 1982; Markusen, 1989; Romer, 1987 and 1990; or Grossman and Helpman, 1991) as well as with recent empirical findings (e.g., Kasahara and Rodrigue, 2008 or Halpern et al., 2009), we thus find that a larger use of imported inputs increases TFP.

Technological spillovers may occur as producers of final goods learn from the technology embodied in the intermediate goods through careful study of the imported product (the blueprint) (Keller 2004). One may expect that such embodied technology is higher for those inputs produced in the most advanced economies. In order to test for the hypothesis that varieties from developed countries embody technology and therefore enhance productivity, we regress firm's TFP on the number of imported inputs distinguished by their countries of origin (i.e., developed or developing countries as defined by the World Bank).

Coefficient on imported inputs from developed and developing countries are both positive and significant (see column (3) of Table 5). As the explanatory power of a variable depends on its own variability, we follow Head and Mayer (2004) in computing the impact of a variation in the expanatory variable of one standard deviation with respect to its mean. We find that a one standard deviation increase in the number of imported inputs from the most developed coun-

22. If $\ln y = \alpha \ln x$ and x doubled, y changes by $(2^{\alpha} - 1) * 100$ percent. Similarly, if $\ln y = \alpha \ln x$, the explanatory power of variable x is $((1 + \frac{\sigma_x}{\overline{x}})^{\alpha} - 1) * 100$ percent, where σ_x and $\overline{x}$ are the standard deviation and the mean of x repectively.

Table 5 – TFP estimation OP/ACF

Dependent variable:	Total production of firm (j) in year (t)		
	(1)	(2)	(3)
Employment	0.274***	0.260***	0.271***
	(0.014)	(0.014)	(0.014)
Capital	0.069***	0.071***	0.067***
	(0.003)	(0.003)	(0.003)
Materials	0.498***	0.488***	0.496***
	(0.008)	(0.009)	(0.008)
Number of imported inputs	0.057***		
	(0.006)		
Weighted mean of Theil index		-0.313***	
		(0.060)	
Number of imported inputs from DC			0.044***
			(0.006)
Number of imported inputs from LDC			0.028***
			(0.008)
Observations	110870	79992	110870

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All regressions include industry and year fixed effects. We use imported input intensity, number of imported inputs and import status as alternative definition of the imported inputs behavior of firms. Results using the different state variables for imported inputs are very similar to the one presented here and are available upon request.

tries improves firm TFP by 5.8%, while a one standard deviation increase in the number of imported inputs from developing countries increases the number of exported varieties by 4.8%. The impact of imported inputs on TFP is thus 20% larger when the inputs come from the most developed countries as compared to imported inputs from less developed economies. If we look at the effect of doubling imports from DC and LDC, this number goes up to 60%. This result is in line with the literature. For example, Coe and Helpman (1995) and Coe et al. (1997) find that foreign knowledge embodied in imported inputs from countries with larger R&D stocks has a positive effect on aggregate total factor productivity. More recently, Loof and Anderson (2008) using a database of Swedish manufacturing firms over the 1997-2004 period finds that productivity is increasing in the G7 countries-fraction of total import. Our results thus evidence the technological gains and learning spillovers induced by a rise in imported inputs from developed countries. To sum up, we find strong evidence that using more varieties of imported inputs or a more diversified set of imported inputs rise firm's TFP. Such TFP improvement occurs through better complementarity of inputs and technology spillovers obtained thanks to the information embodied in inputs imported from the most developed countries. Firms' productivity is enhanced which may lead to an increase in the number of variety exported.

5. IMPORTED INPUTS AND EXPORT PATTERNS

5.1. Main empirical specification and results

Our simple model shows that an increase in firm's imports of intermediate goods rises its export scope (see the testable prediction on export varieties). We argue that such increase occurs as imported inputs enhance firms productivity and thereby allow them to bear the cost of exporting. In order to validate such mecanism, we run two types of tests. We first estimate the direct impact of using more imported inputs on export scope. As we posit that imported inputs affect exports through an increase in firm's productivity, we then control for firm's TFP. We expect the coefficient on imported inputs (number and diversification index) to decrease drastically and/or lose significance while TFP is introduced in the regression. Such result would indeed corroborate our assumption that imported inputs affect export scope through an increase in firm's productivity.

