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The enhancing effect of imports of intermediate inputs on firms' exports

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Abstract

We investigate the impact of imports of intermediate inputs on export value and portfolio among Spanish regular two-way trade of manufacturing firms over the period 1997–2018. After controlling for firm characteristics and addressing endogeneity, we find that firms that import intermediate inputs from non-EUEFTA countries enhance the volume and scope of their EU15 exports. The magnitude of the impact is similar for high-income countries and low-income countries and there are no changes in sourcing patterns before or after the financial crisis.

KEYWORDS

exports value, firm scope, firm-level data, imports of intermediate inputs, pre and post-crisis, sourcing countries

1 | INTRODUCTION

The empirical literature using micro-level trade has found three empirical regularities on the relationship between exports and imports among manufacturing firms. First, most companies that export also import (Aristei et al., 2013; Castellani et al., 2010; Muûls & Pisu, 2009). Second, companies that buy directly foreign inputs are more productive than those that do not (Amiti & Konings, 2007; Forlani, 2017; Goldberg et al., 2010; Halpern et al., 2015; Kasahara & Lapham, 2013; Kasahara & Rodrigue, 2008; Topalova & Khandelwal, 2011; Vogel & Wagner, 2010). Third, companies that import

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exhibit a better export performance (Bas, 2012; Bas & Strauss-Khan 2014; Edwards et al., 2018; Feng et al., 2016; Kugler & Verhoogen, 2009; Lo Turco & Maggioni, 2013; Máñez et al., 2020).

The argument of 'importing to export' gains strength in the face of these three empirical regularities: companies that import are more productive than those that do not import because imports of intermediate inputs allow the acquisition of technology and knowledge from abroad (Helpman & Grossman, 1991) as well as permitting quality upgrading (Bas & Strauss-Khan, 2015). Thus, imports of intermediate inputs increases the productivity of the company, which increases the probability of exporting, of becoming a regular exporter and of obtaining a good export performance in terms of more sales or number of products (i.e. via the cost channel). In addition, importing a greater variety of inputs, or higher quality inputs, is a direct method used by firms to improve their final products and thus be able to access foreign markets that are more difficult or demanding than the domestic one (i.e. the demand channel).

In this article, we investigate empirically the imported intermediate inputs ability to enhance firm's exports in the Spanish context. In particular, we examine the import–export link using the universe of regular two-way trading firms operating in the manufacturing sector over the period 1997–2018. We exploit exogenous changes in the relative costs of foreign inputs via the variations in the world export supply of intermediate inputs to instrument for firm changes in the use of imported intermediate inputs, thus measuring the impact of an increased use of imported intermediate inputs on firm export performance.

We provide first-time evidence for Spain of a direct positive connection between imported inputs use and firm exports sales and portfolio among manufacturing firms. For Spain, we complement the findings of Máñez et al. (2020) which found that importing directly intermediate inputs increased the likelihood of becoming an exporting firm. Our results confirm previous findings by Bas and Strauss-Khan (2014) for France and Feng et al. (2016) for China. Following Bas and Strauss-Khan (2014), we select the universe of firms that regularly export to the EU15 market and import intermediate inputs from non-EUEFTA countries to mitigate possible reverse causality issues.[1] We also control for observable firm characteristics such as employment size and apparent labour productivity to consider the indirect impact of imports on exports through costs. In doing so, we can isolate the direct impact of imports on exports through the demand channel only.

Our analysis shows that Spanish firms that increased their use of imported intermediates coming from non-EUEFTA countries increased their exports to the EU15 market, an effect we observe whether the firm's import activity is measured by an increase in expenditure or in the number of imported inputs. However, the effects are economically modest. For example, the baseline estimates, calculated using instrumental variables, demonstrate that a 1% increase in the value of imported inputs boosted a firm's export value by 0.07%; a 1% increase in the scope of imported inputs boosted a firm's export value by 0.12%; and a 1% increase in the scope of import portfolio of imported inputs boosted a firm's export portfolio scope by 0.13%. Our point estimates for Spain (2000–2007) are similar to those for France (1996–2005) reported by Bas and Strauss-Khan (2014) but smaller than the ones for China (2002–2006) found by Feng et al. (2016).

To gain further insights into the import–export nexus, we analyse the benefits of buying foreign inputs from different source countries. In particular, if access to high-quality imported inputs enables firms to upgrade their products in the foreign markets and to increase

[1]EU15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. EUEFTA countries include EU15 plus Norway, Switzerland and Iceland. The selection of non-EUEFTA countries have floating exchange rate with the Euro and face EU tariffs. Table A3 in the Appendix 1 presents the list of non-EUEFTA included in the analysis.

their range of exported products, imported inputs from technologically developed countries will provide the strongest benefits to exports to the highly demanding EU15 market. We document that imported inputs from low-income non-EUEFTA countries have the same effect in boosting firm exports to customers in the EU15 market than from high-income countries over the period 2000–2018. Therefore, both channels are at play, and equally relevant in enhancing Spanish firms' exports. Additionally, this sourcing pattern is stable before and after the financial crisis.

The rest of this article is organised as follows. Section 2 presents the data set and a description of the firm-level connection between imports and exports in Spain over the period 1997–2018. Section 3 describes our empirical strategy, which is followed by our empirical results in Section 4 and robustness analyses in Section 5. Section 6 concludes.

2 | DATA

In order to analyse the import–export link, we use Spanish firm-level data set that combines information on firm import–export activities and on firm attributes over the period 1997–2018. Annual export and import values for the triplet firm-product-country are obtained from Spanish Agencia Tributaria-Aduanas ('Tax Agency – Customs') database. Products are defined at 6-digit level of the Harmonised System (1992 classification).[2] Firm characteristics such as sales, employment and primary sector of activity are obtained from Bureau Van Dick SABI (Iberian Balance Sheet Analysis System, sabi.bvdinfo.com), a database with financial information of Spanish companies. Our data set is the result of merging both databases after applying the following steps. First, we select from Customs database all the firms exporting and importing simultaneously at least 4 years over the period 1997–2018. Second, we restrict the sample to firms exporting to EU15 countries and importing from non-EUEFTA countries. Third, we consider only imported intermediate inputs based on the BEC classification. Fourth, we use the SABI database to identify firms whose main activity is manufacturing. Finally, we restrict the sample to firms with at least 10 workers during the period the firm trades in foreign markets.

Our sample consists of 6621 firms.[3] Table 1 illustrates the importance of those firms in Spanish aggregate exports and imports over the period 2000–2018. Our sample accounts for 51.3% of total Spanish exports (57.3% of Spanish exports to the EU15) and 65.1% of Spanish imports of intermediate inputs. Since we want to investigate whether the post-financial crisis period implied a change in the import–export relationship, we split the sample period into the pre-crisis 2000–2007 and the 2008–2018 periods. On average, the number of firms and their value of exports and imports have increased between periods, though the shares of these firms in aggregate exports and imports remain stable over time.

[2]We converted the Combined Nomenclature eight-digit codes to Harmonised System 6-digit 1992 classification to ensure consistency over time in the definition of a variety (product-country pair). We identified the list of Harmonised System 6-digit 1992 classification codes that belong to the category of intermediate goods according to the Broad Economic Categories, rev.4 classification (BEC). The list was elaborated using the Concordance HS1992-BEC tables elaborated by United Nations (UNSD—Classifications on economic statistics).

[3]We loss a substantial number of firms because SABI database do not report information on employment for many firms. In addition, we also trim the data by eliminating those firms whose labour productivity is extreme (±1%). Table A1 in the Appendix 1 reports the number of firms in the Customs database and in our data set.

TABLE 1 Descriptive of database.

