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EXPORT DYNAMICS AND SALES AT HOME

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Abstract. Using a French firm-level database that combines balance-sheet and product-destination-specific export information over the period 1995-2001, we study the interconnections between exports and domestic sales. We identify exogenous shocks that affect the firms' demand on foreign markets to instrument yearly variations in exports. We use alternatively as instruments product-destination specific imports or tariffs changes, and large foreign shocks such as financial crises or civil wars. Our results show that exogenous variations in foreign sales are positively associated with domestic sales, even after controlling for changes in domestic demand. A 10% exogenous increase in exports generates a 1 to 3% increase in domestic sales in the short-term. This result is robust to various estimation techniques, instruments, controls, and sub-samples. We provide empirical evidence suggesting that this positive effect of exogenous changes in exports on domestic sales is related to a relaxation of short-run liquidity constraints.

JEL classification: F10, F44, L20
Keywords: Export dynamics, domestic sales, demand shocks, markets, liquidity

Non-technical summary

How demand shocks in a given market affect firms' sales in different markets? Answers to this question remain unclear, both at the macroeconomic and microeconomic level, although it may be a significant determinant of firm-level dynamics and have important implications for the transmission of foreign shocks to the domestic economy.

This paper provides an empirical investigation of this question through the lens of the relationship between French firms' exports and domestic sales, based on a yearly firm-level dataset containing both trade data from the French Customs and balance-sheet information over the period 1995-2001. As sales decisions across markets are likely to be simultaneously determined by common - idiosyncratic or aggregate - demand and supply shocks, we develop a strategy that identifies variations in the foreign demand addressed to the firms to predict exogenous changes in exports, and test their effect on the firms' domestic sales. The different dimensions of our data allows us to build instruments that capture the demand specifically addressed to each firm in its foreign markets (destinations and products), while controlling for the demand it faces in the domestic market. In our baseline estimates, we use the sum of imports in the products-destinations served by the firms, weighted by the share of each product-destination in the firm's total exports. We then test the robustness of this strategy by using a number of alternative weighting schemes and instruments, including firm-specific tariff changes and exposure to large foreign shocks, such as financial crises or civil wars. Our main empirical finding is as follows: we find that a 10% exogenous increase in exports coming from foreign demand variations is associated with 1 to 3% increase in domestic sales in the short-run. This complementarity is stronger in firms that are more exposed to foreign shocks, due to a higher exports to total turnover ratio. These results are robust to various estimation techniques, combinations of instruments, sub-samples, and inclusions of additional controls. Variations in domestic sales are related to both factor accumulation and changes in total factor productivity. Finally, our results are valid for both increases and declines in foreign demand, with the effect being larger in the latter case. This result is at odds with theoretical models in international trade where domestic and foreign sales are only connected through exogenous productivity, as in Melitz (2003). Exogenous shocks affecting demand and firms' sales in a given location have no effect on sales in other markets. This is true as long as production processes are independent across the different markets, i.e., there are no cost linkages between them. In practice, a firm relies on a single process for the production of a good that will be sold in different markets. But our result does not fit either the conclusions of a very recent body of literature (Vannoorenberghe, 2012; Blum et al., 2013, Soderbery, 2014) which emphasizes the role of capacity constraints, related to frictions on factor or financial markets. Those frameworks imply a substitution between sales across markets: increasing sales in one market, consecutive to a positive demand shock, requires sacrificing away some sales in other markets. However, empirical analyses in these approaches do not look to establish causal relationships between exports and domestic sales. Why are firms' domestic sales positively related to exogenous changes in exports? This is expected if foreign demand shocks alleviate capacity constraints. For instance, the size of a firm's total production may be limited by the presence of liquidity constraints, which imply that future operations cannot be financed through today's borrowing. In this context, firms become dependent on external shocks affect-

ing their cash-flow and their capacity to finance internally their activity. When foreign demand expands, the increase in exports allows firms to finance their domestic operations, i.e. to pay suppliers, hire workers or make investments. Their order book could also be used as a collateral or as a signal to obtain external financing. More formally, a positive shock on foreign sales will shift the marginal cost downward if firms' liquidity increases as well, leading to an increase of domestic sales. Our results do not exclude the possibility that capacity constraints are important in some cases (for some firms, in some sectors), but show that they do not dominate other channels on average in our sample. Exogenous (orthogonal to firms' characteristics) changes in export sales provide firms with cheap liquidity that relaxes financial constraints and decreases marginal costs. While the main objective of this paper is not to provide a definitive answer to the mechanism underlying our findings, we provide a number of results supporting the liquidity channel. In particular, we show that the positive effect of exogenous changes in exports on domestic sales is stronger for small firms, and for firms relying more on the use of short-run liquidity, based on the computation of several firm- and sector-specific indicators. This liquidity channel is also consistent with the fact that our result is found to be stronger for small firms than for large ones. Our work has direct implications regarding the channels through which international trade in goods might lead to greater business cycle synchronization. Common wisdom generally attributes the strong correlation between trade openness and the synchronization of business cycles to a simple mechanism: as economies become more open, exports and imports represent a larger share of firms' total sales or input purchases. This makes firms more sensitive to variations in foreign demand, which tends to propagate shocks. Our results imply that foreign business cycles may also be transmitted to domestic markets through the complementarity between firms' domestic and foreign sales. This result has many implications, for instance, in terms of transmission to the domestic economy of exchange rate and trade policies, or of financial crisis. In the case of the 1997-98 Asian crisis, we indeed show that firms that were more exposed to the destinations that experienced the crisis suffered a larger drop in domestic sales during the event. As we are looking only at a subset of firms among the population of exporters, we are however unable to draw clear conclusions about the impact of foreign demand variations on aggregate domestic sales. A reallocation of domestic market shares toward non-exporters or firms less exposed to the foreign market experiencing the demand shock could indeed be expected. If non-exporters are on average less productive than exporters, this reallocation could in principle decrease the aggregate welfare. Finally, our empirical evidence also has potential interesting implications for the transmission of real demand shocks to the financial system through firms' financial health. Large negative shocks such as the Eurozone crisis could make exporters more financially vulnerable and force them to default on their loans, which in turn may affect the solvability of the banking sector. Exploring these aggregate indirect effects in more details would be an interesting avenue for future research.

1 Introduction

The sales of a firm are distributed across several markets, each of these markets being identified by a specific location and a particular product. Empirical evidence shows that large, productive firms explore more markets and have larger average sales. How sales between these different markets interplay, and in particular how demand shocks in a given market affect firms' sales in their other markets remains however unclear, although it may be a significant determinant of firm-level dynamics and have important implications for the transmission of foreign shocks to the domestic economy.

This paper provides an empirical investigation of this question through the lens of the relationship between French firms' exports and domestic sales. As sales decisions across markets are likely to be simultaneously determined by common – idiosyncratic or aggregate – demand and supply shocks, we develop a strategy that identifies variations in the foreign demand addressed to the firms to predict exogenous changes in exports, and test their effect on the firms' domestic sales. The different dimensions of our data allows us to build instruments that capture the demand specifically addressed to each firm in its foreign markets (destinations and products), while controlling for the demand it faces in the domestic market.

Our empirical analysis relies on a firm-level dataset containing both firm-level trade data from the French Customs and balance-sheet information over the period 1995-2001, at a yearly frequency. In particular, the balance-sheet data contains information about domestic and foreign sales, our main variables of interest. The customs data reports firm-level exports and imports by product and destination. This information is used to identify variations in the demand addressed to firms in both foreign and domestic markets. Demand addressed to firms in foreign markets is used to instrument for firms' exports, while the domestic demand is used to control for home market conditions. In our baseline estimates, we use the sum of imports in the products-destinations served by the firms, weighted by the share of each product-destination in the firm's total exports. We then test the robustness of this strategy by using a number of alternative weighting schemes and instruments, including firm-specific tariff changes and exposure to large foreign shocks, such as financial crises or civil wars.

We find that a 10% exogenous increase in exports coming from foreign demand variations is associated with 1 to 3% increase in domestic sales in the short-run, depending on the specification. This complementarity is stronger in firms that are more exposed to foreign shocks, due to a higher exports to total turnover ratio. These results are robust to various estimation techniques, combinations of instruments, sub-samples, and inclusions of additional controls. Variations in domestic sales are related to both factor accumulation and changes in total factor productivity. Finally, our results are valid for both increases and declines in foreign demand, with the effect being larger in the latter case.

Why are firms' domestic sales positively related to exogenous changes in exports? In most international trade models (e.g. Melitz, 2003), domestic and foreign sales are only related through idiosyncratic firm productivity shocks, together with local demand conditions. Exogenous shocks affecting demand and firms' sales in a given location have no effect on sales in other markets. This is true as long as production processes are independent across the different markets, i.e., there are no cost linkages between them. In practice, a firm relies on a single process for the

production of a good that will be sold in different markets.

A very recent, yet flourishing body of literature has emphasized the role of cost linkages in explaining how exports affect the volatility of firms' sales (Vannoorenberghe, 2012, Nguyen and Schaur, 2011, Blum *et al.*, 2013, Ahn and McQuoid, 2012, Soderbery, 2014).[1] These models assume that the marginal cost is increasing with quantities due to capacity constraints related to frictions on factor (typically, regulations) or financial markets (liquidity constraints), which implies a substitution between sales across markets: increasing sales in one market, consecutive to a positive demand shock, requires to sacrifice away some sales in other markets.

On the other hand, the relationship between exports and domestic sales is expected to be positive – as our empirical results suggest – if foreign demand shocks alleviate these constraints. For instance, the size of a firm's total production may be limited by the presence of liquidity constraints, which imply that future operations cannot be financed through today's borrowing. In this context, firms become dependent on external shocks affecting their cash-flow and their capacity to finance internally their activity. When foreign demand expands, the increase in exports allows firms to finance their domestic operations, i.e. to pay suppliers, hire workers or make investments. Their order book could also be used as a collateral or as a signal to obtain external financing. More formally, a positive shock on foreign sales will shift the marginal cost downward if firms' liquidity increases as well, leading to an increase of domestic sales. This mechanism allows rationalizing the positive relationship between exports and domestic sales in the empirical analysis that we present below.

Our results do not exclude the possibility that capacity constraints are important in some cases (for some firms, in some sectors), but show that they do not dominate other channels on average in our sample. Exogenous (orthogonal to firms' characteristics) changes in export sales provide firms with cheap liquidity that relaxes financial constraints and decreases marginal costs. While the main objective of this paper is not to provide a definitive answer to the mechanism underlying our findings, we provide a number of results supporting the liquidity channel. In particular, we show that the positive effect of exogenous changes in exports on domestic sales is stronger for small firms, and for firms relying more on the use of short-run liquidity, based on the computation of several firm- and sector-specific indicators.

Our work has direct implications regarding the channels through which international trade in goods might lead to greater business cycle synchronization (with trading partners/with the rest of the world). Common wisdom generally attributes the strong correlation between trade openness and the synchronization of business cycles to a simple mechanism: as economies become more open, exports and imports represent a larger share of firms' total sales or input purchases.[2]

[1] This recent literature follows a more ancient research documenting the relationship between exports and domestic production at the country level (Ball *et al.*, 1966, Dunlevy, 1980; Haynes and Stone, 1983; Zilberfarb, 1980). Most of these papers tested the "capacity pressure" hypothesis (i.e. the fact that an increase in the home country's income leads firms to adjust their foreign deliveries to satisfy domestic consumers) using aggregate data, and produced mixed results. In any event, the first evidence in favor of the capacity pressure in the case of the United Kingdom provided by Ball *et al.*, 1966 is later strongly contradicted by Dunlevy, 1980 or Haynes and Stone, 1983 using different empirical strategies. In both cases, capacity utilization or home income are either uncorrelated or positively correlated with aggregate exports.

[2] Whether international trade causes tighter international business cycle synchronization is theoretically ambiguous. If trade openness leads to greater specialization, and cycles are predominantly sector-specific, trade openness may actually decrease business cycle correlation. However, empirical works have found strong evidence that trade openness amplifies international business cycles correlation. See, among many others, Frankel and Rose (1998) or Baxter and Kouparitsas (2005).

This makes firms more sensitive to variations in foreign demand, which tends to propagate shocks. Our results imply that foreign business cycles may also be transmitted to domestic markets through the complementarity between firms' domestic and foreign sales.

Implications regarding the transmission of foreign trade policy, exchange rate shocks or financial crises to the domestic economy are also potentially important. In the case of the 1997-98 Asian crisis, we indeed show that firms that were more exposed to the destinations that experienced the crisis suffered a larger drop in domestic sales during the event. As we are looking only at a subset of firms among the population of exporters, we are however unable to draw clear conclusions about the impact of foreign demand variations on aggregate domestic sales. A reallocation of domestic market shares toward non-exporters or firms less exposed to the foreign market experiencing the demand shock could indeed be expected. If non-exporters are on average less productive than exporters, this reallocation could in principle decrease the aggregate welfare. Finally, our empirical evidence that foreign shocks are transmitted to domestic sales through changes in firms' liquidity suggests that real foreign demand shocks might be transmitted to the financial sector. For instance, a large negative shock affecting most French exporters - such as the Eurozone crisis - could make these firms more financially vulnerable, and may force them to default on their loans, which in turn may affect the solvency of the banking sector.