Table 6 presents various estimators using the number of imported inputs, the measure of imported inputs diversification (i.e., the weighted Theil index) and the number of imported inputs from DC and LDC as independent variable.[23] Export scope, the dependent variable, is captured by the number of exported varieties. Whereas it is likely that the number of exported varieties and imported inputs are size dependent, time and fixed effects do not capture firm-time specific evolutions in size. Controlling for size is therefore primordial and is carried over all other specifications. In specification (4) (7) and (10), we also control for the firm's TFP. We do not report OLS estimates which are likely to be biased due to correlation between unobserved firms specific permanent shocks and imported inputs decisions.[24] While the within estimator control for correlation between inputs and permanent shocks, it does not deal with inverse causality issues between exports and imported inputs decisions or omitted variable bias. As a first step toward correcting for this issue and because it does not lack economic sense, we decided to consider the effect of past imported inputs decision on contemporaneous export pattern. The technology and complementarity gains that firms acquire through increased varieties of imported inputs are indeed likely to increase the variety of export with time lags. The inverse causality issue is however likely to still be present: Firms that aim at increasing its exported varieties in $t + 1$ increase their inputs and thereby, may import more varieties of imported inputs in t. Moreover, firms that sell goods in the export market benefit from direct linkages with foreign suppliers of intermediate inputs in their destination market. In this case the error distribution of our previous specifications might not be independent of the regressors' distribution. We thus propose an alternative estimator: the difference GMM.

23. As for the TFP estimation (section 4), estimations using inputs intensity or import status as independent variables provide very similar results, we thus decided not to include them in the paper. Theses results are available upon request.

24. OLS estimates encounter endogeneity issues caused by omitted variables at the firm level. Exports decision may indeed be influenced by some firm-specific attributes or firm-specific macroeconomic aggregate shocks that also affect imported inputs decision. OLS estimations do not deal with firm-specific unobserved characteristics that are carried through time.

The GMM estimator (Arellano and Bond (1991)) corrects for causality/simultaneity issues by treating the number of imported inputs as endogenous variables and exploiting moment conditions of exogeneity of lagged endogenous variables.[25] Our GMM specification treats all variables as endogenous. As we find order-2 serial correlation in the disturbance term, we restrict ourselves to a set of instruments composed of large lags of endogenous variables – 4 to 6 lags depending on the specification (Roodman, 2009). Sargan tests validate our choice of instruments.

25. Relative to instrumental variables method, the GMM estimation is efficient in the presence of heteroskedasticity. We also run IV and system GMM estimates. Using these alternative specifications provides similar results to the one presented here confirming the impact of intermediate inputs on export scope. Results are available upon request.

Table 6 – Export scope and imported inputs

	Dependent variable: Number of exported varieties of firm (f) in year (t)									
	(1) Within	(2) Within	(3) GMM	(4) GMM	(5) Within	(6) GMM	(7) GMM	(8) Within	(9) GMM	(10) GMM
Number of imported inputs (t-1)	0.127***	0.120***	0.507***	0.340***						
	(0.004)	(0.005)	(0.085)	(0.079)						
Number of imported inputs (t-2)		0.022***								
		(0.004)								
Weighted Theil index (t-1)					-0.355***	-5.253**	-3.687*			
					(0.044)	(2.515)	(1.896)			
Number of imported inputs DC(t-1)								0.114***	0.610***	0.312***
								(0.004)	(0.147)	(0.060)
Number of imported inputs LDC(t-1)								0.069***	0.014	0.036
								(0.005)	(0.108)	(0.079)
Size(t-1)	0.339***	0.318***	-0.202*	0.264*	0.407***	0.456***	0.501***	0.335***	-0.258*	0.410***
	(0.012)	(0.014)	(0.113)	(0.158)	(0.014)	(0.119)	(0.101)	(0.012)	(0.154)	(0.121)
TFP(t-1)				0.374***			0.237*			0.473***
				(0.122)			(0.136)			(0.107)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	137473	117185	87495	78578	116302	91714	75940	137473	87495	78578
R^2	0.062	0.051			0.049			0.063		
p-value of Sargan			0.149	0.336		0.481	0.115		0.138	0.205