Period	Firms (*N*)	Export value (th. mill. eur)	Share in Spanish exports (%)	Exports value to EU15 (th. mill. eur)	Share in Spanish exports to EU15 (%)	Value of interm. inputs imports from no-EUEFTA (th. mill. eur)	Share in Spanish interm. inputs imports from non-EUEFTA (%)
Total							
2000–2018	6621	1603.4	45.1	1083.4	48.6	608.5	26.9
Annual average							
2000–2007	3030	63.7	43.4	45.1	44.2	21.4	21.2
2008–2018	3274	99.4	45.9	61.0	46.1	39.7	29.2

Note: Own elaboration using Tax Agency-Customs database. Calculations based on information of Table A2.

Table 2 presents some characteristics of the firms in the sample. Firms that engage in regular two-way trade tend to be large, with average employment size of 147 workers, exporting on average each year 17.1 million euros to the EU15, with a portfolio of 17 product-country combinations. The value of imports on intermediate inputs coming from non-EUEFTA countries is on average 10.1 million euros with a portfolio of seven product-country combinations. While import portfolio scope is dominated by products coming from high-income non-EUEFTA countries (40%) and low-income non-EUEFTA countries (41%), the main origin of imports in terms of value comes from middle-income non-EUEFTA countries (55%). On average, a typical two-way trade manufacturing firm exports 16 years to the EU15, was born in 1980 and has a 17% probability of being foreign owned.

We use additional data sets in thisarticle to obtain data on EU15 potential demand and the non-EUEFTA supply of products available to firms in export and import markets as well as other instruments in the robustness section. First, we use COMTRADE database to obtain the annual value of EU imports (excluding Spain) from non-EUEFTA countries and the annual

TABLE 2 Firm-year descriptives (2000–2018).

	Mean	SD	P10	P50	P90
Export value EU15	17,121	136,147	185	1924	23,132
Export scope EU15	17	29	3	10	37
Interm. import value no EU-EFTA	10,099	217,508	13	265	5208
Share of high-income countries	16%				
Share of medium-income countries	55%				
Share of low-income countries	29%				
Interm. import scope no EU-EFTA	7	12	1	4	15
Share of high-income countries	40%				
Share of medium-income countries	19%				
Share of low-income countries	41%				
Employment	174	560	17	57	335
Labour productivity	292,210	542,955	87,000	190,878	518,795
Number of years exporting to EU15	16.65	5.30	8	19	22
Year of birth	1980	16.18	1961	1985	1996
Foreign ownership status	0.175	0.38	0	0	1

Note: The sample has 60,253 firm-year observations. Value is expressed in thousand euros and scope is the number of product-country pairs. Firm-level trade flows are obtained from Tax Agency-Customs database (Agencia Tributaria: Estadísticas de Comercio Exterior) and firms' characteristics are obtained from SABI (sabi.bvdinfo.com). Labour productivity is calculated as total sales divided by employment. See Table A4 in Appendix 1 for classification of countries by level of income.

value of non-EUEFTA exports to the EU (excluding Spain) for each product at six digit of HS 1992. Second, in the robustness section, we use data for the most-favoured-nation (MFN) tariff rates applied by the EU over the period 1997–2018 from UNCTAD's TRAINS database. Data are harmonised across products at 6-digit level of the Harmonised System (HS) 1992 classification. Third, Second, we also use data from IMF database to calculate the bilateral real exchange rate of Euro, $rer_{ct} = E_{EUR/cou,t} * \frac{CPI_{cou,t}}{CPI_{Spain,t}}$, where $E_{EUR/cou,t}$ is the exchange rate index of euros per unit of foreign currency, expressed as an index (2010 = 100), and CPI is the consumer price index of Spain and the trading partners (2010 = 100). Therefore, an increase in the value of *rer* indicates a real depreciation of the Euro currency, so Spanish exports become cheaper and Spanish imports become more expensive.

3 | EMPIRICAL MODEL

We investigate the import–export connection using an empirical equation that relates a measure of export performance (value and portfolio scope) with an indicator of import experience (value and portfolio scope). More specifically, we estimate the following equation:

$$\ln(exp_{it}) = \beta \ln(imp_{it-1}) + \gamma_1 \ln(employment_{it-1}) + \gamma_2 \ln(productivity_{it-1}) + \gamma_3 \ln(demand_{it-1}) + \alpha_i + \delta_t + \varepsilon_{it} \quad (1)$$

Where the dependent variable, $\ln(exp_{it})$, is the log of firm *i*'s exports value (or the log of the number of product-country combinations in the export portfolio) to the EU15 countries in year *t*; the main explanatory variable, $\ln(imp_{it-1})$, is the log of firm *i*'s import value (or log of the number of product-country combinations in the import portfolio) of intermediate inputs from non-EUEFTA countries.

As control variables, we include two time-varying firm characteristics: *employment* is captured by the number of employees and is a measure of firm size, and *productivity* is the firm's labour productivity and is calculated as total sales divided by the number of workers. Productivity and size account for indirect effects of imports on firm's exports both through the diffusion of new technologies embodied in imported intermediates and through scale economies from combining more varieties of imported intermediate inputs. The explanatory variables have been lagged 1 year to alleviate potential reverse causality. We also include a measure of the potential demand of products exported by each firm, which is constructed as following:

$$demand_{it-1} = \sum_p^{P_i^X} \frac{exp_{p,it-1}}{exp_{it-1}} IMP^{*EU\ from\ world}_{p,t-1}$$

where $demand_{it-1}$ is the weighted average of EU imports (without Spain) of all products *p* exported by firm *i* in *t*−1, where the weight is the share of each product *p* in firm *i*'s exports in *t*−1. Firm's exports (*exp*) are obtained from Spanish Customs database and EU imports (IMP*) are obtained from COMTRADE database.

Equation (1) includes a full set of firm dummies (α_i) and year dummies (δ_t) to control for unobserved time-unvarying firm characteristics and time-varying macroeconomic factors respectively.

TABLE 3 Main regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Export value	Export value	Export value	Export value	Export value	Export value	Export scope	Export scope	Export scope
Method	**OLS**	**OLS**	**IV**	**OLS**	**OLS**	**IV**	**OLS**	**OLS**	**IV**
Import value ($t-1$)	0.109***	0.0524***	0.0742***						
	(0.00715)	(0.00675)	(0.0141)						
Import scope ($t-1$)				0.166***	0.0742***	0.126***	0.0975***	0.0629***	0.131***
				(0.0124)	(0.0109)	(0.0301)	(0.00713)	(0.00652)	(0.0186)
Employment ($t-1$)		0.860***	0.860***		0.876***	0.874***		0.356***	0.333***
		(0.0363)	(0.0417)		(0.0361)	(0.0418)		(0.0187)	(0.0210)
Productivity ($t-1$)		0.563***	0.536***		0.587***	0.565***		0.162***	0.143***
		(0.0370)	(0.0424)		(0.0367)	(0.0409)		(0.0163)	(0.0178)
Potential demand ($t-1$)	0.0490***	0.0128	0.0145	0.0508***	0.0128	0.0141	0.0397***	0.0260***	0.0249***
	(0.0158)	(0.0154)	(0.0164)	(0.0160)	(0.0155)	(0.0166)	(0.00867)	(0.00839)	(0.00911)
Constant	6.406***	−3.350***		6.767***	−3.515***		1.673***	−1.593***	
		(0.508)		(0.225)	(0.508)		(0.122)	(0.265)	
Observations	47,462	47,462	40,106	47,462	47,462	40,106	47,462	47,462	40,106
R-squared	.877	.888	.115	.876	.888	.112	.866	.872	.058
Weak identif. SW F Test			1394			1015			1015
Hansen J p-value			.811			.744			.712
Endog. test p-value			.0411			.0415			.0000

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the IV estimations, the set of instruments includes the second lag of log supply and log import. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

3.1 | Instruments

To address possible endogeneity in the export–import connection, we adopt an instrumental variables (IV) approach to estimate the effect of imports on exports. The instruments set includes the potential international supply of intermediate inputs available to the firm and firm's lagged imported intermediates. Changes in the production of foreign suppliers of intermediate inputs are arguably exogenous trade shocks affecting the cost of imported inputs in small economies and it is unlikely that changes in Spanish firms' demand affect international prices. Purchases of intermediate imported inputs in the past are pre-determined by past production decisions and are not affected by current export shocks. Additionally, as far as firms' purchases of imports of intermediate inputs exhibit high inertia over time due to production reasons, we should expect a high degree of autocorrelation in imports value or scope. Finally, we rely on the fact that the origin of imports and the destination of exports of Spanish firms are different and supply shocks affecting the production of intermediate inputs in sourcing countries (in our case, non-EUEFTA countries) are less likely to be correlated with demand shocks of manufactured goods in destination countries (in our case EU15).