Beyond the above-mentioned papers investigating the relationship between sales in different markets, our paper is connected to a recent literature interested in the influence of foreign macroeconomic shocks on firms' activities through factor utilization and productivity. Of particular interest are the papers by Ekholm *et al.* (2012) and Hummels *et al.* (2013). Ekholm *et al.* (2012) show that for Norway, firms that were more exposed to the appreciation of the Krona in the early 2000's (through higher competitive pressure at home or reduced competitiveness on foreign markets) restructured more. Hummels *et al.* (2013) use micro-level Danish data and a methodology similar to ours to show that positive export shocks lead to an expansion of firms' employment and wages paid to all types of workers. Our results suggest that these gains are not only directly related to foreign shocks, but may also be the indirect consequence of the complementarity between export and domestic sales.[3]

Finally, our paper is related to the literature looking at the effect of credit constraints on exporting behavior. The latter builds on the important strand of research studying the impact of financing constraints on firm's investment decisions. Empirically, many papers have identified financing constraints via the sensitivity of investment to internal or external funds.[4]. It is only quite recently that a comparable interest arose regarding the relationship between financial

[3]To a lesser extent, our paper also contributes to the vast literature interested in the effect of international trade on firm performance, which has been a major area of research since the late 1990's. Most papers focused on the link between exporting and productivity at the firm level, showing that the most productive firms self-select on export markets. They provide only mixed evidence on the productivity gains generated by entry into foreign markets, however (early works include Bernard and Jensen, 1999 or Bernard and Wagner, 1998; for recent contributions see De Loecker, 2007, Van Biesebroeck, 2005, Park *et al.*, 2009). These results have led many authors to argue that trade liberalization may affect economic growth mainly through the process of resource reallocation across firms within sector, with little contribution of productivity gains within firms. Our results suggest that export performance may affect domestic performance in the short-term, either through factor accumulation or TFP gains.

[4]See the surveys by Schiantarelli (1995), Blundell *et al.* (1996), Hubbard (1998) and Claessens and Tzioumis (2006). The intuition is that a stronger investment-cash flow or investment-debt relationship reflects more prevalent financing constraints. Numerous results and survey evidence support the intuition that investment-cash flow sensitivities are indeed a reflection of the extent of financing constraints (Love, 2003 and Beck *et al.*, 2005)

constraints and trade behavior (see e. g. Chaney, 2013, Manova, 2013 or Kohn *et al.*, 2012 for theoretical approaches incorporating financial frictions into international trade models; recent firm-level empirical works include Greenaway *et al.*, 2007, Berman and Héricourt, 2010 and Minetti and Zhu, 2011). Our perspective is however quite different and broader, as we are more generally interested in the way in which demand shocks in a given market might be transmitted to firm's sales in other markets. Our results suggest that a possible mechanism underlying this transmission is related to the fact that changes in exports affect the firms' liquidity and financial health in the short-run.

The next section presents the data and some descriptive statistics. Section 3 presents our empirical methodology. Section 4 reports our baseline results, a number of robustness checks, and a test of our results using the 1997-98 Asian crisis as a natural experiment. We discuss various potential channels of transmission in section 5, the liquidity channel emerging as the most plausible one. The last section concludes.

2 Data and stylized facts

2.1 Data

Our empirical analysis relies on two main datasets that report information at the firm level.

The first source is the balance sheet dataset BRN (Bénéfice Réels Normaux), which relies on fiscal declarations by domestic French firms. The BRN database is constructed from mandatory reports of French firms to the tax administration, which are in turn transmitted to INSEE (the French Statistical Institute). This dataset reports information including firms' total sales and export sales, employment, capital stock, value added, the industry, year, and balance-sheet variables. Our data covers the period 1995-2001, for which we have information on both the total sales and export sales. This combined information is used to compute domestic sales. The BRN contains between 650,000 and 750,000 firms per year over the period, which is around 60% of the total number of French firms. Importantly, this dataset is composed of both small and large firms, since no threshold applies on the number of employees.[5] Eaton *et al.* (2011) provide a more detailed description of the database. Because we are interested in the relationship between export flows and domestic sales, we only keep firms that export at least once over the period 1995-2001. We also restrict our analysis to firms whose primary activity is manufacturing. This excludes in particular wholesalers. Finally, we clean the data by dropping the firms that have a share of exports over total sales above 90%[6], and the top and bottom percentile in terms of total average sales growth.

The second source of data used in this paper corresponds to the French customs data (Douanes), which reports exports flows with firm, destination and product dimensions. Both the quantity (in tons) and value of each flow are reported. The product classification system is the European Union Combined Nomenclature at 8 digits (CN8). The customs database is quasi-exhaustive.[7] Balance-sheet and customs data can be merged using the firm identifier (SIREN

[5]The BRN files contain all firms which sales are at least 763 K euros (230 K euros for services). Smaller firms are however included if they choose to be subject to the normal tax regime.

[6]This drops firms located in France whose main activity is to sell goods abroad. Less than 1.8% of the observations are dropped. Note that our results are robust to the use of the full sample.

[7]Only some small shipments are excluded from this data collection. Inside the European Union (EU), firms

number) and the year. After merging the two sources, we are left with 70% of the exporters initially present in the customs data, these firms representing between 90-95% of total exports contained in the customs data depending on the year.[8]

Our strategy relies on the estimation of the effect of export sales on domestic sales. We use the firm-specific structure of exports (by destination *and* by product) to compute measures of the foreign demand addressed to each firm. We use either all products exported by the firms, or their main product. These variables are used as instruments for export sales in our empirical analysis. Their construction is further detailed in the next section. We also build alternative instruments using the Asian crisis as a foreign demand shock, tariffs, or civil wars.

2.2 Descriptive statistics

This section provides some descriptive statistics about the characteristics of the firms contained in our sample. Our final sample is an unbalanced panel containing 29,221 firms exporting at least once over the period 1995-2001. On average, around 21,000 firms report exports each year. Table 1 reports information for these firms regarding their number of employees, their domestic sales (in thousands of euros), their export sales (in thousands of euros), export share, which is measured as the ratio of export sales over total sales, and the log change of exports and domestic sales. The size of the firms contained in the data is very heterogeneous: it starts with a single employee for the smallest firm, whereas the largest has almost 82,000 employees. More generally, our sample contains a large number of small and medium size enterprizes, as the median number of employees is 32. At the 25^{th} percentile firms therefore sell around 1 million euros in France and a bit less than 100,000 euros in the foreign markets.

Table 1: Descriptive statistics: firm size, sales and export share

	Mean	1st Quartile	Median	3rd Quartile	S.D.
Number of employees	114.9	12.0	32.0	77.0	607.7
Domestic sales	16894.4	1138.0	3013.8	8602.2	137496.9
Export Sales	8949.6	97.6	435.0	2079.4	145433.2
Export Share	0.22	0.04	0.13	0.33	0.22
Δ ln Domestic sales	0.03	-0.07	0.03	0.13	0.25
Δ ln Export Sales	0.06	-0.20	0.04	0.30	0.88

Note: Source: authors' computations from BRN data. Export and domestic sales are expressed in thousands of euros. Export share corresponds to exports/total sales. The number of observations if 143,515, and the number of firms 29,221.

The distribution of export share confirms that most of firms' sales correspond to business operations on the domestic market: half of firms in the sample export 13% or less of their total

are required to report their shipments by product and destination country only if their annual trade value exceeds the threshold of 150,000 euros. For exports outside the EU all flows are recorded, unless their value is smaller than 1000 euros or one ton. Those thresholds only eliminate a very small proportion of total exports.

[8] In our final sample, the export variable from the customs and the export sales variable from the balance-sheet data are highly correlated at 0.97. Yet, they generally differ. This is mainly due to the fact that the balance-sheet reports the actual turnover, while the customs reports the shipments. Due to delays in the payment of the shipments, it is normal to expect differences. As a robustness check, we have replaced the right-hand side variable by exports from the customs and the results were very robust.

sales; 75% of firms export at most a third of their total sales. Hence, this empirical pattern confirms that firms' sales are mostly concentrated on the domestic market, whereas exports are concentrated on a small number of firms that have a large degree of internationalization. Finally, both domestic sales and export exhibit, on average, a positive growth (3% and 6% respectively), with foreign sales being significantly more volatile than domestic sales. Note that within firm, this higher volatility of export sales is even more striking: the variance of the log of exports within firm is 0.65 on average, which is ten times bigger than the average within firm variance of the log of domestic sales.

Table 2: Export share by firm-size class

Size class	Export Share
1- 20 employees	0.147^a
20 - 50 employees	0.131^a
50 - 100 employees	0.162^a
100 - 200 employees	0.194^a
200 - 500 employees	0.228^a
$>$ 500 employees	0.265^a

This table presents the results of a regression of firms' export share on size bins, which includes year and sector dummies, and from which we exclude the constant term. Export share corresponds to exports/total sales. ^{a} significant at 1%, based on robust standard errors. All coefficients are significantly different from each other at the 1% level.

Table 2 shows the relationship between firm size (number of employees) and export share. We regress export share on bins representing intervals of sizes in terms of number of employees. The estimations include year and sector dummies. Apart from small firms, we can see that export share increases with firm size. Firms with more than 500 employees are almost twice more open than firms with less than 50 workers. We will show that the positive effect of exogenous changes in exports on domestic sales is significantly stronger in firms characterized by a high export share.

3 Empirical methodology

Endogeneity issues. Our main objective is to identify how variations in export sales, driven by changes in foreign demand, affect domestic sales at the firm-level. In general, we want to estimate a specification of the following form:

$$\ln Y_{it} = \beta \ln X_{it} + \mu_i + \lambda_{kt} + \varepsilon_{it} \tag{1}$$

where X_{it} and Y_{it} are respectively the exports and domestic sales of firm i during year t. μ_i denotes firm-specific unobserved characteristics, and λ_{kt} represents sector $\times$ year dummies.[9]

[9] A sector is defined at the 2 digit (NES classification) level.

The latter captures in particular sector-specific business cycle conditions and changes in input prices.[10] We are specifically interested in changes in exports driven by exogenous variations in foreign demand. Our coefficient of interest is β: a negative sign would imply substitutability between export and domestic sales, while a positive sign would suggest complementarity. As mentioned in the introduction, most international trade models would predict that $\beta = 0$, i.e. that firm sales across markets are unrelated.

Exports and domestic sales are theoretically driven by a variety of demand and supply shocks, specific to the firm, the markets it serves, or both. What sign we should expect for β if equation (1) were estimated by OLS is unclear. Eaton *et al.* (2011) or more recently Lawless and Whelan (2014) indeed find that the bulk of firms' sales variations is not explained by market-specific conditions, nor by firm efficiency, but by firm-market specific shocks.[11] A large part of the correlation between domestic and foreign sales might therefore come from the idiosyncratic (i.e. firm-market specific) components of demand and supply shocks. The correlation between these shocks is however unclear, as discussed below.

We are specifically interested in how demand shocks affect domestic sales through exports. We do not observe idiosyncratic demand shocks, but we observe market-specific ones. As explained in more details in the next subsection, our identification strategy will be based on these market-specific (i.e. destination-product) demand variations. The different dimensions of our data allow us to build instruments capturing the demand specifically addressed to a firm in the foreign markets it serves (using sector and product information), *while controlling for the demand it faces in the home market*. This is important as domestic and foreign demand shocks are likely to be correlated (positively or negatively). Alternatively, we will provide additional instruments which are orthogonal to domestic demand conditions (such as the occurrence of civil wars in destination countries).

There are a number of reasons to believe that the OLS estimates of β might be biased toward zero or even negative values. Generally speaking, export sales are much more volatile than domestic sales[12], which suggests that the idiosyncratic supply and demand shocks that are driving firm-level exports and domestic sales in both markets are, to a large extent, disconnected. For instance, inefficiencies in the distribution network in the foreign market or payment default by the importer are affecting exports (and potentially domestic sales indirectly through exports) but are unrelated to the domestic market firm-level conditions. Similarly, if firms decide to invest to explore new markets when the size of local sales has reached maturity (domestic sales are stabilizing or even declining), this would imply that expansion in the exports market upon survival is mostly unrelated to the firms' dynamics in the local market.[13] These examples

[10] Alternatively, we will use in some specifications for comparison purposes, the number of firms that operate in the same industry (ln Number of firms$_{kt}$) and the industry domestic sales (ln Industry domestic sales$_{kt}$) when year dummies are used instead of sector-year dummies.

[11] This is also the case in our dataset: when regressing firm-destination specific exports on a set of firm-year and destination-year fixed effects, the R^2 only reaches 0.4.