Notes: For the GMM estimation, the set of instruments is composed of lagged values of the number of imported inputs and firm size (number of employees). All these variables are treated as endogenous variables. Since the Arellano-Bond test of autocorrelation reveals that the disturbance might be in itself auto-correlated of order 2, but not further, we restrict the instrument set to lags 4 to 6 (Roodman, 2009). Sargan test validate our choice of instruments. The number of individuals relative to the number of instruments is reassuring as regards to any possible bias resulting form using large number of instruments (Windmeijer, 2005). *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses

The impact of a rise in the number of varieties of imported inputs on the number of exported varieties is positive and significant in all specifications. Importantly, the magnitude of the coefficient is reduced while we control for firm's TFP. Relying on the GMM specification (i.e., column (3)), a doubling in the number of imported inputs raises the number of exported varieties by 42%. We find that a one standard deviation increase in the number of imported inputs rises the number of exported varieties by 77%.[26] Once we control for firm's TFP (i.e., column (4)), the effect of imported varieties is weaker, increasing export scope by 47%. The observed average increase in imported inputs over the period leads to an increase in the number of exported varieties of 13% or 8.5% once controlled for TFP.[27] We thus find strong evidence of the positive impact of imported inputs on exports. Much of this impact occurs through an increase in productivity. The coefficient on imported inputs stays however significant suggesting that importing more varieties of inputs entail an increase in the number of exported varieties through other channels than TFP for example by enhancing trade networks and improving firms knowledge of foreign markets. In such case, the export fixed costs is reduced. Our model captures such effect: a decline in export fixed costs, F_x, entails higher export profits and thus results in an increase in exported varieties.

The effect of the number of varieties of imported inputs on the number of exported varieties is robust to the introduction of lagged imported inputs variables. An increase in the number of imported inputs with two periods lags has a positive effect on the current number of exported varieties although this effect is smaller in magnitude (column (2)). This suggests that adapting production and exports to the new set of inputs takes time.[28]

Table 6 also reports results of the impact of imported inputs diversification on the number of exported varieties. We look at weighted average Theil indices, where Theils are computed at the firm-product level and measure concentration across varieties. The weights correspond to products shares in firms production. The coefficient on the concentration index is negative and significant in all specifications suggesting that the more diversified the firm, the higher the number of varieties it exports. A one standard deviation increase in the concentration index decreases the number of exported varieties by 33% (relying on our prefered GMM estimation in column (6)). The observed average decrease in the Theil index over the 1995-2005 period entailed a 4% increase in export scope. In specification (7), once TFP is introduced in the regression, the coefficient on the diversification index loses significance. The positive effect of an increase in imported input diversification on export scope is thus mostly due to the impact of diversification on firm's TFP. The use of concentration measures improve our understanding of the effect of imported inputs on exported varieties as it does not focus uniquely on numbers but

26. Note that these large numbers result from the fact that a one standard deviation in the number of imported inputs corresponds to a increase of 60 varieties

27. Note that the coefficient on imported inputs is always greater under the GMM specification. This indicates that coefficients of our baseline results might suffer from a downward bias when endogenous variables are not instrumented.

28. We also used lag of three and four periods. The impact of imported inputs on number of exported varieties is still positive and significant with a decreasing influence.

also on the relative share of each input varieties in firms imports. A better distribution of imports across varieties entails an increase in exported varieties. This pushes for the complementarity argument where all inputs enter the production process with similar weights.