The potential international supply of inputs available to the firm i in year t is the weighted average of the exports of intermediate inputs from non-EUEFTA countries in year t, excluding sales to Spain $\left(EXP^{*}_{pct}\right)$. The weights used are calculated as the firm i's shares of the value of imports of intermediate products $\left(imp^{ini}_{pci}\right)$ over firm i's total intermediate imported inputs at the beginning of firm's import activity,

$$supply_{it} = \sum_{p=1}^{P_i^M} \sum_{c=1}^{C_i^M} \frac{imp^{ini}_{pci}}{\sum_{p=1}^{P_i^M} \sum_{c=1}^{C_i^M} imp^{ini}_{pci}} EXP^{*}_{pct}$$

We expect that the cost of importing intermediates inputs to be lower when the potential supply of imports $\left(supply_{it}\right)$ is higher. So we should observe a positive correlation between imports of foreign intermediate inputs and the potential non-EUEFTA supply of inputs.

Finally, concerning OLS and IV estimations of Equation (1), robust standard errors clustered at the firm level are considered in all the regressions to account for heteroskedasticity and within-industry autocorrelation.

4 | ESTIMATION RESULTS

4.1 | Baseline results

We start estimating Equation (1) using the value of exports and the number of product-country combinations in the export portfolio (exports scope). In order to investigate whether imports enhance export performance, the two key explanatory variables are the value of imports and imports scope (captured by the number of product-country combinations in the import portfolio). Table 3 shows the main results using the OLS and IV estimators. Column (1) shows the OLS estimation results including firm and year fixed effects. The results point to a significantly positive effect of imports of intermediate goods on firm's export value.

Column (2) includes firm size and productivity as additional control variables. Both control variables have a positive and significant impact on firms' export value, while the impact of international demand is positive but not statistically different from zero. The coefficient on imports remains positive and significant but the magnitude falls from 0.109 to 0.052. Therefore, after including firm size and productivity to take into account the indirect effect of imports on exports, the estimated direct effect of imports on exports is significantly positive but small: a 1%increase in import values leads to a 0.05% increase in export values. Column (3) shows the IV estimation results.[4] We also report the corresponding validation tests: the weak instruments F-test, the Hansen's overidentification J-test for the validity of instruments and the endogeneity test for our regressor of interest.[5] The null hypothesis of weak instruments is rejected at the 5% significance level and the null hypothesis of Hansen's J-test of valid overidentifying restrictions (or instruments uncorrelated with the error term) is not rejected at a 5% significance level, so we cannot reject the validity of our set of instruments. Using this set of instruments, we test for the endogeneity of the intermediate imports regressor. We reject the null hypothesis of weak exogeneity of imports at a 5% significance level. Since we find that there is an endogeneity issue with the OLS estimates, we focus on consistent IV estimations in column (3) where we find that a 1% increase in the value of imported intermediate inputs leads to a 0.07% increase in firms' export value.

We next consider whether the diversification of imports may lead to higher exports given that the use of a larger set of input varieties may improve the quality and market adequacy of a firm's products. Table 3 columns (4) to (6) show our model's OLS and IV estimation results looking at the effect of firm's imports scope (portfolio dimension) on firm's exports value. The results are in line with the previous ones. When including firm's size and productivity, the direct effect of intermediate inputs portfolio scope on exports value remains positive and significant but decreases by a half, with an estimated elasticity of 0.074. Nevertheless, according to validation tests in column (6), we reject the null hypothesis of exogeneity of imports scope while we cannot reject Hansen's J null hypothesis of valid overidentification restrictions. So, based on consistent IV estimation results, the response of firm's exports value to changes in its imports scope is positive and statistically significant, but in this case with a higher estimated elasticity of 0.12%.

Columns (7) to (9) in Table 3 analyse the intensive margin of the import–export relationship in terms of the portfolio dimension in order to explore whether import diversification increases the scope of export portfolio. According to the validation tests results at the bottom of column (9), we focus on the consistent IV estimation results. Column (9), our preferred specification, shows that it is very important to account for firm size and firm productivity to control for the positive indirect effects that imports have on export performance through productivity gains and scale economies. Firm's potential demand from EU countries also positively and significantly determines firm's export scope. The higher the potential demand the higher the number of varieties exported by the firm, enhancing firm's export diversification. We conclude that there is a positive and significant direct effect of import scope on export

[4]Notice that IV estimations lose about 10% of the sample observations because there is missing data for some two period lagged instruments.

[5]The endogeneity test is a C-type test statistic. Under the null hypothesis that the endogenous regressors can be treated as exogenous, the test statistic is distributed as chi-squared with degrees of freedom equal to the number of regressors tested. In Stata, we use the command ivreg2, endog().

scope: a 1% increase in the import portfolio scope leads to a 0.13% increase in export portfolio scope.[6]

We next consider the structural stability of the import–export relationship since we have a long period of analysis, including the trade collapse and financial crisis that impacted negatively on the Spanish economy from 2008 to 2012 and the subsequent recovery from 2013 to 2018. The change in the model's parameters is evaluated by including differential effects in the impact of all the explanatory variables through the interaction of each regressor with time-dummy variables. One time-dummy variable takes a value 1 for years in the 2008–2012 period, that is the crisis period, 0 otherwise, and a second time-dummy variable that takes value 1 for years in the 2013–2018 period, that is the post-crisis period, 0 otherwise. Additionally, this analysis allows us to compare our results with those of previous research for other economies over the pre-crisis period.

Table 4 reports the direct effect of imports on exports and their differential effect by time periods. We run both OLS and IV estimations for each model specification. The set of instruments is created accordingly and includes the interaction of each instrument with the corresponding 2008–2012 and 2013–2018 time-period dummies. The validation tests for the set of instruments used are reported in columns (2), (4) and (6). Hansen's J-test null hypothesis of valid instruments is not rejected at a 5% significance level and the null hypothesis of weak instruments is rejected at a 5% significance level. The rejection of the null hypothesis of the weak exogeneity of intermediate imports in the three specifications points to an endogeneity problem of imports, so we focus on the consistent IV estimation results. In all the three specifications, we do find a significant positive effect of intermediate inputs imports from non-EUEFTA countries on firm's exports to EU15 countries. Firm imports of intermediate inputs stimulate firm exports especially in terms of imports scope: a 1% increase in import value leads to a 0.08% increase in export value, and a 1% increase in intermediate inputs import scope leads to a 0.14% increase both in export values and in export scope. Nevertheless, neither the differential effect on this direct impact of imports on exports considering the financial crisis period (2008–2012), nor the differential effect referred to the post-crisis period (2013–2018) are significantly different from zero. Thus, our results suggest that the magnitude of the impact of non-EUEFTA intermediate inputs imports on export to the EU15 was not affected by the business cycles. Additionally, our point estimated coefficient for the 2000–2007 period is similar to the one estimated by Bas and Strauss-Khan (2014) using French data (0.105) but much smaller than the ones reported by Feng et al. (2016) using Chinese data (0.949–1.653).

4.2 | Import source and export performance

So far, we have found a robust positive connection between imports of intermediate inputs and exports. Next, we explore whether the origin of imports matters. Imported inputs may differ in terms of quality (superior technology) and prices. Some firms may import expensive intermediate inputs to incorporate higher quality inputs in order to satisfy market quality

[6]We further investigate the import–export connection by splitting export portfolio into the number of products and the number of countries to better assess to what extent importing improves a firm's export diversification. We present the IV results in Table A5 of the Appendix 1. We find that imports value has a positive and significant impact on the number of exported products and the number of EU destination countries. The same result holds for imports scope (product-country pairs) with even higher elasticities.