[12] As mentioned in the previous section, in our data, exports are about ten times more volatile than domestic sales: the average within-firm variance of the log of domestic sales is 0.068, against 0.656 for exports. This pattern has been documented for most countries where firm-level exports data is available. This volatility is related to the fact that firms tend to enter and exit frequently from the export market, to enter or exit frequently from export destinations, to introduce or stop exporting specific products. This makes firms vulnerable to a great variety of idiosyncratic exports supply and demand shocks. Even the intensive margin (i.e. the exports value for continuing relationships) is very volatile (Berthou and Vicard, 2014).

[13] Recent empirical studies indeed show that very few firms are born global. Before stabilizing their exports

suggest that the OLS coefficient on export sales might suffer from an attenuation bias due to firm-specific supply shocks, or, put differently, that the estimated correlation between domestic and foreign sales should be biased toward zero. As shown below, our instrumentation strategy focuses on market-specific demand shocks which are orthogonal to these firm-specific supply shocks.

Two additional elements might generate a *negative* correlation between foreign and domestic sales in the OLS estimations. The first is related to the firms' choice of export mode. For given levels of domestic and foreign demands, any firm needs to choose between serving the market directly or indirectly through an intermediary.[14] These intermediaries are either wholesalers, or firms that "carry along trade" (Bernard *et al.*, 2012). If indirect exports are at least partly recorded as domestic sales, this might automatically generate some substitution between domestic and export sales. Second and importantly, measurement error might be a source of negative spurious correlation. The problem arises because the sum of domestic sales and export sales are constrained to be equal to total sales. More precisely, domestic sales are obtained by subtracting export sales from total sales (as is generally the case in the literature). Whenever the firm makes a positive (negative) error in the declaration of its exports, mechanically its domestic sales decrease (increase).[15] This non-classical measurement error, which is detailed more formally in section 10 of the online appendix, is not an issue anymore in our IV estimations as we use only a part of export sales variations which is orthogonal to the errors contained in the export variable.

To cope with these issues, our IV strategy has to identify sources of variations in export sales that are truly exogenous to the firm, reflect foreign demand conditions rather than domestic supply shocks, and are orthogonal to domestic demand conditions. As we are interested in the effect of exogenous changes in exports on firms' domestic sales, the identification of this link requires instruments that are independent from firm-specific shocks, controlling for business cycle correlation across markets. Our strategy uses variations in foreign demand addressed to each firm (using destination and product specialization), which are unaffected by firm characteristics. Firm-level exports will be therefore driven by exogenous changes in demand condition in foreign markets served by the firms.

Baseline Instruments. Our baseline instrument is constructed using information about the foreign demand addressed to the firm using product and destination information. Specifically, we compute the sum of foreign imports in the products-destinations served by the firm in year t (using country-level imports by product from BACI - see data appendix for more details),

sales at maturity, they need to meet new clients, set up their distribution network, learn about foreign demand. Firms start by experiencing their products in the home market and developing a local consumer base, before they eventually test the waters into foreign markets (Arkolakis, 2010, Albornoz *et al.*, 2012). Firms may be unsuccessful in the export market if their products were not enough adapted to the tastes of the foreign consumer, or if the firm was unable to meet delivery requirements. Conversely, recent literature on export dynamics has shown that successful new exporters grow very rapidly in the first years of export experience.

[14] See for instance Ahn *et al.* (2011), Bernard *et al.* (2013), or Crozet *et al.* (2013)

[15] This means that firms wrongly declare as sales in France operations where the client was located abroad, or the reverse. The fact that intra-EU trade is now highly facilitated with the absence of customs at the border tends to make this type of error in the reporting of exports turnover more likely: firms have to fill a customs declaration (Déclaration d'Échanges de Biens) for intra-EU trade above a certain threshold (460,000 euros of cumulative exports over the previous year). Exports outside the EU are subject to more stringent declaration (threshold of 1,000 euros per shipment).

weighted by the average share of each product-destination in the firm's total exports over the period (using the firm-level exports data). Weights are computed using the average share of the product-destination in the firm's total exports over the 1995-2001 period.[16] A product is defined at the 6-digit (HS6) level. More precisely, we define:

$$FD_{it} = \sum_{j,p} \omega_{ijp} M_{j,p,t} \tag{2}$$

where ω_{ijp} is the average share of each product p and destination j in firm i's exports over the period, and is time-invariant. $M_{j,p,t}$ is the total value of imports for product p and destination j in year t. All the time-variation of the FD_{it} variable therefore comes from the country-level imports by product, not from the firm-level weights. This variable is expected to impact the firm's exports, but not domestic sales, unless foreign demand for the firm's products is correlated with the domestic demand of these products. To ensure that our results are not driven by this international business cycle correlation, we explicitly control in our baseline specification for the domestic equivalent of our instrument. It is defined as the domestic demand addressed to the firm (DD_{it}). This mirror variable is the sum of the world imports from France for all products exported by firm i (from the BACI data), weighted by the share of each product in the firm's exports (using the firm-level exports data that reflect product-specialization of firms):

$$DD_{it} = \sum_{p} \omega_{ip} M_{FR,p,t} \tag{3}$$

Therefore, this variable provides a firm-specific measure of domestic demand addressed to the firm. Alternatively, we compute the foreign demand and domestic demand variables using sales for the "core" product of the firm on each destination: FD_{it}^{core} and DD_{it}^{core}, respectively. The core product of the firm is defined at the HS4-digit level as the product with the highest value of export over the entire period. The detailed computation of these variables is provided in the data appendix.

Baseline specification. We include DD_{it} explicitly in equation (1). The following equation assesses the effect of exogenous changes in exports (through variations in the instruments presented above in a first stage) on domestic sales, controlling for domestic demand:

$$\ln X_{it} = \alpha \ln FD_{it} + \delta \ln DD_{it} + \mu_i + \lambda_{kt} + u_{it} \tag{4}$$

$$\ln Y_{it} = \beta \ln \widehat{X}_{it} + \gamma \ln DD_{it} + \mu_i + \lambda_{kt} + \varepsilon_{it} \tag{5}$$

Where $\ln \widehat{X}_{it}$ is the predicted value of log exports from (4). We expect γ to be positive. We estimate (4) and (5) by two-stage-least-squares (2SLS).[17] In all estimations, standard errors are

[16] As mentioned below, we have checked the robustness of our results with various alternative definitions of weights, including weights computed at the sectoral level or at the beginning of the period. See subsection "Weights" below.

[17] Note that our results are unchanged when the two-way relationship between export and domestic sales is jointly estimated using 3SLS, allowing for residual correlation across equations. Results are available upon request. In general, we do not estimate jointly the two-way relationship between foreign and domestic sales as we do not have - apart from DD_{it} - enough instruments for domestic sales to be able to study comprehensively the effect of

robust to heteroscedasticity and clustered at the 2-digit sector level.

What are the threats to identification? Our instrument is valid if and only if $\text{cov}(FD_{it}, \varepsilon_{it}) = 0$. This condition would most probably fail to be satisfied if we were to omit DD_{it} from the estimation, as DD_{it} and FD_{it} are likely to be correlated. We therefore want to ensure that β is not capturing some unobserved correlation between domestic demand and FD_{it}. Put differently, we want our proxy for domestic demand, DD_{it}, to capture the part of FD_{it} which is correlated with domestic demand conditions. Note that DD_{it} does not need to fully reflect changes in domestic demand, but only the part of the domestic demand being correlated with the instrument. Assume domestic demand has two parts: one stemming from global shocks, and therefore correlated with FD_{it}, another coming from shocks specific to the French market, uncorrelated with FD_{it}. We do not observe the latter, but we observe the former as these global shocks appear in the French imports of good k. Our proxy for domestic demand will capture the part of domestic demand that is correlated with global shocks.

An issue with DD_{it} is that we do not observe the firm's domestic product mix, and therefore assume that it is the same (on average) than on the export market. What if these product mixes are different? If they are completely orthogonal, foreign and domestic demand variations should be uncorrelated. If they are partly the same, our domestic demand proxy will precisely capture the part of domestic demand which is correlated with foreign demand. However, to further ensure that this potential difference in product mixes across domestic and foreign markets is not an issue, we run a number of robustness checks in which we focus on single-product exporters, and control for product×year dummies (see Table 7 below). These dummies will directly capture domestic demand variations without having to include a proxy for it. We will also show that our results hold equally for countries in which business cycles are correlated with the French ones, and for the others (see Table 9 below).

Another potential problem is that DD_{it} might capture domestic demand for foreign varieties, not for the French ones. Imagine there is a world increase in the demand for the French varieties of a given product. FD_{it} would increase – as they include imports from France –, and so would X_{it} and Y_{it}. There are two ways to ensure that this is not driving our results. First, we can again run estimations on single-product exporters, controlling for product×year dummies. Second, we can drop imports from France from the computation of the instrument. As shown later in Table 17 in the appendix of the paper, when we do so, we obtain almost exactly the same results as in our baseline estimations.

Could β capture supply shocks rather than demand variations? Imagine that there is a worldwide supply shock decreasing production costs of a given product. FD_{it}, X_{it} and Y_{it} increase simultaneously. But again, this is perfectly captured by our domestic demand proxy DD_{it}, which increases as well. What if the supply shock occurs only in France? Indeed, the instrument, export and domestic sales would increase all at once. But again, dropping imports from France from the computation of the instrument, or running estimations on single-product firms with product-year fixed effects solve the problem. Supply side conditions are therefore unlikely to drive our results.

Alternative instruments. Our baseline identification strategy requires that we are able to

domestic sales on exports.

properly capture the correlation between our baseline instrument and domestic demand (or supply) conditions. As explained above, the various robustness checks we perform makes us confident that this is the case. We nevertheless pursue an alternative strategy to show that our results indeed reflect foreign demand variations, and that the precise source of these does not matter. More specifically, we construct a number of alternative instruments which are clearly orthogonal to domestic conditions. These alternative instruments also allow us to test for overidentifying restrictions.

First, we build a measure of firm-specific tariffs faced by French exporters, which depend on the destinations they serve and products they export. It is constructed essentially in the same way as FD_{it} above, but using tariffs instead of imports. Tariffs are arguably more exogenous because they are less correlated with domestic conditions. However, this instrument is weaker as tariff variations are limited over the period. Second, we make use of the occurrence of large (negative) shocks, such as civil wars or the 1997-98 Asian crisis, to show that our results hold whatever the source of variations in foreign demand. Finally, we also show that our results remain robust when we use as an instrument a firm-specific, time-varying proxy of transportation costs constructed following Hummels *et al.* (2013). This variable is built from variations in transport mode, oil price and distance to destination countries. More details about the computation of these variables are provided later in the paper, as well as in the data appendix. These alternative instruments capture very distinct shocks, and are clearly uncorrelated with domestic business cycles (especially foreign civil wars).[18] Yet, they yield very similar results.

Using alternative instruments allows us to perform Hansen's J-test of overidentifying restrictions. Insignificant test statistics indicate that the orthogonality of the instruments and the error term cannot be rejected; thus, our choice of instruments is appropriate on that ground. As shown later, the overidentifying restrictions cannot be rejected. Finally, we performed the Durbin-Wu-Hausman test for exogeneity of regressors. Unsurprisingly, the null hypothesis of exogeneity is rejected in most cases.[19] This clearly shows that we need to use IV methodologies to identify exogenous variations of exports. In all estimations, we report the F-stat form of the Kleibergen-Paap statistic, the heteroskedastic and clustering robust version of the Cragg-Donald statistic suggested by Stock and Yogo (2005) as a test for weak instruments. Most statistics are comfortably above the critical values, confirming that our instruments are strong predictors of export sales.

Weights. A last issue might be that our instruments reflect firm characteristics which might jointly determine sales across different markets (in the same direction or not). Our baseline instruments contain two parts: (i) a foreign shock (imports, tariffs, civil wars, financial crises) which is unlikely to be correlated with firm-specific characteristics; (ii) weights which are potentially correlated with firm-specific characteristics. Here endogeneity concerns might remain, for the following reason. Eaton *et al.* (2011), among others, have shown that firms with higher productivity self-select into the most difficult markets. If these are markets which on average grow faster, then our baseline instrument might be correlated with firm productivity. Our estimations

[18] This is supported by the fact that the domestic sales variable DD_{it}, whether included or not, does not affect the coefficient on the export sales variable when the latter is instrumented by tariffs or civil wars; this clearly suggests that these variables are uncorrelated with domestic business cycle.

[19] Detailed results of these tests available upon request.

include firm-fixed effects which account for the average growth in the foreign markets served by the firm. What remains is the issue of the weights: the weights in our baseline specification are averages over the period. This might be problematic if, say, because of good productivity shocks a given year, the firm decides to export more to the faster-growing markets: this would mean that our instrument is positively correlated with productivity. But this can be remedied by constructing the weights at the beginning of the period: we will show that the results are actually very similar in this case, and the only reason we choose the average weights is to improve the strength of the instruments and therefore the efficiency of the estimation.[20]

A last possibility is that even weights computed at the beginning at the period are endogenous to some extent, as firms may have rational expectations about future growth, so that firms with expected productivity growth self-select into markets with growing future demand. To address this issue, we will show that our results remain robust to (i) the use of weights computed at the sectoral level, or at the sector-location level; (ii) concentrating on firms which exports only to relatively similar destinations (EU, OECD countries) in which self-selection is less of an issue.