The previous results evidence the importance of importing large varieties of intermediate goods. By including a diversified set of imported inputs in the production process, firms raise their ability in entering export markets. As mentioned above, a variety is defined as a product-country pair. We may thus wonder whether all varieties impact export in a similar way. That is: Does the origin of imported inputs matter for firms export patterns?

For each measure of imported inputs, we distinguish varieties according to their country of origin (i.e., developed vs. developing countries in our context). As for our study of the impact of imported inputs on productivity, the rationale behind this distinction is that varieties imported from more advanced countries presumably contain more technology and thereby may affect production and exports more significantly.

Columns (8) to (10) of Table 6 report the results. As expected, varieties from developed countries increase the number of exported varieties more significatively than varieties from less developed economies. Our prefered GMM estimations indeed shows that increasing imported inputs from less developed countries does not significantly impact exports scope. By contrast, the effect of imports from developed countries is strong. Doubling the number of imported inputs from DC countries raises the number of exported varieties by 53%.The observed 1995-2005 average increase in imported inputs leads to a rise in the number of exported varieties of 12% (specification (9)). This number drops to 6% once we control for firm's TFP. Our prior that advanced economies produce varieties embodying more of the technology and quality required for an increase in the number of exported varieties find some support. We also evidence that the main channel through which inputs from developed countries affect the number of exported varieties is the TFP channel. Note that the import premia analysis (Section 2.2) also suggests that firms importing mainly from developed countries are also more capital intensive. This may reflect the importance of absorptive capacities or may be a consequence of "learning by importing". [29]

As alternative specifications, we also tested for the impact of our main independent variables on the other margins of exports: the number of exported product (instead of varieties), the number of destination countries of exports and on the intensive margin of exports. The results, presented in Table 11 to 13 in the Appendix, are very similar to the one found with the number of exported varieties. The impact of an increased used of imported inputs on export is thus independent of the margin chosen in order to measure export scope.

29. On the same token, Serti and Tomasi (2008) finds than importers sourcing from developed countries are more capital and skilled intensive than firms buying only from developing countries.

5.2. Robustness checks

Previous estimations assumed a linear relationship between number of imported inputs varieties and firm's export scope. Since we expect some non-linearity between these variables, we carry out a robustness check by estimating a non parametric relationship between the number of imported inputs and export varieties.

We classify firms into six different imports status from non-importer to large importer. More specifically, we create six dummy variables indicating if (i) the firm does not import or if it imports (ii)1 to 5, (iii) 6 to 20, (iv) 21 to 50, (v) 51 to 100 or (vi) more than 100 inputs in the year (t-1).

This estimation strategy also allows to explicitly take into account the observations with zero imports. Table 7 reports the results. Specifications (1) gives the within estimates whereas specifications (2) and (3) report the GMM. Results are interpreted relative to the omitted category. The coefficient on the number of imported inputs is increasing with the number of such inputs used in production. Being an importer of 1 to 5 inputs increases the number of exported varieties by 76% compared to not importing, whereas being an importer of more than 100 inputs increases it by 290% (specification (2)). This feature holds when we distinguish imports by their country of origin (results not reported here but available upon request). Importantly, the main results of this paper are robust to this alternative econometric specification. [30]

Considering our time frame (i.e., 1995-2005), the increased importance of trade among European countries may greatly influence our results. With the introduction of the unique currency in 1999, we indeed expect a important increase in French imports of inputs from and exports of final good to other EU countries. In order to correct for this European biais, we follow two strategies. First, we run our usual regressions excluding imported inputs from EU countries from the sample. The main results are not affected by this ommission. We also distinguishing varieties imported from EU countries from varieties imported from other developed economies. Results are presented in Table 8 and reveal two interesting features. First, the effect of imported inputs varieties on exported varieties is not driven by intra EU trade. Second, while correcting for TFP (i.e., column 3), the coefficient on imported inputs from the EU loses significancy whereas the coefficient on imported inputs from other developed economies decreases in magnitude but stay significative. These results do not lack relevance. They suggest that the effect of an increase in imported inputs from the EU occurs through an increase in TFP whereas other factors such as network effect matters for imports from other developed economies which are more distant to French producers.