TABLE 4 Structural change analysis with two break periods 2008–2012 (financial crisis) and 2013–2018 (recovery).

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value	**Export value**	**Export value**	**Export value**	**Export scope**	**Export scope**
Variables	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
Import value ($t-1$)	0.0509***	0.0789***				
	(0.00836)	(0.0162)				
Import value ($t-1$) * D (2008–2012)	0.00714	−0.00787				
	(0.00881)	(0.0154)				
Import value ($t-1$) * D (2013–2018)	0.00153	−0.00456				
	(0.0106)	(0.0153)				
Import scope ($t-1$)			0.0837***	0.143***	0.0670***	0.140***
			(0.0145)	(0.0353)	(0.00838)	(0.0215)
Import scope ($t-1$) * D (2008–2012)			−0.0199	−0.0412	−0.0105	−0.0180
			(0.0167)	(0.0300)	(0.00930)	(0.0168)
Import scope ($t-1$) * D (2013–2018)			−0.0105	−0.00686	−0.000940	−0.00256
			(0.0199)	(0.0311)	(0.0117)	(0.0187)
Constant	−3.236***		−3.390***		−1.542***	
	(0.503)		(0.504)		(0.266)	
Observations	47,462	40,106	47,462	40,106	47,462	40,106
R-squared	.889	.115	.888	.113	.872	.059
Weak identif. SW F Test		462.7		335.9		335.9
R-squared		.271		.266		.180
Endogeneity test p-value		.0203		.0463		.0000

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the IV estimations, the set of instruments includes the second lag of log supply and log import and their corresponding time-periods differential effects. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

requirements (i.e. quality channel); others may simply import cheaper inputs in order to reduce costs (i.e. price channel). As we do not have specific information on the technology or quality level embedded in intermediate imported inputs by Spanish firms, we use the level of income of the sourcing country to approximate inputs quality, in line with previous research (Bas & Strauss-Khan, 2014; Feng et al., 2016; Lo Turco & Maggioni, 2013). We assume that imports from high-income sourcing countries provide high-technology or quality inputs, while low-income sourcing countries provide cheaper inputs to firms seeking to reduce costs. In our empirical exercise, we distinguish three groups of countries according to the income per capita in 2000: high-income sourcing countries (>$20,000), medium-income sourcing countries (between $8000 and $20,000) and low-income sourcing countries (<$8000). Accordingly, we split firm's total imports of intermediate inputs into three variables: imports of intermediate inputs from high-income, imports from medium-income and imports from low-income non-EUEFTA sourcing countries.

Table 5 reports the estimations once we allocate the value or scope of the imported intermediate inputs by sourcing country according to their income level. Columns (1) and (2) examine the import value–export value connection. Our set of instruments corresponds to each one of these imports regressors of interest: instruments specific of each explanatory variable for each group of high/medium/low-income sourcing countries of origin and for each period, are created.[7] The Hansen's J-test does not reject the null of the validity of instruments and the endogeneity test results do not reject the null hypothesis of the weak exogeneity of imports at a 5% significance level. Therefore, both OLS and IV estimates are consistent, but the former is more efficient. OLS estimation results point to the relevance of imports of intermediate inputs independent of the sourcing country from which they are obtained since the equality of imports coefficient estimates is not rejected in column (1). In column (2), the IV estimated coefficients of imports from high-income countries (0.034) and from low-income countries (0.019) are positive and statistically significant, while the one from medium-income countries is not statistically different from zero. However, the difference in the magnitude of the coefficients is not statistically significant (p-value = .17). The same result is obtained in columns (3) and (4) when we analyse the import scope–export value nexus. Based on the validation tests shown at the bottom of column (4), we cannot reject the null hypotheses of the validity of instruments and of the weak exogeneity of imports of intermediates. Consequently, based on the results shown in column (3), we find again that there are not significant differences in the enhancing effect of imports scope through either the quality channel or the price channel on export values.

Finally, in columns (5) and (6), we examine the imports scope–exports scope link. Validation tests results shown at the bottom of column (6) suggest an endogeneity problem of the import variables in the OLS estimation since we reject the null hypothesis of import variables' weak exogeneity at a 5% significance level (Hansen's J-test null hypothesis of the validity of instruments is not rejected at a 5% significance level). Thus, based on the consistent IV estimation results shown in column (6), our conclusions remain unaltered. Considering the whole sample period (2000–2018), we do not find any significant difference in the enhancing effect of imports on exports through the quality channel or the prices channel—the coefficient estimates for import scope from high-income sourcing countries and from low-income sourcing countries are positive

[7]We calculate the potential supply instrument by the level of income of the imports-sourcing countries. Basically, we first keep information on firm's imports coming from countries in each income-level group of sourcing countries and then we calculate the corresponding instrument for that income-level group and year using the expression in Section 3.

TABLE 5 Analysis of the impact of imports on exports by income level of sourcing country, 2000–2018.

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value	Export value	Export value	Export value	Export scope	Export scope
Variables	OLS	IV	OLS	IV	OLS	IV
Imp. val. ($t-1$) high income	0.0207***	0.0340***				
	(0.00385)	(0.0103)				
Imp. val. ($t-1$) med. income	0.0110***	0.00655				
	(0.00369)	(0.00973)				
Imp. val. ($t-1$) low income	0.0183***	0.0197**				
	(0.00406)	(0.00866)				
Imp. scope ($t-1$) high income			0.0654***	0.125***	0.0472***	0.0834***
			(0.0129)	(0.0424)	(0.00744)	(0.0236)
Imp. scope ($t-1$) med. income			0.0324**	0.0243	0.0234***	0.0226
			(0.0127)	(0.0399)	(0.00787)	(0.0262)
Imp. scope ($t-1$) low income			0.0485***	0.0312	0.0524***	0.0791***
			(0.0130)	(0.0321)	(0.00784)	(0.0189)
Potential demand ($t-1$)	0.0125	0.0140	0.0122	0.0137	0.0254***	0.0242***
	(0.0154)	(0.0165)	(0.0155)	(0.0166)	(0.00840)	(0.00912)
Employment ($t-1$)	0.863***	0.871***	0.870***	0.877***	0.351***	0.338***
	(0.0365)	(0.0430)	(0.0363)	(0.0424)	(0.0186)	(0.0212)
Labour productivity ($t-1$)	0.572***	0.555***	0.585***	0.570***	0.160***	0.149***
	(0.0369)	(0.0419)	(0.0366)	(0.0409)	(0.0162)	(0.0177)
Constant	−3.323***		−3.474***		−1.561***	
	(0.511)		(0.509)		(0.264)	
Observations	47,462	40,106	47,462	40,106	47,462	40,106
R-squared	.888	.114	.888	.113	.872	.063

TABLE 5 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value	**Export value**	**Export value**	**Export value**	**Export scope**	**Export scope**
Variables	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
High-med.-low (*p*-value)	.143	.171	.177	.192	.0175	.196
Weak identif. SW *F* Test		315.9		217.4		217.4
Hansen J *p*-value		.680		.647		.919
Endog. test *p*-value		.465		.376		.00341

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the IV estimations, the set of instruments includes the second lag of log supply, and log import and are split by high/medium/low-income sourcing country. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

and statistically significant, but the difference in the estimated magnitudes is not statistically different from zero.

We conclude that the enhancing effect of imports of intermediate inputs from non-EUEFTA countries on manufacturing firm's exports to EU15 countries is not affected differently by the country of origin of imports over the period 2000–2018. This result contrasts with previous research by Lo Turco and Maggioni (2013), Bas and Strauss-Khan (2014) and Feng et al. (2016) that found a higher effect of imports from high-income countries on firm's exports over the period 2000–2006, providing evidence supporting the dominance of the quality channel for Italian, French and Chinese exporting firms.