4 Main Results

4.1 Export-domestic sales: OLS results

We start with a simple estimation of Equation (5) by OLS where the firms' domestic sales are explained by export sales and a set of controls for the domestic market conditions, firm fixed-effects and year dummies (alternatively with sector × year dummies). This specification offers a benchmark estimation of the relationship between domestic and foreign sales, which can be compared to our preferred estimations (presented in the following tables) where export sales are instrumented by foreign market demand.

Table 3 presents the results of the estimation in levels (column 1 to 4) and in first differences (columns 5 to 8). Domestic market conditions are controlled for by using a measure of the domestic demand addressed to the firm (ln Domestic demand$_{it}$ as defined by (3)), and, when the sector × year dummies are not included, the number of firms that operate in the same industry (ln Number of firms$_{kt}$) and the industry domestic sales (ln Industry domestic sales$_{kt}$). Our domestic demand proxy has positive and significant effect on domestic sales, as expected. The results show that the correlation between domestic and foreign sales is either insignificant or slightly negative depending on whether estimates are based on levels or first differences. When significant, the elasticity of domestic sales to exports is extremely small: a 10% increase in exports is associated with a 0.3% decline in domestic sales on average in columns (5) to (8). This echoes the findings of the literature, which finds negative but quantitatively small correlations when using similar specifications. The papers containing results directly comparable to ours are Ahn and McQuoid (2012) and McQuoid and Rubini (2014). The former find negative but quantitatively limited coefficients – around 0.08 in absolute terms.[21] The latter find a correlation

[20] Note also that in unreported regressions we use binary weights, i.e. only summed imports of the destinations-products served by the firm during the first year it exported. The results were very similar. We have also dropped the destination-specific dimension from the weights altogether (therefore computed initial weights by product) and again, the results were qualitatively similar.

[21] The relationship becomes quantitatively stronger only when the authors control for employment or TFP. This is expected as it implicitly constrains firm size and its ability to increase capacity when demand expands. This

Table 3: Export and domestic sales: correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.	ln Dom. sales				Δ ln Dom. sales			
ln Export sales$_{it}$	-0.001	-0.001	-0.007	-0.007^{c}				
	(0.004)	(0.004)	(0.004)	(0.004)				
ln Domestic demand$_{it}$	0.143^{a}	0.152^{a}	0.151^{a}	0.157^{a}				
	(0.023)	(0.019)	(0.024)	(0.020)				
ln Number of firms$_{kt}$	0.344^{a}		0.335^{a}					
	(0.112)		(0.121)					
ln Industry domestic sales$_{kt}$	0.139^{b}		0.129^{b}					
	(0.056)		(0.052)					
Δ ln Export sales$_{it}$					-0.027^{a}	-0.027^{a}	-0.033^{a}	-0.033^{a}
					(0.003)	(0.003)	(0.004)	(0.004)
Δ ln Domestic demand$_{it}$					0.140^{a}	0.126^{a}	0.140^{a}	0.121^{a}
					(0.021)	(0.020)	(0.031)	(0.030)
Δ ln Number of firms$_{kt}$					0.161^{b}		-0.005	
					(0.073)		(0.060)	
Δ ln Industry domestic sales$_{kt}$					0.072^{a}		0.054^{b}	
					(0.026)		(0.022)	
Observations	143515	143515	107113	107113	107113	107113	107113	107113
Firm FE	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Year dummies	Yes	No	Yes	No	Yes	No	Yes	No
Sector × year dummies	No	Yes	No	Yes	No	Yes	No	Yes

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. Columns (3) and (4) contains the results of estimations similar to (1) and (2), ran on the sample of columns (5) to (8)

which depends on the type of exporters: it is actually positive and significant for permanent exporters.

As mentioned in section 3, the fact that the OLS coefficients shown in Table 3 are slightly negative or close to zero is consistent with the existence of an attenuation bias or of a negative bias in OLS estimations. These coefficients can reflect the correlation between a variety of idiosyncratic or aggregate supply and demand shocks. They are also likely to be affected by measurement error. In the rest of the paper, we shall use the aforementioned instruments to estimate the effect of an exogenous change in exports on domestic sales, originated by a variation of foreign demand.

4.2 Baseline results

We present in Table 4 the results of the 2SLS estimations, in which foreign sales are instrumented by measures of foreign demand addressed to the firm (see table 15 in the appendix for the first stage results of these estimations). In the first five columns, all variables are expressed

is also the case in Vannoorenberghe (2012), who performs the reciprocal estimation, i.e. he regresses residual growth rates of exports on residual growth rates of domestic sales. He finds negative but quantitatively small effects (between -0.05 and -0.08), which once again become more sizeable when he controls for firms' capital stock and/or firm fixed effects - the latter controlling for firm-specific trends in the evolution of production capacities.

in levels and export sales are instrumented using foreign demand in firms' markets (FD_{it}, as defined in equation (2)). Column (1) includes year dummies and controls for additional variables that identify sector-specific domestic business cycle: the industry domestic sales and the number of domestic firms operating in the same industry. In columns (2) to (5), and in the rest of the paper, sector×year dummies are included instead. Estimation (3) which controls for the domestic demand addressed to the firm due to product-specialization is our preferred specification. Column (4) includes an additional interaction term between export sales and the export share of the firm, computed the first year the firm exports in our sample. We expect that a higher exposure to foreign demand shocks (higher export share) will magnify the effect of changes in exports on domestic sales. Column (5) uses the foreign demand for the core (HS4) product exported by the firm (FD_{it}^{core} as defined above) as the instrument for exports.

Table 4: Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Estimator	2SLS					2SLS	
Dep. Var.	ln dom. sales					Δ ln dom. sales	
ln Export sales$_{it}$	0.133^{a}	0.213^{a}	0.143^{a}	0.031	0.177^{a}		
	(0.030)	(0.026)	(0.026)	(0.023)	(0.033)		
ln Number of firms$_{kt}$	0.290^{a}						
	(0.083)						
ln Industry domestic sales$_{kt}$	0.115^{b}						
	(0.047)						
ln Domestic demand$_{it}$	0.109^{a}		0.117^{a}	0.122^{a}			
	(0.022)		(0.018)	(0.018)			
ln Export sales$_{it}$× export ratio$_{i0}$				0.515^{a}			
				(0.126)			
ln Dom. demand main prod.$_{it}$					0.093^{a}		
					(0.016)		
Δ ln Export sales$_{it}$						0.214^{a}	0.323^{a}
						(0.046)	(0.083)
Δ ln Domestic demand$_{it}$						0.088^{a}	0.076^{a}
						(0.014)	(0.017)
Observations	143515	143515	143515	143515	143515	107113	101414
Firm FE	Yes	Yes	Yes	Yes	Yes	No	Yes
Year dummies	Yes	No	No	No	No	No	No
Sector × year dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap stat.	102.24	109.62	104.06	62.27	68.45	45.53	18.15

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations but (6) (first differences) include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. The instruments are the following. In columns (1), (2),(3), (4), (6), (7): foreign demand in HS6 products exported by the firm (FD_{it} in the main text) - instruments taken in first difference in columns (6) and (7); in column (5): foreign demand for the core (HS4) product exported by the firm (FD_{it}^{core} in the data appendix). See Table 15 for the first stage of these regressions.

The estimation results contrast with those presented in Table 3. Changes in firm exports, as predicted by changes in foreign demand, are positively related with the variations of the domestic sales by the firm. This result is stable when we introduce industry×year dummies to better control for sector-specific shocks that may affect firm-level sales simultaneously in the

domestic and export markets (column (2) to (5)). Controlling for the domestic demand addressed to products exported by firms tends to reduce the estimated β coefficient as expected, but it remains positive and highly significant. Similarly, using as an alternative instrument the foreign demand addressed to the core product of the firm, while still controlling for the domestic demand addressed to the core product, leaves our estimate of the β coefficient unchanged (column (5)). In all cases, the strength of our instruments is confirmed by the Kleibergen-Paap statistics. Given the first stage coefficients (Table 15, column (3)), a 10% increase in foreign demand is found to generate a 4% increase in exports, which in turn implies a 0.5-0.6% increase in domestic sales.

Interestingly, the firms which are more exposed to export variations - as measured by their beginning-of-period ratio of exports over total sales - react significantly more to changes in exports.[22] No effect is found for firms with an export share close to zero, while firms exporting a third of their total sales increase their domestic sales by around 2% following a 10% increase in exports. While this result is intuitive, and would fit with most transmission mechanisms, it also suggests that the correlation of demand shocks across domestic and foreign markets is not driving our results: indeed, if we were unable to properly capture changes in domestic demand, the coefficient on export sales would be picking up the correlation between domestic and foreign demand shocks, but we would not expect this coefficient to depend on the firms' export ratio.

Columns (6) and (7) in Table 4 report the estimation results of the relationship between domestic and foreign sales, when all variables are expressed in first differences - the first difference of Export sales is therefore instrumented with the first difference of FD_{it}. Both estimations include sector×year dummies, and estimation (7) also contains firm fixed effects. These alternative specifications confirm that an increase in export sales, consecutive to an improvement in foreign demand conditions, raises domestic sales.[23] Overall, results from columns (1) to (7) suggest that a 10% exogenous increase in exports generates between 1.5 and 3% increase in domestic sales.[24]

Table 17 in the appendix shows that our results are almost identical when we remove imports from France from the computation of our baseline instruments. Therefore, our findings are not driven by supply shocks specific to the French market and affecting simultaneously domestic sales, exports and our instrument.

We now run a number of robustness checks to ensure that we are indeed capturing the causal effect of exogenous changes in export, driven by foreign demand variations, on firms' domestic sales.

[22] This can also be seen in in Figure A.1 in the online appendix, where we plot the coefficient on export sales for different bins of export ratio$_{i0}$.

[23] These results also demonstrate that our estimates are not influenced by non-stationarity in the data that we use. In particular, estimates in first-difference with firm fixed effects in column (7) corrects implicitly for potential firm-specific trend.

[24] As can be seen in the next sections and in Tables A.1 to A.4 of the online appendix, our results are extremely robust to the use of a first-differences estimator. We however keep as our baseline specification the estimation in levels, as it is more precise, which has some importance as we will check the robustness of our results to very restrictive specifications or samples, and to the use of instruments, such as import tariffs, which exhibit little variations over our time period. Moreover, our first differences residuals exhibit substantial negative serial correlation, as can be seen in Table A.1, which suggests that the fixed effects estimator is more efficient (Wooldridge, 2002).

4.3 Robustness: instrumentation strategy

Our econometric strategy relies on two identifying assumptions. The first is that, while we can plausibly consider changes in foreign total imports in a given product as exogenous to a given French firm[25] , one may argue that these imports are correlated with domestic demand, which is itself imperfectly captured by our domestic demand proxy DD_{it} since we do not observe the set of products sold by the firms on the domestic market. The second assumption, with which we will deal thereafter, relates to the exogeneity of the firm-level weights used to compute the instruments.

Alternative instruments. A first way to get around the first issue is to use alternative instruments which are less likely to be correlated with French demand variations. This also allows us to test for overidentifying restrictions and to show that the precise type of exogenous foreign shocks considered does not matter for the results. We construct two sets of alternative instruments, which construction is provided in full details in the data appendix.

As a first alternative instrument, we compute firm-specific tariffs, based on the products and destinations served by the firm. This instrument is computed exactly in the same way as FD_{it} in equation (2), but uses the multilateral (MFN) tariffs of destination j for (HS6) product p instead of imports. All instruments are described in full details in the data appendix. This instrument is arguably more exogenous, but also weaker as tariff changes over the period are limited. As a second alternative instrument, we compute variables reflecting the firm's exposure to civil wars in its destination countries. We define two variables: (i) a dummy variable that equals 1 if at least one of the destinations to which the firm exported in $t-1$ experiences a civil war in year t; and (ii) a variable representing the exposure to civil wars which equals the number of wars in the destinations served by the firm, weighted by the share of exports in these destinations in $t-1$.

Table 5 displays the results.[26] In addition to our baseline instrument, tariffs (column (1)) and exposure to civil war (column (2)) are used as additional instruments for exports. The Hansen tests of overidentifying restrictions cannot reject the exogeneity of our instruments in both cases, and the coefficients on exports sales are largely unaffected. Note that the number of observations is lower because we removed from the sample the firms that export only to countries in which there is no tariff variation over the period (this includes in particular EU countries) or for which information on the occurrence of civil wars is missing.