We also excluded of our sample French multinational firms in order to explore whether our

30. We also tested for non-linearity between number of imported inputs varieties and firm's TFP. Results are similar to the one presented here. The OP/ACF estimation shows significative coefficients which are increasing in the number of imported inputs. After cathegorie (v), i.e., 51 to 100 varieties), we however observe sluggish increases which may reflect a situation where having too many suppliers generates an organization problem within the firm. These results are available upon request.

Table 7 – Export scope and number of imported inputs – Non linear

Dependent variable: Number of exported varieties of firm (f) in year (t)			
	(1) Within	(2) GMM	(3) GMM
Import 1 to 5 inputs	0.073***	0.758**	0.009
	(0.009)	(0.339)	(0.208)
Import 6 to 20 inputs	0.187***	1.326***	0.526***
	(0.011)	(0.343)	(0.204)
Import 21 to 50 inputs	0.323***	1.965***	1.008***
	(0.014)	(0.438)	(0.264)
Import 51 to 100 inputs	0.458***	2.221***	1.027***
	(0.018)	(0.496)	(0.329)
Import more than 101 inputs	0.628***	2.905***	1.589***
	(0.025)	(0.649)	(0.405)
Size(t-1)	0.352***	-0.183	0.235
	(0.013)	(0.125)	(0.147)
TFP(t-1)			0.281**
			(0.118)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	136393	87495	78578
R^2	0.061		
p-value of Sargan		0.345	0.417

Notes: Same as Table 6

results do not mainly capture intra-firm trade. To identify multinational firms, we combine our main dataset with the Enquete Echanges Internationaux Intra-Groupe provided by the French Office of Industrial Studies and Statistics (SESSI). [31] As shown in Table 9, our results are robust to this exclusion and are thus not driven by French multinationals.

Finally, we also use alternative definitions of intermediate goods relying on the Broad Economic Categories (BEC) classification at the hs6 product level from United Nations. Results are in the same line as the one presented in so far.

Thus, by and large, we find that an increase in the number of varieties and diversification of imported inputs has a robust impact on the extensive (products and varieties) margin and the in-

31. This second dataset is based on a firm-level survey of manufacturing firms belonging to groups with at least one affiliate in a foreign country and with international transactions totaling at least one million euros. The survey year is 1998. The data provide a good representation of the activity of international groups located in France. They account for around 82% of total trade flows by multinationals, and 55% and 61% of total French imports and exports respectively.

Table 8 – Export scope and number of imported inputs – Non EU

Dependent variable: Number of exported varieties of firm (f) in year (t)			
	(1) Within	(2) GMM	(3) GMM
Number of imported inputs from DC NON UE(t-1)	0.070***	0.140*	0.134*
	(0.004)	(0.073)	(0.071)
Number of imported inputs from UE(t-1)	0.088***	0.370***	0.125
	(0.004)	(0.113)	(0.100)
Number of imported inputs from LDC(t-1)	0.063***	-0.112	-0.136
	(0.005)	(0.086)	(0.086)
Size(t-1)	0.328***	-0.093	0.384***
	(0.012)	(0.120)	(0.129)
TFP(t-1)			0.354***
			(0.114)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	137473	87495	78578
R^2	0.065		
p-value of Sargan		0.155	0.274

Notes: Same as Table 6

tensive margin of exports. This impact is renforced if the inputs come from the most developed countries and it mostly occurs through an increase in firm's TFP.

6. CONCLUSIONS

This paper provides robust evidence of the role of imported intermediate inputs on export scope. An increase in the set of input varieties imported by the firm raises significantly the number of varieties it exports. We posit and show that such positive link between imported inputs and exported varieties occurs through an increase in firms' TFP. By using more varieties of imported inputs, the firm reaches a better complementarity of inputs and therefore raises its productivity. More productive firms are also more likely to export more varieties as they are able to bear the export fixed cost and survive on competitive export markets. Importing inputs from developed countries carries the advantage of capturing new embodied technologies. An increase in imported inputs from developed countries has a larger impact on firms' TFP and exports than a similar increase in imported inputs from developing countries. This result plays in favor of the technology argument for imports.