Our next step is to check whether the lack of a different impact of imports by income level of the sourcing country on exports holds along the entire period, because the financial crisis that erupted in 2008 could imply a structural change in the import–export relationship at the firm level in Spain. For that purpose, we include interactions of imports values (scope) from high- medium- and low-income sourcing countries with a period dummy for 2008–2018.

Table 6 presents the results. Columns (1) and (2) report the coefficient estimates of the model specification in terms of import values determining export values. The results of the validation tests at the bottom of column (2) do not reject the null of weak exogeneity of the import regressors. Therefore, both OLS and IV estimates are consistent but OLS is more efficient. Thus, based on column (1) estimation results, we obtain non-significant coefficients for the variables interacted with the dummy period 2008–2018. The same results are obtained when import variables are measured in terms of portfolio size in columns (3) and (4).

Finally, columns (5) and (6) report the coefficient estimates of the model specification in terms of import scope determining export scope. Validation test results point to the IV estimator as the consistent one, which reveal a positive and significant effect of imports scope from high- and low-income countries on firm's exports scope, while the differential effect in the impact of imports from high-income countries for the period 2008–2018 is negative and significant, a result that moderates its impact in the post-crisis period. Nevertheless, the results of the test for the equality of the impact of imports coming from high- or low-income sourcing countries is not rejected at a 5% significant level.[8]

We provide first time evidence for the period 2008–2018 that the financial crisis did not significantly affect the import–export nexus, nor the crisis alter the relative importance of the technological and price channels.

5 | ROBUSTNESS ANALYSIS

In this section, we examine the robustness of the enhancing effect of imports on exports, considering alternative dependent variables and selecting different samples of firms (Tables 7 and A6 in the Appendix 1) and constructing different sets of instruments (Table 8). We will compare our results with those obtained in our preferred specification. Baseline results in Tables 7 and 8 are obtained from our IV estimations in Table 3 and are now organised as three panels in the same column in Tables 7 and 8: Panel A refers to the imports value and export values specification (Table 3, column 3), Panel B refers to the imports scope and exports values specification (Table 3, column 6) and Panel C refers to imports scope and exports scope specification (Table 3, column 9).

[8]To check for potential composition effects, we repeated the analysis using the sample of firms that exported and imported regularly in both periods. The results remain unaltered.

TABLE 6 Analysis of the impact of imports on exports by income level of sourcing country and by periods.

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value	**Export value**	**Export value**	**Export value**	**Export scope**	**Export scope**
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**
Imp. val. ($t-1$) high income	0.0211***	0.0311**				
	(0.00558)	(0.0129)				
Imp. val. ($t-1$) high * D08_18	−0.000324	0.00390				
	(0.00629)	(0.0113)				
Imp. val. ($t-1$) med. income	0.0123**	0.00860				
	(0.00492)	(0.0116)				
Imp. val. ($t-1$) med. income * D08_18	−0.00181	−0.00363				
	(0.00584)	(0.0105)				
Imp. val. ($t-1$) low income	0.0188***	0.0156				
	(0.00523)	(0.0107)				
Imp. val. ($t-1$) low income * D08_18	0.000187	0.00792				
	(0.00561)	(0.00933)				
Imp. scope ($t-1$) high income			0.0817***	0.134***	0.0610***	0.109***
			(0.0178)	(0.0465)	(0.0103)	(0.0266)
Imp. scope ($t-1$) high income * D08_18			−0.0268	−0.0194	−0.0220*	−0.0394**
			(0.0208)	(0.0344)	(0.0115)	(0.0200)
Imp. scope ($t-1$) med. income			0.0472**	0.0248	0.0351***	0.0497
			(0.0192)	(0.0531)	(0.0104)	(0.0313)
Imp. scope ($t-1$) med. income* D08_18			−0.0216	−0.0119	−0.0162	−0.0268
			(0.0237)	(0.0466)	(0.0133)	(0.0281)
Imp. scope ($t-1$) low income			0.0545***	0.0338	0.0486***	0.0783***
			(0.0170)	(0.0401)	(0.0101)	(0.0238)

(Continues)

TABLE 6 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value	**Export value**	**Export value**	**Export value**	**Export scope**	**Export scope**
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**
Imp. scope ($t-1$) low income * D08_18			−0.00285	0.00537	0.0126	0.0168
			(0.0189)	(0.0323)	(0.0106)	(0.0185)
Potential demand ($t-1$)	0.00842	0.00966	0.00787	0.00903	0.0226**	0.0191*
	(0.0168)	(0.0179)	(0.0168)	(0.0180)	(0.00920)	(0.0102)
Potential demand ($t-1$) * D08_18	0.00620	0.00657	0.00586	0.00640	0.00368	0.00627
	(0.0121)	(0.0129)	(0.0121)	(0.0130)	(0.00641)	(0.00698)
Employment ($t-1$)	0.863***	0.879***	0.864***	0.879***	0.355***	0.338***
	(0.0380)	(0.0444)	(0.0379)	(0.0443)	(0.0191)	(0.0220)
Employment ($t-1$) * D08_18	−0.0180	−0.0258	−0.00677	−0.0129	−0.0154*	−0.0124
	(0.0168)	(0.0193)	(0.0170)	(0.0194)	(0.00916)	(0.0106)
Labour productivity ($t-1$)	0.538***	0.530***	0.546***	0.540***	0.142***	0.125***
	(0.0402)	(0.0452)	(0.0402)	(0.0451)	(0.0192)	(0.0217)
Labour productivity ($t-1$) * D08_18	0.0491	0.0344	0.0550*	0.0433	0.0267*	0.0314*
	(0.0337)	(0.0375)	(0.0329)	(0.0362)	(0.0152)	(0.0171)
Constant	−3.219***		−3.353***		−1.513***	
	(0.505)		(0.504)		(0.264)	
Observations	47,462	40,106	47,462	40,106	47,462	40,106
R-squared	.888	.114	.888	.113	.872	.064
Rich = Poor (p-value)	.775	.452	.886	.244	.0628	.447
Weak identif. SW *F* Test		150.5		110.9		110.9
Hansen J p-value		.402		.219		.952
Endog. test p-value		.757		.779		.00334

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the IV estimations, the set of instruments includes the second lag of log supply, and log import and are split by high/medium/low-income sourcing country. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

TABLE 7 Robustness analysis with different endogenous variable and samples of firms (IV estimation results).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline	**New endog. vble exports to EUEFTA countries**	**New sample excluded 10% top exporters**	**Excluded top 10 firms of each industry**	**Excluded foreign-owned firms**	**Excluded firms exporting all the period**	**Excluded firms borned before 1992**	**Only firms 100% exports to EU**	**Firms importing mainly from non-EUEFTA**
Number of firms	4884	4884	3665	3610	4083	2462	1531	747	1992
Number of observations	40,106	40,106	27,054	27,159	32,235	15,061	10,595	5330	16,013
Panel A. Export value									
Import value ($t-1$)	0.0742***	0.0733***	0.0782***	0.0829***	0.0628***	0.104***	0.102***	0.104**	0.125***
	(0.0141)	(0.0135)	(0.0176)	(0.0170)	(0.0146)	(0.0297)	(0.0326)	(0.0460)	(0.0258)
R-squared	.115	.125	.087	.097	.122	.112	.086	.043	.143
Weak identif. SW *F* Test	1394	1394	817.5	876.7	1113	382.4	275.5	161.3	405.9
Hansen J *p*-value	.811	.512	.886	.702	.630	.378	.496	.721	.779
Endog. test *p*-value	.0411	.0402	.0605	.0239	.107	.151	.416	.0898	.0264
Panel B. Export value									
Import scope ($t-1$)	0.126***	0.130***	0.181***	0.164***	0.156***	0.193***	0.205***	0.154*	0.205***
	(0.0301)	(0.0293)	(0.0395)	(0.0379)	(0.0318)	(0.0715)	(0.0756)	(0.0920)	(0.0498)
R-squared	.112	.122	.082	.094	.119	.108	.079	.042	.134
Weak identif. SW *F* Test	1015	1016	550.8	610.3	808	218.7	158.9	138.6	379.9
Hansen J *p*-value	.744	.464	.876	.711	.660	.353	.449	.715	.917
Endog. test *p*-value	.0415	.0196	.00151	.00611	.00239	.105	.125	.136	.00355
Panel C. Export scope									
Import scope ($t-1$)	0.131***	0.137***	0.136***	0.124***	0.133***	0.209***	0.234***	0.105*	0.197***
	(0.0186)	(0.0190)	(0.0230)	(0.0223)	(0.0193)	(0.0384)	(0.0449)	(0.0561)	(0.0297)