Estimations in columns (3) to (8) use our alternative instruments alone. We include both firm-specific tariff and its lag in columns (3) and (4) to test for overidentifying restrictions. Columns (5) and (6) contain the results using both the binary and the continuous proxies for firm-specific exposure to civil wars as instruments. Column (7) and (8) use both contemporaneous tariffs and exposure to civil wars as instruments. Once again, in all estimations, the Hansen test cannot reject our overidentifying restrictions, and the coefficient on export sales is positive and significant in all cases. The coefficients are found to be quantitatively larger in the estimations

[25]This is investigated in Table A.10 in the online appendix, in which we drop from the construction of the instruments the destinations-products for which the market share of France goes beyond various thresholds. In the most restrictive specification (column (4)), we drop all product-destinations for which France has a market share above 5%. Our results are qualitatively unchanged, if not slightly strengthened.

[26]Table A.1 in the online appendix reproduces these estimations using first differences.

Table 5: Alternative instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	2SLS							
Dep. Var.	ln domestic sales							
ln Export sales$_{it}$	0.158^{a}	0.148^{a}	0.351^{c}	0.365^{b}	0.209^{a}	0.203^{a}	0.269^{c}	0.283^{b}
	(0.029)	(0.027)	(0.180)	(0.180)	(0.046)	(0.045)	(0.140)	(0.137)
ln Domestic demand$_{it}$	0.126^{a}	0.119^{a}		0.089^{c}		0.108^{a}		0.094^{b}
	(0.024)	(0.017)		(0.048)		(0.017)		(0.044)
Observations	118077	114514	85163	85163	114514	114514	95625	95625
Sector × year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instruments	FD_{it}+Tariffs	FD_{it}+CW	Tariffs		Civil War		Tar.+CW	
Hansen P-value	0.54	0.62	0.19	0.20	0.95	0.87	0.89	0.91
Kleibergen-Paap stat.	61.37	44.58	2.03	2.15	56.55	54.98	3.50	3.79

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 19.9 in all estimations. See main text and appendix for a more detailed description of the instruments. See Table 16 for the first stage of these regressions.

using tariffs as instruments, but our estimates are also less accurate. These results suggest that, whatever the (exogenous) shock causing them, variations of exports are positively related to the variation of domestic sales.

Interestingly enough, we can see by comparing columns (3) and (4), (5) and (6) or (7) and (8) that the inclusion of the domestic demand term has almost no impact on the size of the export sales coefficients, contrary to what happened in Table 4. This was to be expected as these estimations use instruments (MFN tariffs and civil wars) which are largely uncorrelated with French demand shocks. Finally, note that these alternative instruments have the expected effect on exports, as shown in the Table 16 in the appendix, which reports the first stage coefficients.[27]

Table 6 presents an additional robustness check using an adapted version of the instruments used in Hummels *et al.* (2013), who construct a firm-specific transport cost based on transportation mode, oil price, and distance to the destination markets. As we do not have direct information on the mode of transportation, we use destination-specific data on the main transportation mode (air, rail, road, sea) used in the sector in which the product is classified from Cristea *et al.* (2013). More details about the computation of this instrument is provided in the data appendix and in Hummels *et al.* (2013). The fact that we do not have direct information on the transport mode of the firm but rely on a sector-destination specific proxy implies that we do not expect this instrument to be as strong as in Hummels *et al.* (2013). On the other hand, it is clearly orthogonal to domestic demand conditions. The results are presented in Table 6 (see Table 16 in the appendix for first stage results). The first two columns use the transport cost

[27]Our results are unchanged when we restrict our sample to the firms which export continuously over the period (Table A.6 in the online appendix, columns (1) to (4)). Therefore, firms close to bankruptcy, which could decrease simultaneously both exports and domestic sales, do not drive our results. When concentrating on occasional exporters (columns (5) to (8)), i.e. firms which enter the export market several times over the period, our results remain similar: the coefficient on export sales becomes statistically insignificant only when we use tariffs alone as an instrument (column (6)), which is explained by the extreme weakness of the instrument in this case.

Table 6: Additional alternative instrument: transportation costs

	(1)	(2)	(3)	(4)	(5)
Estimator			2SLS		
Dep. Var.			ln domestic sales		
ln Export sales$_{it}$	0.258^{c}	0.247^{c}	0.177^{a}	0.321^{c}	0.173^{a}
	(0.137)	(0.136)	(0.029)	(0.166)	(0.045)
ln Domestic demand$_{it}$		0.098^{a}	0.114^{a}	0.080^{c}	0.113^{a}
		(0.032)	(0.018)	(0.048)	(0.016)
Observations	89743	89743	89743	80410	73150
Sector × year dummies	Yes	Yes	Yes	Yes	Yes
Instruments	τ_{it}	$\tau_{it} + FD_{it}$	τ_{it}+Tar.	τ_{it}+CW	
Hansen P-value	-	-	0.11	0.66	0.40
Kleibergen-Paap stat.	6.78	6.50	71.17	3.49	31.14

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 19.9 in all estimations. See main text and appendix for a more detailed description of the instruments. See Table 16 for the first stage of these regressions.

instrument alone, and columns (3)-(5) add our other instruments separately. As expected, the estimates are more imprecise which is a direct consequence of the weakness of the instrument. Our results are however confirmed in all estimations.

Single-product firms. In the case of our baseline instrument, we can perform an additional robustness check to ensure that we capture properly domestic demand variations. The main potential issue is that we do not have information on the set of products sold domestically by the firms. If these are different from the exported products but face correlated demand shocks (as otherwise our instrument would still be valid), our instrument could be picking up changes in domestic demand, which would explain the positive coefficient found on export sales. Also, sector-year fixed effects do not fully control for the exact composition of products of the firm, and imperfectly capture domestic demand or supply shocks that could be correlated with our instruments.

We pursue a number of alternative strategies to ensure that this is not biasing our estimates. First, we restrict our sample to single-product firms. It is all the more likely that these firms are selling the same product at home and away. We define a product at the HS4-level (which contains around 1,400 products), and consider both firms that are entirely single product over the period and firms for which more than 99% of export is single-product.[28]

The results from these estimations are provided in Table 7, columns (1) to (4). We use as instruments in these estimations the weighted foreign demand for the firms' main product

[28]We do so because very few firms are single-product over our entire period. Most firms are exporting at least once, to a given destination, more than one product (as our dataset does not contain very small firms which are more likely to be single-product, the problem is exacerbated). Changes in product classification might also lead to observe artificially multi-product firms. At the HS4 level, considering only entirely single-product firms leaves us with only 7% of our initial sample (this figure drops to 3.5% when a product is defined at the 6-digit level). Considering firms which are single-product at 99% or more doubles this number. This is important as we include in some estimations both firm fixed effects and product×year dummies, which leaves us very few degrees of freedom.

Table 7: Robustness: single-product firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	2SLS				2SLS			
Sample	Single HS4				Main sector			
Restriction	100%	100%	100%	>99%	100%	100%	100%	>99%
Dep. Var.	Domestic sales[1]				Domestic sales[1]			
ln Export sales$_{it}$	0.146^{b}		0.149^{c}	0.313^{a}	0.145^{a}		0.161^{b}	0.162^{a}
	(0.074)		(0.086)	(0.079)	(0.047)		(0.080)	(0.035)
ln Domestic demand core HS4$_{it}$	0.215^{a}			0.151^{b}				
	(0.050)			(0.060)				
ln Domestic demand core prods.$_{it}$					0.103^{a}		0.079^{a}	0.113^{a}
					(0.025)		(0.022)	(0.018)
Δ ln Export sales$_{it}$		0.099				0.210^{b}		
		(0.064)				(0.106)		
Δ ln Domestic demand core HS4$_{it}$		0.186^{a}						
		(0.033)						
Δ ln Domestic demand core prods.$_{it}$						0.103^{a}		
						(0.026)		
Observations	7302	5002	7302	16996	11359	8022	11359	24716
Firm FE	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Sector-year FE	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Product-year FE	No	No	Yes	No	No	No	Yes	No
Kleibergen-Paap stat.	10.88	10.01	8.19	22.58	21.84	8.26	10.96	74.55

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 in all estimations. [1]: ln domestic sales or Δ ln domestic sales in columns (2) and (6). Columns (1)-(4): instrument is the foreign demand for the core HS4 product of the firm (FD_{it}^{core} in the data appendix -taken in first difference in column (2)). Columns (5)-(8): instrument is the foreign demand for the firm's products falling into the main 4-digit sector of activity of the firm.

in the destinations it serves (see data appendix). Columns (1) to (3) restrict the sample to firms which are entirely single-product over the 1995-2001 period, and column (4) contains firms for which the main exported product represents at least 99% of total trade value over the period. Column (1) and (4) replicate our baseline specification, while column (2) presents first differences estimates. Column (3) contains the most demanding specification, which includes HS4 product×year dummies instead of sector-year dummies. In this specification, we identify exogenous export variations through demand differentials across the various destinations served by the firm for a given exported product. Note however that the number of observations is much smaller than in our previous estimates based on the full population of exporters, and the number of degrees of freedom is also considerably reduced given the large number of fixed effects (especially in column (3) where HS4 product-year fixed effects are used).

Our coefficient of interest is within the range 0.1 to 0.3, quantitatively close to our baseline estimates. It is significant at the 1, 5 or 10% level in all specifications but column (2) with first difference estimations, where the coefficient remains positive and close to the 10% significance threshold (the p-value is equal to 0.12 - note that the coefficient becomes significant at the 10% level if we drop extreme values of export sales variations). Note also that our instruments are

much weaker than in our baseline estimations, which explains why the statistical significance of the coefficients is generally smaller. On the other hand, it is reassuring to note that the size of the coefficients remain similar to our baseline estimates.

It can well still be the case that firms that are selling a given single product on the export market sell a different one on the domestic market. An alternative methodology is to consider those firms which export only in the sector of activity they declare as their main sector (defined at a 4-digit level, i.e. 700 sectors) in the balance sheet data. Again, we consider two cases: firms which export products always classified as belonging to their main sector of activity, and firms for which more than 99% of the total export value is made by products belonging to their main sector of activity. In these estimations, we drop the firms which have an export ratio larger than 50% as in this case the main sector of activity of the firms might be defined according to the product exported and not to the ones sold domestically. The results are shown in Table 7, columns (5) to (8). We still lose a lot of observations, but the coefficients remain very similar to our baseline results. This is true for fixed-effects estimations (columns (5) and (8)), first-differences (columns (6)), and even for estimations in which we include 4 digit sector-year dummies (column (7)).[29]

Endogenous weights. Our instrumentation strategy relies on a second identifying assumption: the firm-specific weights used in the computation of our instruments should be uncorrelated with potential determinants of domestic sales. As mentioned above, a potential problem arises if the firms with growing productivity (and therefore domestic sales) self-select into fast growing markets (e.g. China). However, as shown in Table 8, our results are robust to the use of alternative weights in the computation of the instruments. In Table 8, columns (1) to (3), we use weights computed the first year the firm exports. In columns (4) to (6), we use the first two years. In all cases, the instruments are somewhat weaker than in our baseline estimates, which leads to more noisy estimates, but in all columns the effect of exogenous changes in export sales remains positive and significant.[30] Note that this is also the case when dropping from the estimations the years used for the computation of the weights (columns (2) and (5)). Our results though remain unaffected by the use of the initial weights in the construction of the instruments. This clearly suggests that we are not capturing changes in firm characteristics, but rather exogenous changes in foreign demand condition.[31]

In columns (1) to (4) of Table 9, we pursue an alternative strategy and construct weights using only sector-specific or sector×location-specific information. In column (1), the weights are

[29] A last test that we performed to ensure that international business cycle correlation was not driving our results was to separate our sample into firms exporting to destinations which have cycles more or less correlated with the French one. Columns (1) and (2) of Table A.5 in the online appendix shows that whether the firm exports a lot (above the sample median) to EU-15 countries or not does not affect the estimated coefficient. If the correlation between foreign and domestic business cycles was driving our results, the coefficient on exports should be higher for firms more exposed to the EU market, as business cycles are expected to be more synchronized. The same Table (columns (3) and (4)) shows that our results holds for exporters regardless of their level of export diversification.

[30] The Kleibergen-Paap statistic is reduced in estimations using weights in the beginning of the period for the construction of instruments, compared to estimation results reported in Table 4. This is all the more the case when we use our alternative instruments (e.g. tariffs) or when we test the channels of transmission.

[31] As mentioned earlier, in unreported regressions we used binary weights, i.e. only summed trade on the destinations served by the firm during the first year it exported. The results were very similar. We have also dropped the destination-specific dimension from the weights altogether (therefore computed initial weights by product) and again, the results were qualitatively similar. All these robustness checks are available upon request.