Table 9 – Export scope and number of imported inputs – No Multinationals

Dependent variable: Number of exported varieties of firm (f) in year (t)			
	(1) Within	(2) GMM	(3) GMM
Number of imported inputs (t-1)	0.121***	0.458***	0.336***
	(0.005)	(0.078)	(0.086)
Size(t-1)	0.326***	-0.171	0.115
	(0.014)	(0.118)	(0.169)
TFP(t-1)			0.215*
			(0.123)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	114373	70131	62890
R^2	0.057		
p-value of Sargan		0.353	0.459

Notes: Same as Table 6

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8. APPENDIX

Table 10 – Intermediate inputs

Firm Sector	Bodies, for specific motor vehicles	Footwear, outer sole rub, plastic or lea
HS4	(8707)	(6403)
Intermediate inputs	Other Polyethers (390720) Other Articles of Vulcanized Rubber (401699) Other Hollow profiles of Aluminium Alloys (760429) Other Parts and Accessories of Bodies for the Motor Vehicles (870829)	Woven Labels, Badges and Similar Articles, Not Embroidered (580710) Other Textile Products and Articles, for Technical Use (591190) Other Articles of Leather or of Composition Leather (420500) Woven Fabrics of Metal Thread, of Metallized Yarn (580900) Coniferous-Air (470421) Other Whole Skins (Tanned or Dressed) (430219) Textile Fabrics Impregnated, Coated, Covered With Polyurethane (590320)
Final products	Other Bodies, for the Other Motor Vehicles (870790)	Other Footwear With Uppers of Leather or Composition Leather (640510) Other Footwear With Uppers of Leather (640399) Outer Soles and Heels, of Rubber or Plastics (640620) Other Footwear With Uppers of Textile Materials (640520)

8.1. Estimation Algorithm: Identification of Productivity Gains from Importing intermediate goods

8.1.1. The OP method

Olley and Pakes (OP) (1996) develop a dynamic model of firm behavior and a semi parametric algorithm estimator in order to address the simultaneity and selection issues that arise when estimating production functions using firm level data.

The dynamic model is based on productivity heterogeneity among firms which is modeled as an idiosyncratic shock. In this model, based on Ericson and Pakes (1995), factor prices evolve according to an exogenous first order Markov process, while productivity and investment functions are determined as part of the Markov perfect Nash equilibrium.

Firms maximize their expected value of both current and future profits. Current profits are a function of two state variables: capital (k) and unobserved productivity (ω). The OP algorithm estimator of the production function parameters is based on two assumptions. First, the unobserved productivity is the only state variable that creates differences in firm behavior (e.g., firm productivity determines firms' entry and exit decisions). Second, conditional on the values of all the observed state variables, investment is an increasing function of productivity. Thereby, OP methodology consists in inverting the investment function to determine the unobserved productivity variable as a function of the observables variables such as investment or capital.

As argued in the text, we modify the OP estimator to take into account firms' import behavior. We estimate the following production function:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_i Imp_{it} + \omega_{it} + \eta_{it} \quad (1)$$

All variables are expressed in natural logarithms. y_{it} is gross output, k_{it} is capital, m_{it} is materials and l_{it} is labor. Imp_{it} represents the imported input behavior of firms. It could take the value of (i) imported input intensity over wages, (ii) the number of imported input varieties by country of origin or (iii) import status. ω_{it} is the productivity shock that is observable to firms when they make their production choices but not to the econometrician, while η_{it} is unobservable to both the firm and the econometrician.