(Continues)

TABLE 7 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline	**New endog. vble exports to EUEFTA countries**	**New sample excluded 10% top exporters**	**Excluded top 10 firms of each industry**	**Excluded foreign-owned firms**	**Excluded firms exporting all the period**	**Excluded firms borned before 1992**	**Only firms 100% exports to EU**	**Firms importing mainly from non-EUEFTA**
R-squared	.058	.070	.044	.047	.050	.040	.022	.029	.062
Weak identif. SW *F* Test	1015	1016	550.8	610.3	808	218.7	158.9	138.6	379.9
Hansen J *p*-value	.712	.655	.738	.693	.737	.727	.250	.395	.415
Endog. test *p*-value	.0000	.0000	.0000	.0001	.0000	.0000	.0000	.0930	.0000

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. Panel A examines the import value–export value connection, panel B the import scope–export value relationship and panel C the import portfolio–export portfolio relationship. The set of instruments includes the second lag of log supply and log IMP. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

TABLE 8 Robustness using alternative instruments and definition of intermediate inputs (IV estimation results).

	(1)	(2)	(3)	(4)	(5)
	Baseline (Table 3)	**Instr. T-3**	**Feenstra-Hanson (industry shares)**	**RER, TAR (firm shares)**	**RER, TAR (industry shares)**
Observations	40,106	34,190	36,006	39,813	40,106
Number of firms	4884	4301	4516	4847	4884
Panel A. Export value					
Import value ($t-1$)	0.0742***	0.104***	0.0428***	0.0725***	0.0738***
	(0.0141)	(0.0249)	(0.0136)	(0.0141)	(0.0124)
R-squared	.115	.111	.112	.115	.115
Weak identif. SW *F* Test	1394	286.2	977	937.2	730.9
Hansen J *p*-value	.811	.601	.531	.363	.660
Endog. test *p*-value	.0411	.0355	.898	.0514	.0321
Panel B. Export value					
Import scope ($t-1$)	0.126***	0.0969*	0.0957***	0.123***	0.123***
	(0.0301)	(0.0564)	(0.0348)	(0.0304)	(0.0317)
R-squared	.112	.112	.111	.113	.112
Weak identif. SW *F* Test	1015	257.2	472	678.2	421.4
Hansen J *p*-value	.744	.534	.511	.352	.625
Endog. test *p*-value	.0415	.0911	.279	.0433	.0538
Panel B. Export scope					
Import scope ($t-1$)	0.131***	0.149***	0.114***	0.129***	0.130***
	(0.0186)	(0.0352)	(0.0229)	(0.0187)	(0.0191)
R-squared	.058	.052	.060	.059	.059
Weak identif. SW *F* Test	1015	257.2	472	678.2	421.4
Hansen J *p*-value	.712	.301	.193	.0041	.441
Endog. test *p*-value	.0000	.0038	.0004	.0000	.0000

Note: All variables are in logs. All regressions include firm fixed effects and year fixed effects. Panel A examines the import value–export value connection, panel B the import scope–export value relationship and panel C the import portfolio–export portfolio relationship. Column (2) uses instruments lagged three periods. Column (3) uses the definition of intermediate imported inputs proposed by Feenstra-Hanson. Column (4) uses tariff and exchange rate instruments proposed by Bas et al (2015) defined at firm-level. Column (5) uses tariff and exchange rate instruments proposed by Feng et al. (2016) defined at industry firm-level. Robust standard errors clustered by firm in columns 1, 2 and 4 and by industry in columns 3 and 5 in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

5.1 | Alternative endogenous variables and different subsamples

We begin considering a wider and less restrictive export market, including countries belonging to EUEFTA rather than EU-15 in the definition of our endogenous variable. IV estimation results in Table 7 column (2) are almost identical to the baseline ones.[9]

Additionally, we examine the impact of imports value/scope on the average value per product, per destination and per product-country pair as endogenous variables to better assess the extent to which imports of intermediate inputs improve firm's intensive margin of exports. The results are presented in Table A6 of the Appendix 1. Since we cannot reject the null hypothesis of both the Hansen's J-test and the endogeneity test, we only report the consistent and efficient OLS coefficient estimates. We observe that import values have a positive and significant impact on the intensive margin of exports while the size of the import portfolio has a positive and significant effect on the export value per country.

Table 7 columns (3) to (9) shows the IV results using alternative firm sub-samples and different criteria according to several firm characteristics as a sensitivity analysis. In column (3), we exclude the top 10% of exporters in our sample, and in column (4), we exclude the top 10 exporters in each industry to check whether our results are affected by the size of exporters. These restrictions reduce the sample size by about 33% or 13,000 observations. Comparing these estimation results with those in the baseline, we find very similar results both in the significance and in magnitude of the coefficient estimates, suggesting that the import–export connection is unaltered by the volume of exports of the firms. When we restrict our sample to domestic-owned firms (column 5), to firms that do not export more than 10 years over the entire period 2000–2018 period (column 6), or to firms born after 1992 (column 7), the key results remain unaltered after taking into account ownership, age or export tenure of the firm.

So far we did not take into account the fact that the EU market is not the only export destination and the non-EUEFTA market is not the only source of imports of intermediate goods. To complete our robustness check, we restrict the samples of two-way trading firms to those exporting exclusively to EU15 (column 8) and to those buying the majority of their intermediate inputs from the non-EUEFTA countries (column 9). In the first sample, with only 747 firms, the point estimates of import–export elasticities in panel A are similar to the baseline ones while imports scope—exports value or—exports scope connections are not statistically different from zero. In the second sample, with 1992 firms, all the point estimates are slightly higher in magnitude, but the interval estimates indicate that the coefficient estimates are not different from the baseline results. Overall, the results in Table 7 confirm that the enhancing effect of imports on exports is robust to different samples of firms.

5.2 | Alternative instruments

We finish this robustness section presenting a further set of estimations using the IV estimator with alternative sets of instruments.

The results are shown in Table 8. First, we use the third lag rather than the second lag of all the instruments. As expected, IV estimations include less observations than the baseline (Table 8, column 2). Validation test results do not reject the null hypothesis of the validity of instruments

[9]The results were also the same when we restricted the sample of destination countries to the EURO zone.

and reject the null hypothesis of weak exogeneity of the import variables in panels A and C. IV estimation results are in line with our baseline ones (column 1).

Second, we consider an alternative definition of imports of intermediate inputs based on Feenstra and Hanson (1996). To do so, we first select the firm's main sector of activity defined at the HS 4-digit level, and then consider that the firm's imports belonging to the same HS 4-digit level than the firm's exports are final goods, whereas imports from any other category are intermediate inputs. The results are shown in Table 8 column (3). Hansen's J-test null hypothesis of the validity of instruments is not rejected in the three panels. The results of the endogeneity test in panel C reject the exogeneity of intermediate imports scope, thus supporting the consistency of IV estimation results that are in line with our main results.