Table 8: Baseline results, robustness with different weights

	(1)	(2)	(3)	(4)	(5)	(6)
Estimator	2SLS			2SLS		
Dep. Var.	ln dom. sales		Δ ln dom. sales	ln dom. sales		Δ ln dom. sales
Weight	First year			First two years		
Sample	All	excl. 1^{st} year	All	All	excl. $1^{st}/2^{nd}$ years	All
ln Export sales$_{it}$	0.196^a	0.229^a		0.158^a	0.269^a	
	(0.043)	(0.055)		(0.027)	(0.061)	
ln Domestic demand$_{it}$	0.078^a	0.074^a		0.098^a	0.083^a	
	(0.013)	(0.014)		(0.014)	(0.016)	
Δ ln Export sales$_{it}$			0.204^a			0.179^a
			(0.067)			(0.052)
Δ ln Domestic demand$_{it}$			0.057^a			0.075^a
			(0.010)			(0.011)
Observations	143231	109971	106914	143465	80899	107078
Firm FE	Yes	Yes	No	Yes	Yes	No
Sector × year dummies	No	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap stat.	33.50	28.11	34.19	62.82	23.87	46.63

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations but (3) and (6) (first differences) include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. The instruments are the following. In columns (1) to (3): foreign demand in HS6 products exported by the firm with weights computed the first year the firm exports - instrument taken in first difference in column (3); in column (4) to (6): foreign demand in HS6 products exported by the firm with weights computed the first two years the firm exports - instrument taken in first difference in column (6). See Table 16 for the first stages estimates and the data appendix for more information on the instruments' construction.

computed at the 3-digit sectoral level. In column (2), we use frequency weights computed by sector. Columns (3) and (4) constructs weights by sector and location (French "departement"). The details of the computations of the instruments are provided in the data appendix. Column (4) additionally controls for location×year dummies. While the estimates are, as expected, more noisy (as these weights represent more imperfectly the firms' specialization), our coefficients of interest remain very close to our baseline estimates, and significant at least at the 10% level in all estimations.

Finally, to ensure that self-selection into fast growing markets is not biasing our results, we have restricted our sample to firms exporting only to EU or OECD countries, or which do not export to the BRICs (Brazil, Russia, India, China). The results are provided in columns (5) to (8). The coefficient decreases slightly compared to our baseline estimates but remains significant at the 5% or 1% level despite the much lower number of observations.[32]

Overall, in all specifications where firm-level exports are explained by variations of the foreign demand, and therefore not affected by firm-level idiosyncratic shocks, we find that the β coefficient is positive: exogenous changes in firm-level exports are positively related to variations of firms domestic sales.

[32]Note that these sample contain firms which export to "easier" markets and have therefore a lower export ratio than the average firm. This can contribute to explain the lower coefficient that we find.

Table 9: Robustness: selection

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	2SLS				2SLS			
Dep. Var.	ln dom. sales				ln dom. sales			
Weigths / Sample	Sector	Sector	Sector-location		EU dest. only	EU dest.>90%	OECD> 90%	No BRIC
ln Export sales$_{it}$	0.202^{c}	0.244^{b}	0.222^{b}	0.172^{c}	0.112^{b}	0.135^{a}	0.113^{a}	0.137^{a}
	(0.112)	(0.104)	(0.105)	(0.097)	(0.055)	(0.046)	(0.029)	(0.027)
ln Domestic demand$_{kt}$	0.101^{a}	0.081	0.095^{a}	0.104^{a}				
	(0.035)	(0.100)	(0.036)	(0.035)				
ln Domestic demand$_{it}$					0.080^{a}	0.093^{a}	0.117^{a}	0.105^{a}
					(0.018)	(0.017)	(0.016)	(0.019)
Observations	138469	138469	137715	137715	22354	43567	82435	114509
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector×year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location×year dummies	No	No	No	Yes	No	No	No	No
Kleibergen-Paap stat.	23.81	17.13	12.53	13.02	20.30	42.15	120.96	72.47

Robust Standard errors, clustered by 3-digit industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. In columns (5) to (8), foreign demand in HS6 products exported by the firm (FD_{it} in the main text) used as instrument. Columns (1) and (2) use instruments in which the weights are computed by sector instead of firm; columns (3) and (4) use instruments in which the weights are computed by sector-location instead of firm. See Table 16 for the first stages estimates and the data appendix for more information on the instruments' construction. Column (5) concentrate on firms exporting only to the EU-15; column (6) on firms exporting at least 90% to the EU; column (7) on firms exporting at least 90% to OECD countries; finally, column (8) drops firms exporting to BRICs.

4.4 More robustness

Imports. Recent papers have shown that offshoring may exacerbate international business cycle correlation.[33] Another potential bias may arise in our estimations if firms export and import products from the same destination. The positive effect of foreign shocks on domestic sales could in this case be partly due to better or cheaper access to foreign inputs. Our firm-level customs data also contain information on firm-product-country specific imports, so that we can explicitly control for this channel in our estimations. We therefore include the firms' imports as a control variable in our estimation. This variable is either simply included as a control in the second stage equation or instrumented using the foreign supply addressed to the firm according to its product structure of imports (FS_{it}): foreign exports by country-product are weighted by the share of each country-product pair in each firm's imports (see data appendix for more details).

Table 10 reports the estimation results that control specifically for firms' predicted imports. Columns (1) to (5) differ in terms of the instruments used for export sales: foreign demand in the HS6 product exported by the firm (columns (1) and (2)), foreign demand for the core (HS4) product exported by the firm (columns (3), (4) and (5)), firm-specific tariffs (column (4)) or exposure to civil war (column (5)). Imports are instrumented in all estimations but column (1). In these augmented specifications, the effect of export decreases slightly in column (2), but remains positive and significant at the 1% level in all specifications. The coefficient estimate of exports varies between 0.1 and 0.2, quantitatively close to our baseline results.

Services. A first measurement issue might arise if firms export both goods and services. If

[33] See Bergin *et al.* (2009) and Burstein *et al.* (2008).

Table 10: Robustness: imports

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	ln domestic sales				
ln Export sales$_{it}$	0.143^a	0.087^a	0.152^a	0.144^a	0.142^a
	(0.026)	(0.030)	(0.032)	(0.033)	(0.037)
ln Domestic demand$_{it}$	0.117^a	0.099^a			
	(0.018)	(0.019)			
ln Imports$_{it}$		0.090^a	0.080^a	0.082^a	0.094^a
		(0.019)	(0.017)	(0.024)	(0.022)
ln Dom. demand main prod.$_{it}$			0.077^a	0.082^a	0.093^a
			(0.017)	(0.016)	(0.017)
Observations	143515	143515	143515	114514	92456
Sector × year dummies	Yes	Yes	Yes	Yes	Yes
Instruments	FD_{it}	FD_{it}	FD^{core}_{it}	FD^{core}_{it} + Tar.	FD^{core}_{it} + CW
Hansen p-value	-	-	-	0.95	0.44
Kleibergen-Paap stat. /	104.06 /16.4	15.21/7.0	17.81/7.0	4.13/7.6	9.33/7.6

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. The critical values for the weak instruments test are based on a 10% 2SLS bias at the 5% significance level. The instruments are the following: in columns (2) to (5), foreign supply in HS6 products imported by the firm (BC^M_{it} in the main data appendix); in columns (1) and (2) foreign demand in HS6 products exported by the firm (FD_{it} in the main text); in column (3) to (5) foreign demand for the core (HS4) product exported by the firm (FD^{core}_{it} in the main text); in column (4), firm-specific tariff; in column (5), exposure to civil wars. See appendix for more details about the instruments' construction.

services are not properly registered, and if exports of goods and services are correlated (let say that exporting goods requires exporting services at the same time), then a fall in exports could be associated with a fall in domestic sales. To control for this potential bias, we perform a robustness check by making use of a database of trade in services for French firms, collected by the Banque de France. We have information for the period 1999-2007, i.e. only part of the time dimension of our dataset. We use this data to identify firms exporting services at least once[34], and exclude these firms from the estimations. The estimation presented in Table 11, column (1) shows that our main result remain almost unchanged.

Multinationals. Another issue is related to the presence of multinationals (MNCs) for which the positive relationship between export and domestic sales might reflect transfer pricing. To ensure that this is not driving our results, we drop from the estimations firms which are affiliated to a business group or to a MNC.[35] The results, presented in Table 11, columns (2) and (3), are again very close to our baseline estimates.

Intermediaries. The final measurement issue is related to the presence of intermediaries. If firms are exporting (the same product, to the same destinations) partly directly and partly

[34]This data was used in different works such as Crozet *et al.* (2012). The services covered in the dataset fall into the Mode I classification by the GATS, covering all services exchanged between residents and non-residents across the borders. See data appendix for more details.

[35]This is done using a second dataset (the LIFI survey) which covers the period 1993-2007 and contains information about financial linkages of firms located in France and allows identifying those firms which are affiliated to a multinational group. See data appendix for more details.

Table 11: More Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Estimator	2SLS			2SLS			
Dep. Var.	ln dom. sales			ln dom. sales			
Sample	No services exporters	No MNCs	No bus. groups	Interm. (number) High	Low	Interm. (value) High	Low
ln Export sales$_{it}$	0.138^a	0.158^a	0.184^a	0.161^a	0.150^a	0.137^a	0.164^a
	(0.024)	(0.030)	(0.048)	(0.037)	(0.049)	(0.042)	(0.047)
ln Domestic demand$_{it}$	0.115^a	0.102^a	0.078^a	0.075^a	0.162^a	0.082^a	0.135^a
	(0.017)	(0.023)	(0.023)	(0.019)	(0.028)	(0.018)	(0.034)
Observations	121329	102457	55813	62989	60964	63229	61308
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector × year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap stat.	89.46	65.49	26.28	50.03	32.72	41.37	54.07

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. Instrument: foreign demand in HS6 products exported by the firm (FD_{it} in the main text). Column (1) exclude services exporters; columns (2) and (3) exclude respectively firms affiliated to a multinational and firms belonging to a business group ; columns (4) to (7) split the sample into sub-samples defined according to the sector share of intermediaries, either in terms of export value or in terms of number of exporters.

through an intermediary, and if indirect exports show up in domestic sales, this could generate the positive coefficient that we observe.[36] As we know from the customs data the products exported by the intermediaries, we are able to compute sector-specific indicators reflecting the share of intermediaries in the products exported by different sectors. We end up with two sector-specific indicators, respectively representing (i) the share of intermediaries in the total number of exporters of a sector; (ii) the share of intermediaries in the total value of export of a sector.[37] These indicators represent the importance of intermediaries given the products exported by this sector. We find the intermediaries to have a highly variable importance, as they represent between 15 and 60% of total number of firms, and between 1 and 60% of total trade value depending on the sector. For each of these indicators, we perform the same exercise: we split the sample between low and high intermediation sectors (above or below the sample median). As can be seen in Table 11, columns (4) to (7), our estimates are very stable across these different samples.

4.5 A quasi-natural experiment: the 1997-1998 Asian crisis

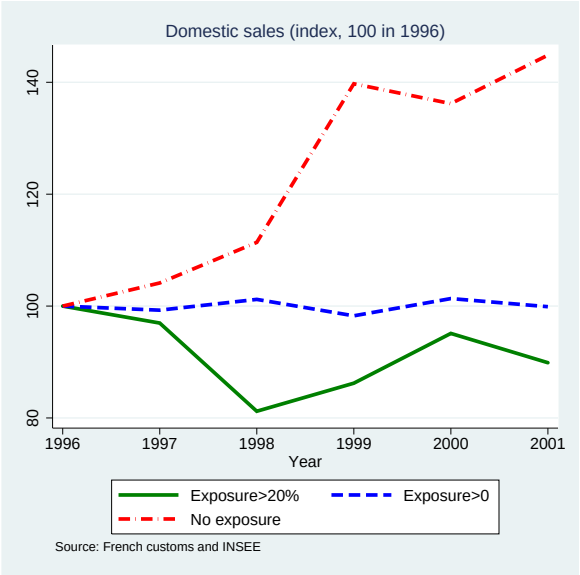
A direct implication of our results is that negative external demand shocks, such as those implied by financial crises, are transmitted to domestic sales through trade. The time period for which our data is available enables us to directly assess the effect of a particular event, the 1997-1998 crisis in South-East Asia, on French firms' domestic sales. Both the banking and currency crises that several Asian countries experienced generated a large negative demand shock for French firms serving these destinations.

[36] Whether this is a commonly observed pattern remains however unclear. Similarly, it is unclear that that firms do report indirect exports in their domestic sales and not in their exports.

[37] Complete details about the construction of these indicators are provided in the data appendix.