Relative to the standard OP estimator, in this model imported inputs enter as an additional state variable like capital stock. Thereby, the investment function will depend on firms imported inputs choices. The investment function (i_{it}) is given by:

$$i_{it} = f_{it}\left(\omega_{it}, k_{it}, Imp_{it}\right) \Leftrightarrow \omega_{it} = h_{it}(i_{it}, k_{it}, Imp_{it}) \quad (2)$$

The investment function is then inverted to express the unobserved productivity shock (ω_{it}). The coefficients of the polynomial h_{it} are different depending of the imported input behavior of firms. As in OP, the first stage of the estimation algorithm consists in plugging the productivity function (ω_{it}) in the production function to consistently estimate the coefficient of the labor factor.

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_m m_{it} + \widetilde{\phi}(i_{it}, k_{it}, Imp_{it}) + \eta_{it} \quad (3)$$

where $\widetilde{\phi}(i_{it}, k_{it}, Imp_{it}) = \beta_k k_{it} + \beta_i Imp_{it} + h_{it}(i_{it}, k_{it}, Imp_{it})$. The variable inputs, labor and materials, are consistently estimated in this stage dealing with simultaneity issues. This estimation, however, does not allow us to separate the effect of capital and imported inputs on investment decision from their effect on output.

The second stage consists in taking into account exit decisions of firms to deal with selection issues. The probability of exiting is written as:

$$\Pr(\chi_{i,t+1} = 1|I_t) = \Pr(\chi_{i,t+1} = 1|\omega_{it}, \underline{\omega}_{i,t+1}(k_{i,t+1})) = \widehat{\rho}_{it}(i_{it}, k_{it}, Imp_{it}) \quad (4)$$

The final step consists in plugging the labor coefficient, the productivity function and the probability of survival into the production function equation, to obtain the capital and imported inputs coefficients. This last stage consists in a non linear least square estimation (NNLS) on:

$$y_{i,t+1} - \beta_l l_{i,t+1} - \beta_m m_{i,t+1} = \beta_0 + \beta_k k_{i,t+1} + g((\widehat{\widetilde{\phi}} - \beta_k k_{it}), \widehat{\rho}_{i,t+1}) + \upsilon_{i,t+1} \quad (5)$$

This semi parametric estimation gives consistent estimates of the capital coefficient. Since we introduce the imported intermediate goods as an input in the production function, its coefficient is also identified in this last stage. As in Olley and Pakes (1996), the productivity shock follows a first order Markov process (ξ), which implies that $\omega_{t+1} = E(\omega_{t+1}|\omega_t) + \xi_{t+1}$. Thus, the error term ($\upsilon$) is decomposed into the i.i.d. shock (η) and the news term in the Markov process (ξ).

8.1.2. The ACF method

The main difference between the ACF and OP methods is that in the former the labor input coefficient is not estimated in the first stage of the estimation. As in the OP estimation, k_{it} is chosen in $t-1$. In order to account for the collinearity between labor and unobserved productivity, ACF assumes that labor, l_{it}, is chosen in $t-b$ with $0 < b < 1$ instead of t. In this case the firm investissement at t also depends on labor and i_{it} can be re-written as

$$i_{it} = f_{it}\left(\omega_{it}, k_{it}, l_{it}, Imp_{it}\right) \Leftrightarrow \omega_{it} = h_{it}(i_{it}, k_{it}, Imp_{it}) \quad (6)$$

Inverting the investment function and substituting into the production function yields:

$$y_{it} = \beta_0 + \beta_m m_{it} + \widetilde{\phi}(i_{it}, k_{it}, l_{it}, Imp_{it}) + \eta_{it} \quad (7)$$

where $\widetilde{\phi}(i_{it}, k_{it}, l_{it}, Imp_{it}) = \beta_k k_{it} + \beta_l l_{it} + \beta_i Imp_{it} + h_{it}(i_{it}, k_{it}, l_{it}, Imp_{it})$. Under the ACF technique, in this first stage just the coefficient of materials is consistently estimated. The estimation then follows the OP methodology.