Third, we use the definition of tariff and exchange rates instruments proposed by Bas and Strauss-Khan (2014). These two instruments for intermediate inputs imported by a firm are constructed at firm level, using firm's shares. The tariff in product p is computed as a weighted average of EU tariffs, TAR_{pt}, applied to the p products imported by Spanish firm i from non-EUEFTA countries. The weights are the shares of imports of each product p imported by firm i, IMP_{pi}^{ini}, belonging to the set of products imported by firm i, P_i^M, in its initial year of activity.

$$tariff_{it} = \sum_{p=1}^{P_i^M} \frac{IMP_{pi}^{ini}}{\sum_{p=1}^{P_i^M} IMP_{pi}^{ini}} TAR_{pt}$$

Similarly, the real exchange rate for firm i is computed as the weighted average of real exchange rates applied to imports of intermediate products from non-EUEFTA country c, RER_{ct}. The weights are the shares of firm's imports of intermediate inputs sourced from each non-EUEFTA country c, IMP_{ci}^{ini}, in the set of sourcing non-EUEFTA countries of firm i's imports, C_i^M, in its initial year of activity:

$$rer_{it} = \sum_{c=1}^{C_i^M} \frac{IMP_{ci}^{ini}}{\sum_{c=1}^{C_i^M} IMP_{ci}^{ini}} RER_{ct}$$

Table 8, column (4) provides the IV estimation results. The Hansen's J-test null hypothesis of the validity of instruments is not rejected and the null hypothesis of the weak exogeneity of the intermediate imports regressor is rejected in panels A and B—in panel C, we reject the Hansen's J null hypothesis. Based on these alternative instruments, we obtain almost identical positive and significant impact of imports of intermediate inputs on firm exports to our baseline estimates.

Finally, we construct two instruments for intermediate inputs imported by a firm at industry level, considering the industry in which the firm operates, following Feng et al. (2016). The tariff in industry j is computed as a weighted average of EU tariffs applied to the p products imported by Spanish firms in each industry j (NACE 4-digit) from non-EUEFTA countries in year t, TAR_{pt}. The weights are the shares of imports of each product p, IMP_{pj}^{ini}, belonging to the set of products imported by firms operating in industry j, P_j^M at the beginning of the period, in 1997.

$$tariff_{jt} = \sum_{p=1}^{P_j^M} \frac{IMP_{pj}^{1997}}{\sum_{p=1}^{P_j^M} IMP_{pj}^{1997}} TAR_{pt}$$

Similarly, the real exchange rate in industry *j* is computed as the weighted average of real exchange rates applied to imports of intermediate products from non-EUEFTA country c, RER_{ct}. The weights are the shares of imports of intermediate inputs sourced from each non-EUEFTA country c, IMP_{cj}, in the set of importing source non-EUEFTA countries of industry j, C_j^M, in 1997:

$$rer_{jt} = \sum_{c=1}^{C_j^M} \frac{IMP_{cj}^{1997}}{\sum_{c=1}^{C_j^M} IMP_{cj}^{1997}} RER_{ct}$$

We expect that the cost of importing intermediate inputs to be lower when the import tariffs ($tariff_{jt}$) is lower and the real exchange rate appreciates (rer_{jt}). Therefore, we should observe a negative correlation between imports and tariffs and real exchange rate.

Table 8, column (5) provides the IV estimation results. The Hansen's J-test null hypothesis of the validity of instruments is not rejected and the null hypothesis of the weak exogeneity of the intermediate imports regressor is rejected in the three panels. Based on these alternative instruments, we obtain almost identical positive and significant impact of imports of intermediate inputs on firm exports to our baseline estimates.

Overall, the enhancing effect of imports of intermediate inputs on firm's exports by Spanish firms is robust to sample selection, the definition of the dependent variable and the use of alternative instruments.

6 | CONCLUSIONS

This is the first article that measures the impact of importing intermediate inputs on the export value and scope of Spanish manufacturing firms over the period 1997–2018. To alleviate endogeneity problems in the import–export link, we use the universe of firms that regularly export to the EU15 market and import intermediate inputs from non-EUEFTA markets. In addition, we use an IV estimation strategy, using potential supply for firm's imports as exogenous measures of trade shocks affecting firm's import costs. Moreover, we control for observable firm characteristics such as employment size and apparent labour productivity to consider the indirect impact of imports on exports through costs, so we can isolate the direct impact of imports on exports through the demand only.

We find robust evidence on the enhancing effect of importing intermediate inputs on firm's exports. The higher the value of imports of intermediate inputs the higher the value of exports. Similarly, the higher the firm's import scope, the higher the exports values and scope. Moreover, this direct effect of imports on exports is stable over time.

We further disentangle the channels through which the import–export link operates. We consider high quality imports as a source of firm's exports improvement to satisfy more difficult or demanding markets imports, where high-quality imports are proxied by inputs purchased from high-income countries. Alternatively, cost-saving or low-price intermediate imports may increase expected export returns and thus stimulate exporting more, where low price intermediate inputs are proxied by inputs purchased from low-income sourcing countries. On average, over the whole sample period, 2000–2018, we do not find any significant difference in the enhancing effect of imports on exports through either the quality channel or the prices channel.

Our finding suggests that the enhancing effect of imports of intermediate inputs on exports should be taken into account by policymakers in the design of promotion policies that facilitate access to key foreign intermediate inputs. We provide evidence, for the first time, that low-income sourcing countries are increasingly becoming providers of intermediate inputs that enhance the export performance of Spanish firms. Therefore, internationalisation promotion policies should provide information, advice and support about these new sourcing countries, so companies can expand the range of their input suppliers with foreseeable competitiveness gains.

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DATA AVAILABILITY STATEMENT

We are happy to share the code programs in Stata but the data used in the article (AEAT-Custom data) are confidential.

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APPENDIX 1

TABLE A1 Number of firms in Customs database and number of firms in the data set.

Year	Exporters	Regular exporters	Regular exporters to EU	Regular exporters to EU and regular importers from EUEFTA	Manufacturers >10 employees (data set)
1997	47,308	25,792	16,682	3761	1158
1998	52,061	29,476	18,285	4344	1543
1999	52,284	32,961	20,044	4926	1851
2000	56,871	36,914	22,174	5635	2206
2001	59,185	38,185	22,640	5776	2429
2002	60,467	39,130	23,170	6028	2744
2003	61,568	39,865	23,447	6354	3084
2004	61,836	40,207	23,424	6681	3270
2005	63,149	40,573	23,345	6997	3438
2006	65,046	40,985	23,108	7192	3546
2007	64,538	40,893	22,527	7273	3519
2008	67,188	40,487	21,924	7294	3520
2009	67,444	40,038	21,504	7105	3444
2010	69,563	40,765	21,399	7122	3423
2011	70,898	41,219	21,658	7249	3448
2012	76,807	43,071	22,281	7463	3485
2013	80,150	44,566	22,688	7552	3464
2014	77,442	45,840	22,896	7771	3506
2015	75,765	46,252	22,156	7750	3550
2016	74,217	42,875	20,801	7258	3356
2017	73,526	39,783	19,624	6771	2656
2018	72,538	36,540	18,374	6282	2165

Source: Own elaboration using Tax Agency-Customs and SABI database.

TABLE A2 Sample data (regular two-way traders whose main activity is manufactures and employ 10 or more workers).

	Number firms	Total exports (th. million eur)	Share in total Spanish exports (%)	Exports to EU15 (th. million eur)	Share in Spanish exports to EU15 (%)	Intermediate imports from non-EUEFTA (th. million eur)	Share in Spanish intermediate imports from non-EUEFTA (%)
1997	1158	20.6	23	14.6	23	4.9	11
1998	1543	24.8	25	17.7	25	4.9	10
1999	1851	26.7	26	19.5	26	5.8	10
2000	2206	33.4	27	24.0	28	10.6	14
2001	2429	45.2	36	34.1	37	11.3	14
2002	2744	49.8	38	37.0	40	12.5	16
2003	3084	63.2	47	45.8	47	17.6	22
2004	3270	69.7	49	49.8	49	19.7	22
2005	3438	74.2	49	51.1	49	26.4	26
2006	3546	83.6	50	56.8	51	34.8	28
2007	3519	90.6	51	61.9	52	38.5	28
2008	3520	88.9	49	59.0	50	44.0	30
2009	3444	70.9	46	47.1	47	25.7	26
2010	3423	85.1	47	55.0	48	34.7	28
2011	3448	98.3	48	61.0	48	47.0	33
2012	3485	105.4	49	61.9	49	48.1	33
2013	3464	107.1	48	61.5	47	49.4	35
2014	3506	108.6	48	62.6	46	46.2	32
2015	3550	117.0	49	70.4	49	36.9	27
2016	3356	116.6	47	72.9	49	33.1	27
2017	2656	102.6	39	62.4	39	34.4	25
2018	2165	93.3	34	57.3	35	37.4	25

Source: Own elaboration using Tax Agency-Customs database.