Figure 1: Domestic sales of French firms and exposure to the 1997-1998 Asian crisis

(a) All firms



(b) Firms present all years

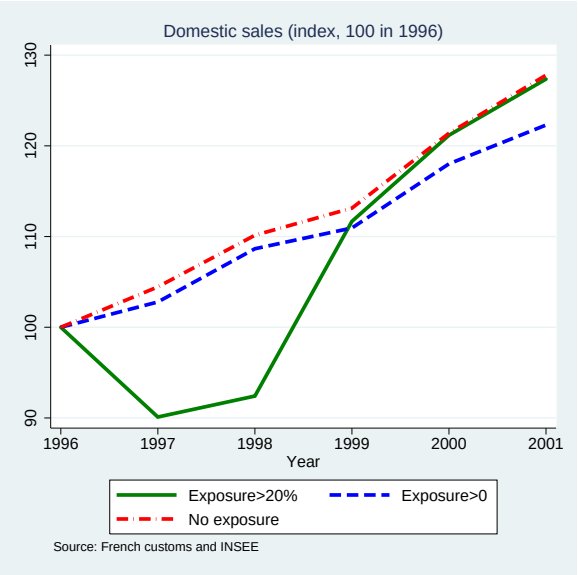


Figure 1 shows the total domestic sales for different categories of French firms defined according to their exposure to countries that were the most affected by the crisis. "Exposure" is defined as the average share of total exports before the crisis (in 1995 and 1996) in the following destinations: Thailand, the Philippines, South Korea, Malaysia, and Indonesia. Panel (a) contains all the firms, while panel (b) considers the firms present in our sample over the whole 1995-2001 period. In both cases, the difference between the firms that were not exposed (i.e. did not export to these countries prior to the crisis) and the others is striking. The trend of domestic sales is either less positive for all firms with a positive exposure, or negative for firms with an exposure larger than 20%.

Table 12 reports estimates of the effect of the Asian crisis on French firms' domestic sales. We regress the log of domestic sales on an interaction term between a dummy variable which identifies the years of the crisis (Asian crisis$_{97-01}$, which equals 1 from 1997 on), and a dummy variable that equals 1 if the firms exported to the crisis countries before the start of the event and were consequently exposed to the shock (exposed$_i$). As already suggested by Figure 1, we find that the crisis had a significantly more negative impact on domestic sales for firms that were exposed to the crisis countries (column 1). Domestic sales are found to be 3.5% lower for those firms. Controlling for domestic demand hardly affect this point estimate (column (2)). In column (3), we replicate the estimation presented in column (1), but including 3-digit (instead of 2-digit) sector-year dummies. In column (4), we show that we are not picking up the effect of a supply chain disruption: the effect is similar when excluding the firms which imported from these Asian countries before the crisis. In column (5), the estimation is performed on a sample of firms that are present through the entire time period of 1995-2001. Our results are robust to this alternative specification. In columns (6) and (7), the interaction term between the Asian crisis and firms' exposure before 1997 is used directly as an instrument for exports in the 2SLS

Table 12: Effect of the Asian crisis on French firms domestic sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	ln Domestic sales						
Sample	All	All	All	No imp. from Asia	Firms present all years	All	All
Asian crisis$_{97-01}$*Exposed$_i$	-0.034^a	-0.035^a	-0.025^b	-0.040^a	-0.036^a		
	(0.011)	(0.011)	(0.010)	(0.011)	(0.013)		
ln Export sales$_{it}$						0.848^b	0.488^a
						(0.427)	(0.160)
ln Domestic demand$_{it}$		0.152^a					
		(0.017)					
Observations	143515	143515	143515	130811	81088	143515	118077
Dummies	Sector×Year						
Estimation	FE	FE	FE	FE	FE	2SLS	2SLS
Instruments						Crisis	Crisis + Tariffs
Hansen p-value							118077
Kleibergen-Paap stat. / S-Y Crit. val. (10%)						7.70/16.4	14.97/19.9

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. OLS estimations in columns (1) to (5), and 2SLS estimations in columns (6) and (7). All estimations include firm fixed effects and 2-digit sector×year dummies, except column (3) which includes 3-digit sector×year dummies. Export sales instrumented by Asian crisis$_{97-01}$ × Exposed$_i$ in column (6), and by Asian crisis$_{97-01}$ × Exposed$_i$ and firm-specific tariffs in column (7). See data appendix for more details.

estimation of the domestic sales equation (1). These results confirm our previous findings: the coefficient of the exports variable is positive and significant when the Asian Crisis$_{97-01}$*Exposed$_i$ variable is used as instrument for exports, alone (column (5)) or together with firm-specific tariffs (column (6)). The Hansen test indicates that we cannot reject the overidentifying restrictions.[38]

5 Channels of transmission

5.1 Theoretical mechanisms

As mentioned in the introduction, in most international trade models, aggregate or idiosyncratic productivity shocks, together with local demand conditions, determine simultaneously the level of sales in each market. However, exogenous changes in demand conditions in a given market have no effect on the level of sales in other markets: in these models, the β coefficient in the baseline estimation is expected to be equal to zero. This abstracts from potential general equilibrium effects arising through firm selection. In models such as Melitz (2003) or Demidova and Rodríguez-Clare (2013), an increase in foreign demand will influence domestic sales of – high productivity – home firms as it pushes some domestic – low productivity – firms out of the domestic market. This results in larger domestic sales for all surviving firms, everything else equal. However, as we are considering short-run effects and including sector×year dummies in our specification, we consider as very unlikely the possibility that such mechanisms drive our results.

[38]The larger coefficients on export sales in columns (6) and (7) of Table 12 may suggest that negative foreign shocks are more likely to be transmitted to domestic sales than positive ones. The symmetry of the complementarity is discussed in the online appendix, section 4. Indeed, we do find that the effect of negative export variations is significantly larger than the effect of positive changes.

Sales in different markets may be related, however, due to the existence of cost linkages across markets. In general, a unique production process involves labor, equipments, and inputs for the production of a single good that will be sold in different markets. A number of recent trade models (Vannoorenberghe, 2012, Blum *et al.*, 2013, Ahn and McQuoid, 2012) feature increasing marginal cost reflecting capacity constraints. These capacity constraints can be physical, and related to short-term rigidities on factor markets (for instance, on the French labor market, many regulations start binding from 50 employees – see Garicano *et al.*, 2013) or financial markets imperfections. Indeed, in the short-term, firms need liquidity to fulfill working capital requirements, i.e. to purchase capital, buy intermediates, or hire additional workers so as to increase their sales in a market. Liquidity constrained firms are expected to undermine their production, i.e. their production level is sub-optimal. In the context of capacity constraints, these models predict substitution between sales across markets: when a demand shock affects positively the profitability of the export market relative to the domestic one, firms want to expand exports. This increases the marginal cost, and reduces domestic sales.

Different predictions can be obtained, however, if changes in foreign demand conditions distort the degree of capacity constraints that force home firms to produce at second best. In particular, revenues generated by additional exports can be used by firms to alleviate their liquidity constraints. First, the additional profit flows generated by foreign sales can be used by firms to finance their domestic operations. This type of liquidity shock helps firms to alleviate the financial constraints and to get closer to their optimal size. This mechanism is consistent with models of firm dynamics featuring financial frictions such as Cooley and Quadrini (2001) and Kohn *et al.* (2012).[39] In the latter model, after entry, the additional profit flows generated by exporting makes firms less reliant on external finance, which allows them to increase the scale of their operations in the domestic market. Second, changes in foreign demand directly affect the firms' ability to obtain external finance, as the firms can use their sales orders as collateral. Third, variations in the demand addressed to the firm in foreign markets might affect financial constraints through reputation effects (with the bank or lender): negative demand shocks, for instance, might therefore both directly limit the liquidity available to the firm and make access to external finance more difficult due to these reputation spillovers.

Through all these mechanisms, positive foreign demand variations shifts the firm's marginal cost downward. Conversely, drops in demand would make access to short-run liquidity more difficult, moving up the marginal cost curve. This generates a positive relationship between foreign demand and sales at home through exports, and therefore explains the positive and significant sign of our estimates of β. Note, again, that this result does not exclude the possibility that capacity constraints are important in some cases. They rather suggest that these constraints do not dominate other channels on average. Capacity constraints might be locally important, for certain firms or in specific sectors. For instance, Garicano *et al.* (2013), among others, show in the case of France that size-dependent regulations (mainly related to a threshold at 50 employees) tend to limit firms' size and can therefore be considered as introducing capacity

[39] This mechanism is also consistent with Greenaway *et al.* (2007), who find on a panel of UK manufacturing firms that exporters significantly display better financial health than non-exporters, precisely because financial health is improved by participation in exporting activities. In our context, exogenous changes in export sales should therefore directly be related to the profitability of the firm, its short-run liquidity, and therefore its capacity to hire additional workers, invest in new equipments, or purchase inputs.

constraints. In our data, we indeed find that firms which are close to this 50 employees threshold exhibit no significant effect of exogenous changes in exports on domestic sales (see Table A.11 the online appendix). However, our results show that on average in our sample of firms, these constraints are not large enough to generate substitution between sales across markets.

Beyond the costs of inputs, the relationship between exports and domestic sales could be potentially explained by changes in physical productivity. On the one hand, with increasing returns, larger exports can trigger higher productivity. With elastic demand, this increase of firm's efficiency should promote sales at home if it is - at least partially - reflected in the price of goods sold in the domestic market. This mechanism will be observed if the products sold by the firm in two different markets are produced using the same inputs. A rise in exports may also increase the scale of domestic production through efficiency gains related to exporting activity - the so-called learning-by-exporting hypothesis.[40] These learning effects are probably more likely to be observed in the medium- to long-term, but we will discuss their empirical plausibility below. On the other hand, measured productivity can also change due to unobserved variations in capital utilization or labor effort (Basu, 1996). There is indeed ample evidence that firms do not fully adjust labor and capital along the business cycle (the phenomenon of hoarding), making the evolution of productivity pro-cyclical. In this case, we do not expect domestic sales to be impacted through higher efficiency. However, better factor utilization can improve the firm's profitability, which magnifies the liquidity mechanism mentioned above.

We now provide evidence suggesting that the liquidity channel is indeed empirically relevant, before discussing other potential mechanisms at the end of the section.

5.2 Evidence of the liquidity channel

We explore this transmission channel in more details in Tables 13 and 14. A typical proxy for liquidity constraints used by the finance literature is firm's size. If dependence on short-term liquidity is more important for small firms, we expect the effect to decrease with firm size. In columns (1) and (2) of Table 13, the export sales variable is interacted with the initial number of employees of the firm (the interaction is instrumented by the interaction between our baseline instrument and the initial size of the firm). The coefficient of the interaction variable is negative and significant, i.e. smaller firms tend to benefit more from an exogenous increase in their exports than larger firms. The domestic sales of small firms are therefore more sensitive to variations in exports revenues, which may possibly come from tighter short-term liquidity needs. For the larger firms - of more than 100 employees - we cannot detect any significant effect anymore.

A more direct way to assess the relevance of the liquidity mechanism is to build firm-level proxies of the dependence upon short-run liquidity. Positive interactions between those indicators and the log of export sales (still instrumented by the interaction between our baseline instrument and the beginning-of-period indicator) will indicate that firms with higher liquidity needs will disproportionately take advantage from an exogenous positive export shock, consistently with the above-mentioned channel.

[40] See Wagner (2007) for a survey, and the studies by Bernard and Jensen (1999), De Loecker (2007) and Park *et al.* (2010).

Table 13: Channels of transmission: firm-level indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. Var.	ln Domestic sales									
ln Export sales$_{it}$	0.277^{a}	0.316^{a}	0.077^{b}	0.071^{b}	0.108^{a}	0.101^{a}	0.131^{a}	0.118^{a}	0.103^{a}	0.093^{a}
	(0.060)	(0.071)	(0.032)	(0.032)	(0.030)	(0.028)	(0.028)	(0.025)	(0.036)	(0.036)
ln Export sales$_{it}$ × Size$_{i0}$	-0.034^{a}	-0.046^{a}								
	(0.012)	(0.014)								
ln Export sales$_{it}$ × WCR$_{i0}$			0.104^{b}	0.109^{a}						
			(0.042)	(0.040)						
ln Export sales$_{it}$ × SFR$_{i0}$					0.261^{b}	0.264^{b}				
					(0.111)	(0.108)				
ln Export sales$_{it}$ × (LT Debt / Tot. Debt)$_{i0}$							0.015	0.049		
							(0.055)	(0.060)		
ln Export sales$_{it}$ × (ST Debt/Tot. debt)$_{i0}$									0.043^{c}	0.050^{b}
									(0.024)	(0.024)
ln Export sales$_{it}$ × export ratio$_{i0}$		0.594^{a}		0.494^{a}		0.435^{a}		0.513^{a}		0.474^{a}
		(0.142)		(0.131)		(0.105)		(0.120)		(0.108)
ln Domestic demand$_{it}$	0.119^{a}	0.124^{a}	0.118^{a}	0.122^{a}	0.110^{a}	0.112^{a}	0.117^{a}	0.123^{a}	0.118^{a}	0.122^{a}
	(0.018)	(0.018)	(0.019)	(0.019)	(0.017)	(0.017)	(0.018)	(0.019)	(0.018)	(0.018)
Observations	142536	142536	128356	128356	128372	128372	123870	123870	119156	119156
Kleibergen-Paap stat.	37.86	25.37	50.86	36.68	45.42	37.63	48.69	37.09	49.25	38.51

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. All estimations include firm fixed effects and sector×year dummies. The instrument used for exports is the foreign demand in HS6 products exported by the firm as defined in the main text. Size: number of employees. WCR: working capital requirement ratio; SFR: self-financing ratio; (LT Debt / Tot. Debt): long-term debt over total debt; (ST Debt / Tot. Debt): short-term debt over total debt. All these indicators are taken at the beginning of the period. See main text and data appendix for more details on the computation of these variables. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 7.0 is all estimations. export ratio$_{i0}$ is demeaned.