8.2. Alternative Specifications

Table 11 – Number of exported products and imported inputs

	Dependent variable: Number of exported products of firm (f) in year (t)								
	(1) Within	(2) GMM	(3) GMM	(4) Within	(5) GMM	(6) GMM	(7) Within	(8) GMM	(9) GMM
Number of imported inputs (t-1)	0.110***	0.582***	0.254***						
	(0.004)	(0.123)	(0.056)						
Weighted Theil index (t-1)				-0.211***	-3.961*	-3.436*			
				(0.040)	(2.307)	(1.868)			
Number of imported inputs from DC(t-1)							0.096***	0.497***	0.241***
							(0.004)	(0.119)	(0.076)
Number of imported inputs from LDC(t-1)							0.072***	-0.093	-0.055
							(0.004)	(0.093)	(0.085)
Size(t-1)	0.251***	-0.302**	0.374***	0.308***	0.299***	0.261***	0.247***	-0.176	0.337***
	(0.010)	(0.141)	(0.141)	(0.012)	(0.112)	(0.093)	(0.010)	(0.127)	(0.130)
TFP(t-1)			0.471***			0.237*			0.399***
			(0.116)			(0.135)			(0.119)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	137475	87496	78579	116303	91716	75942	137475	87496	78579
R^2	0.041			0.029			0.043		
p-value of Sargan		0.188	0.224		0.982	0.275		0.308	0.213

Notes:Same as Table 6

Table 12 – Number of export destinations and imported inputs

	Dependent variable: Number of export destinations of firm (f) in year (t)								
	(1) Within	(2) GMM	(3) GMM	(4) Within	(5) GMM	(6) GMM	(7) Within	(8) GMM	(9) GMM
Number of imported inputs (t-1)	0.076***	0.594***	0.358***						
	(0.003)	(0.125)	(0.133)						
Weighted Theil index (t-1)				-0.353***	-4.812**	-4.320**			
				(0.044)	(2.192)	(2.104)			
Number of imported inputs from DC(t-1)							0.073***	0.488***	0.406***
							(0.003)	(0.103)	(0.098)
Number of imported inputs from LDC(t-1)							0.028***	0.074	0.082
							(0.003)	(0.077)	(0.087)
Size(t-1)	0.265***	-0.313**	0.399	0.405***	0.062	0.238***	0.263***	-0.201*	0.067
	(0.010)	(0.134)	(0.245)	(0.014)	(0.076)	(0.092)	(0.010)	(0.110)	(0.129)
TFP(t-1)			0.520***			0.194**			0.252**
			(0.182)			(0.085)			(0.111)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	137432	87461	78552	116223	74709	66992	137432	87461	78552
R^2	0.053			0.049			0.054		
p-value of Sargan		0.128	0.511		0.539	0.286		0.166	0.247

Notes:Same as Table 6

Table 13 – Intensive margin of exports and imported inputs

	Dependent variable: Value of export of firm (f) in year (t)								
	(1) Within	(2) GMM	(3) GMM	(4) Within	(5) GMM	(6) GMM	(7) Within	(8) GMM	(9) GMM
Number of imported inputs (t-1)	0.186***	0.574**	0.371*						
	(0.008)	(0.230)	(0.209)						
Weighted Theil index (t-1)				-0.633***	-9.431*	-7.099*			
				(0.087)	(5.697)	(4.132)			
Number of imported inputs from DC(t-1)							0.170***	0.711***	0.179*
							(0.008)	(0.259)	(0.108)
Number of imported inputs from LDC(t-1)							0.089***	0.304	0.188
							(0.008)	(0.265)	(0.121)
Size(t-1)	0.588***	0.025	0.493**	0.666***	0.133	0.486**	0.583***	-0.269	0.763***
	(0.023)	(0.206)	(0.218)	(0.025)	(0.177)	(0.204)	(0.023)	(0.274)	(0.161)
TFP(t-1)			0.567***			0.421**			0.635***
			(0.177)			(0.170)			(0.156)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	137475	87496	78579	116303	74736	67014	137475	87496	78579
R^2	0.052			0.047			0.052		
p-value of Sargan		0.299	0.145		0.747	0.134		0.113	0.123

Notes:Same as Table 6

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