TABLE A3 Descriptive statistics of database.

Type of variable (number lags)	Name of variable		N. Observ.	Mean	SD	Min.	Max.
Dependent variable	(log)	Export value	47,462	7.73	1.95	0.41	15.58
	(log)	Export scope	47,462	2.37	1.01	0.00	6.79
Controls							
L1	(log)	Potential demand	47,462	13.99	1.52	7.88	19.24
L1	(log)	Employment	47,462	4.30	1.18	2.30	9.62
L1	(log)	Labour productivity	47,462	12.24	0.74	7.20	17.35
Main explanatory variable							
L1	(log)	Import value	47,462	5.85	2.25	0.41	16.47
L1	(log)	Import scope	47,462	1.50	1.00	0.00	5.89
L1	(log)	Imp. value from high-income countries	47,462	3.28	2.90	0.00	13.79
L1	(log)	Imp. value from medium-income countries	47,462	2.46	3.01	0.00	16.35
L1	(log)	Imp. value from low-income countries	47,462	3.80	3.06	0.00	15.71
L1	(log)	Imp. scope from high-income countries	47,462	0.94	0.88	0.00	5.17
L1	(log)	Imp. scope from medium-income countries	47,462	0.57	0.70	0.00	4.96
L1	(log)	Imp. scope from low-income countries	47,462	1.00	0.86	0.00	4.91
L1	(log)	Import value a la Feentra Hanson	43,773	5.46	2.29	0.41	16.36
L1	(log)	Import scope a la Feenstra-Hanson	43,773	1.27	0.96	0.00	5.74
Instruments							
L2	(log)	Potential supply	40,808	12.01	2.21	0.00	18.59
L2	(log)	Tariff (BEC-industry shares)	40,808	0.03	0.02	0.00	0.12
L2	(log)	Rer (BEC-industry shares)	40,808	0.70	0.04	0.48	1.47
L2	(log)	Tariff (BEC-firm shares)	40,808	0.03	0.02	0.00	0.24
L2	(log)	Rer (BEC-firm shares)	40,511	0.00	0.24	−6.23	2.15
L2	(log)	Potential supply a la Feenstra-Hanson	40,650	11.97	2.33	0.00	18.65
L2	(log)	Tariff (Feenstra-Hanson—industry shares)	40,808	0.03	0.02	0.00	0.16
L2	(log)	Rer (Feenstra-Hanson—industry shares)	40,808	0.69	0.08	0.15	2.03

Note: L1 (L2) means one-period (two-period) lagged variable. BEC-industry shares (baseline): definition intermediate according to BEC classification; industry-based import share at the year 1997. BEC-firm shares: definition intermediate according to BEC classification; firm-based import share at the beginning of export–import activity. Feestra-Hanson-industry shares: definition of intermediate inputs (excluded HS4 imports of main HS4 exports); industry-based import share at the year 1997.

TABLE A4 Distribution of countries based on development level (GDP per capita PPP 2000).

High-income No-EUEFTA countries (>20.000$)
AUS, CAN, HKG, ISR, JPN, KOR, NZL, SGP, TWN, USA
Medium-income countries (8.000–20.000$)
ARE, ARG, BHR, BHS, BLR, BRA, CHL, COL, CRI, DOM, DZA, GAB, GNQ, HRV, IRN, JAM, KAZ, KWT, LBN, MEX, MKD, MUS, MYS, OMN, PAN, QAT, RUS, SAU, SRB, SYC, THA, TTO, TUR, URY, VEN, ZAF
Low-income countries (<8.000$)
AGO, ALB, ARM, AZE, BEN, BFA, BGD, BOL, CHN, CIV, CMR, COD, COG, CPV, CUB, ECU, EGY, ETH, GEO, GHA, GIN, GTM, HND, HTI, IDN, IND, JOR, KEN, KGZ, KHM, LBR, LKA, MAR, MDA, MDG, MLI, MOZ, MRT, NAM, NER, NGA, NIC, NPL, PAK, PER, PHL, PRY, SDN, SEN, SLE, SLV, TGO, TUN, TZA, UGA, UKR, UZB, VNM, YEM, ZMB, ZWE

Source: World Development Indicators.

TABLE A5 Robustness analysis. Impact of imports on the extensive margin (number of products and number of countries). IV estimations.

	(1)	(2)	(3)	(4)
	Export products	**Export products**	**Export countries**	**Export countries**
Import value ($t-1$)	0.0286***		0.0175***	
	(0.00771)		(0.00565)	
Import scope ($t-1$)		0.123***		0.0600***
		(0.0198)		(0.0144)
Employment ($t-1$)	0.0423***	0.0412***	−0.000551	−0.000996
	(0.0110)	(0.0110)	(0.00699)	(0.00700)
Productivity ($t-1$)	0.213***	0.188***	0.229***	0.220***
	(0.0222)	(0.0222)	(0.0161)	(0.0156)
Potential demand ($t-1$)	0.102***	0.0958***	0.0849***	0.0847***
	(0.0176)	(0.0172)	(0.0130)	(0.0128)
Observations	40,106	40,106	40,106	40,106
R-squared	.023	.021	.039	.038
Weak identif. SW F Test	1394	1015	1394	1015
Hansen J p-value	.984	.965	.987	.995
Endog. test p-value	.00945	.0000	.0414	.00355

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the IV estimations, the set of instruments includes the second lag of log supply and log IMP. Robust standard errors clustered by firm in parentheses. ***$p < .01$, **$p < .05$ and *$p < .1$.

TABLE A6 Robustness analysis. Impact of imports on the intensive margin of exports (average value per product-country, per product and per country). OLS estimations.

	(1)	(2)	(3)	(4)	(5)	(6)
	Export value per product-country	**Export value per product**	**Export value per country**	**Export value per product-country**	**Export value per product**	**Export value per country**
Import value ($t-1$)	0.0314***	0.0379***	0.0428***			
	(0.00598)	(0.00724)	(0.00590)			
Import scope ($t-1$)				0.0113	0.0190*	0.0459***
				(0.00953)	(0.0115)	(0.00961)
Employment ($t-1$)	−0.0135	−0.0259	0.0108	−0.0132	−0.0256	0.0109
	(0.0135)	(0.0165)	(0.0135)	(0.0136)	(0.0166)	(0.0136)
Productivity ($t-1$)	0.497***	0.633***	0.630***	0.520***	0.658***	0.649***
	(0.0323)	(0.0385)	(0.0318)	(0.0320)	(0.0382)	(0.0316)
Potential demand ($t-1$)	0.403***	0.456***	0.466***	0.425***	0.482***	0.489***
	(0.0302)	(0.0350)	(0.0325)	(0.0299)	(0.0348)	(0.0321)
Constant	−1.717***	−1.641***	−2.806***	−1.922***	−1.872***	−2.988***
	(0.421)	(0.505)	(0.438)	(0.420)	(0.506)	(0.437)
Observations	47,462	47,462	47,462	47,462	47,462	47,462
R-squared	.875	.868	.883	.875	.867	.882
IV tests						
Weak identif. SW F Test	1394	1394	1394	1015	1015	1015
Hansen J p-value	.918	.793	.805	.839	.713	.740
Endog. test p-value	.650	.521	.165	.309	.350	.455

Note: All the variables are expressed in logs. All the estimations include firm and year fixed effects. In the (unreported) IV estimations, the set of instruments includes the second lag of log supply and log IMP. Robust standard errors clustered by firm in parentheses. ***$p<.01$, **$p<.05$ and *$p<.1$.