The first indicator we use is a beginning-of-period measure of working capital requirement (WCR_{i0}), defined as the working capital requirement over long-term resources (equal to equity plus medium-and long-term debt). This indicator represents the need of the firm in terms of short-run liquidity; a high value of WCR implies that firms have a higher need for short-term liquidity. The second indicator is the initial self-financing ratio (SFR_{i0}) that is, retained profits over long-term resources. This indicator gives an indication of the volume of internal funds that can be mobilized quickly by the firm for funding short-term operations. It can be therefore interpreted as an alternative indicator of the firm's difficulty to rely on external finance in order to increase its production and sales. As expected, columns (3) to (6) show that interactions between foreign sales and both indicators are positive and significant. Controlling for the firm's export ratio - which is potentially correlated with any firm-specific indicator - does not alter the results (columns (4) and (6)). Note that the export share variable is demeaned in these estimations to ease the interpretation of the non-interacted export sales coefficient. Quantitatively, these interactions are also relevant. In the case of WCR_{i0}, the effect range from statistically insignificant for the top percentile to 0.25 for the most vulnerable firms.[41]

We repeat these exercises in column (7) to (10), which use two indicators of debt, the ratios of long-term (LT) and short-term (ST) over total debt. Since the liquidity mechanism we explore

[41] Consistently with the above findings, Figures A.2.(a) and A.2.(b) in the online appendix show the size of the effect for four groups of firms defined according to the quartiles of WCR and ST debt ratios. 90% confidence intervals are depicted in grey around the estimated effect. The pattern is clear: the higher the need for short-run liquidity, the higher the effect of exogenous changes in exports on domestic sales.

is essentially a short-run one, we should only observe significance on the interaction between the ST debt ratio and the foreign sales. This is indeed what our estimates show: while interactions with the LT debt ratio (columns (7) and (8)) are insignificant, columns (9) and (10) highlight that the positive impact of an exogenous export shocks is magnified for firms whose debt exhibits a higher share of short-term debt. The result appears strengthened when including the initial export to total sales ratio of the firm (column (10)). Finally, note that all these results are robust to the use of a one-period lagged (instead of contemporaneous) exogenous change in exports in the estimated specification (see Table A.9 in the online Appendix).[42] In these estimations, the average effect of changes in exports on domestic sales is lower, but similar heterogeneity is found across firms with different short-run liquidity needs (in the case of WCR_{i0}, the coefficient ranges from nil to around 0.20).

Table 18 in the appendix presents an additional way to test the relevance of the liquidity mechanism. Namely, we replace the dependent variable by a direct measure of liquidity (cash flow). The overall effect of exogenous changes in exports on cash flow is theoretically unclear: firms might use the extra liquidity to finance operations or keep it as an insurance against future bad shocks. We find in column (1) of Table 18 that liquidity do increase following a positive exogenous change in exports. On the other hand, we expect firms which are more reliant on short-run liquidity to use directly this liquidity to fulfill their working capital requirements. Therefore, the coefficient on exports should be lower for these firms. This is what we find in columns (2), (3) and (5), in which we again interact export with our firm-specific measures of dependence upon short-run liquidity. Similar to our previous results, long-term debt does not seem to matter (column (4)). Finally, in unreported regressions we found that our instruments have a lower effect on exports in the first stage for firms which are the most dependent upon short run liquidity (e.g. small firms and firms with high WCR ratio). This is again consistent with the liquidity mechanism: liquidity constraints firms might not be able to take advantage of increases in demand in foreign markets; however, when they do manage to do so, this has more effect on their domestic sales.

Columns (1) to (4) of Table 14 replicate the main estimates in Table 13, but using sector-specific indicators instead of firm-level one. More precisely, we follow a methodology akin to Rajan and Zingales (1998) and reproduce our four indicators of dependence upon short-term liquidity at the sectoral level. We expect that firms operating in sectors with a higher need for short-term capital, are more sensitive to exogenous variations of the cash flow or exports. This check is done in order to reduce endogeneity concerns, since, as Rajan and Zingales (1998), our identification strategy is based on sectoral heterogeneity, which is not affected by individual firm characteristics. Therefore, for each of our four indicators of dependence on short-term liquidity, we simply compute the median at the sectoral level, and as before, interact the latter with the log of export sales. For comparison purposes, we also include in these specifications the sectoral median of the export-to-sales ratio.[43] This set of indicators is indexed by k. Results

[42] In the simplest specification (Table A.9, column (1)), the effect if positive but the coefficient is small (0.036) and statistically insignificant (p-value is 0.18). However, we can see in columns (2) to (7) that the lagged effect is significantly increasing with the initial export ratio of the firm, consistently with our previous findings. The domestic sales of the most exposed firms (those with an export ratio above around 30%) are significantly affected by changes in exports.

[43] A sector is defined at the 3-digit (NES 114) level, although our results are qualitatively unchanged when using a broader (2-digit) classification. All interacted terms are instrumented by interactions between our main

Table 14: Channels of transmission: sector-specific indicators

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	ln Domestic sales				
ln Export sales$_{it}$	-0.122	0.033	0.072	-0.139	0.058
	(0.094)	(0.125)	(0.071)	(0.126)	(0.065)
ln Export sales$_{it}$ × WCR$_k$	0.471^b				
	(0.188)				
ln Export sales$_{it}$× SFR$_k$		0.487			
		(1.514)			
ln Export sales$_{it}$× LT Debt$_k$			-0.023		
			(0.484)		
ln Export sales$_{it}$ × ST Debt$_k$				0.342^b	
				(0.165)	
ln Export sales$_{it}$ × IRS$_k$					0.032
					(0.044)
ln Export sales$_{it}$ ×export ratio$_k$	0.420	0.539	0.506	0.717	0.535
	(0.341)	(0.403)	(0.375)	(0.436)	(0.422)
ln Domestic demand$_{it}$	0.119^a	0.118^a	0.118^a	0.120^a	0.118^a
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Observations	143515	143515	143515	143515	143515
Kleibergen-Paap stat.	9.89	32.66	37.37	17.32	24.02

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. All estimations include firm fixed effects and sector×year dummies. The instrument used for exports is the foreign demand in HS6 products exported by the firm as defined in the main text. WCR: working capital requirement ratio; SFR: self-financing ratio; (LT Debt / Tot. Debt): long-term debt over total debt; (ST Debt / Tot. Debt): short-term debt over total debt; IRS: returns to scale. All indicators are industry-specific medians, except IRS which is a dummy which equals 1 if the industry exhibits increasing returns to scale. See main text and appendix for more details on the computation of these variables.

are consistent with the ones based on firm-level indicators: firms belonging to sectors with higher WCR and ST debt benefits disproportionately from an exogenous increase in foreign sales, supporting the the story of a short-run liquidity channel.

5.3 Other channels: discussion

We mentioned earlier that our results might theoretically be driven by changes in productivity. The complementarity between exports and domestic sales may reflect the presence of increasing returns in the sector where the firm is operating: if the firm's production technology exhibits increasing returns, a positive demand shock on the foreign market will increase the production scale and decrease average cost. Indeed we do find that TFP increases with exogenous changes in exports (see Table 19, column (7) and Table A.8 in section 5 of the online appendix).[44]

The increasing returns channel can be tested by looking at the differences across sectors in

instrument and the sectoral median of the considered indicator.

[44]The size effect of changes in exports on TFP and inputs displayed in Table A.8 is consistent with the finance-investment literature (e.g. Fazzari *et al.*, 1988 or Love, 2003) who find a cash-flow to investment elasticity between 0.1 and 0.3 for recent periods. If inputs are common to both foreign and domestic productions, these numbers are also consistent with the elasticity of domestic sales to exogenous changes in exports, which is around 0.15 in our baseline specification.

terms of economies of scale. Namely, we estimate a production function by 3-digit sector (NES 114). Whenever the sum of the labor and capital coefficients is significantly larger than 1, we classify the sector as an increasing returns sector (decreasing returns otherwise). The results, shown in column (5) of Table 14, fail to confirm the relevance of the increasing returns channel: the coefficient is correctly signed, but statistically insignificant.

TFP changes could however be driven by unobserved changes in factor utilization along cycle. If labor and capital markets were frictionless, a decline in export revenues would have no effect on firms' unit production costs, as they would reduce their use of labor and capital. Conversely, firms may choose not to adjust labor or capital consecutive to foreign demand shocks, which would then affect the level of unit costs, their productivity and price cost margins. Results reported in Table 19 in the appendix, columns (1) to (4), indeed show that changes in firms' exports are negatively related to changes in unit labor and capital costs: a decline in firms' exports tends to increase unit costs, in particular for those firms having a higher exports to total turnover ratio. This finding confirms that firms in our sample do not fully adjust labor and capital throughout the business cycle. We also confirm that observed changes in TFP are caused by changes in price-costs margins rather than by improvements in physical productivity (columns (5) and (6) of in Table 19 in the appendix). Thus, we believe that the increasing returns channel is unlikely to explain our results. However, changes in the price-cost margins contribute to improve the profitability of the firms, and tend to magnify the liquidity channel.

6 Conclusions

Using a large firm-level database on French firms combining balance-sheet and destination-specific export information over the period 1995-2001, this paper shows that firms' domestic and export sales are complementary when exports are predicted by exogenous changes in foreign demand. A change in foreign demand conditions, which is associated with an increase in the foreign demand of the products sold abroad by the exporter, raises domestic sales. This implies that shocks on foreign markets can be channeled into the domestic business cycle through the complementarity between firms' domestic and foreign sales.

These results are confirmed by a number of robustness checks, in which we assess the validity of the empirical analysis through different specifications. We use alternatively as instruments for export sales the foreign imports for the product range exported by the firm, or for its core product, tariff changes, or large foreign shocks such as civil wars. We take into account the possibility that domestic and foreign macroeconomic conditions may be correlated. We also control for the possibility that the result might be driven by the correlation between exports and imports for each firm. Our results are valid in cases where the foreign demand for firms' products is increasing or decreasing. Finally, our analysis is supported by the natural experiment of the Asian crisis in the late 1990's. Estimation results show that firms that were more exposed to this crisis through their exports suffered a decrease of their domestic sales as compared to firms of the control group.

Overall, this relation between domestic and foreign sales is at odds with theoretical models in international trade where domestic and foreign sales are only connected through exogenous productivity, as in Melitz (2003). Our results rather suggest that exogenous shocks on the

foreign business cycle will reflect in the domestic business cycle through the relationship between domestic and foreign sales. This result has many implications, for instance, in terms of the exchange rate policy or trade policy transmission to the domestic economy.

The precise channel of transmission, however, remains an avenue for future research. We provide evidence in the last section that dependence on short-run liquidity, through working capital requirement, may be a relevant explanation. This channel is also consistent with the fact that our result is found to be stronger for small firms than for large ones. However, other channels may be relevant, including demand side mechanisms. Future research should probably attempt to determine the channel of transmission that is prevalent in explaining this export-domestic sales complementarity. If our results are mainly driven by liquidity constraints, they also have potential interesting implications for the transmission of real demand shocks to the financial system through firms' financial health. Large negative shocks such as the Eurozone crisis could make exporters more financially vulnerable and force them to default on their loans, which in turn may affect the solvability of the banking sector. Exploring these aggregate indirect effects in more details would be an interesting avenue for future research.

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A Data Appendix

The sample is an unbalanced panel of yearly firm-level data over the period 1995-2001. Indexes i, j, k, p and t represent the firm, the destination served, the sector the firm belongs to, the product exported and the time unit (year), respectively. We provide a complete description of the main variables below.

A.1 Main interest variables

Foreign and Domestic sales (X_{it} and Y_{it}). The BRN contains direct information on total sales and export sales. Domestic sales are therefore computed as the difference between total and export sales.

Inputs. Capital stock and the number of employees are from the BRN. Firm specific imports, by product and destination, are taken from the French customs.

Unit cost of inputs. The Unit Labor Cost is defined as the ratio of the wage bill of the firm (W_{it}) and the value-added divided by the sector-level deflator of value-added (V_{it}/P_{kt}). The Unit Capital Cost is defined as the sum of financial cost (FC_{it}) and depreciation of assets (D_{it}) over the real value-added of the firm (V_{it}/P_{kt}). To compute the depreciation of assets, we used a depreciation rate of 10%, which is in line with the numbers reported in EUklems data.

Price-cost margins. The construction of the price-cost margin variable follows Tybout (2001). It is constructed as the ratio of sales ($p_{it}q_{it}$) net of expenditures on labor and materials ($c_{it}q_{it}$) over sales: $PCM_{it} = \frac{p_{it}q_{it} - c_{it}q_{it}}{p_{it}q_{it}}$

TFP. TFP is estimated by OLS sector-by-sector, therefore allowing for different input coefficients across sectors. Capital is deflated using a gross fixed asset deflator from the OECD economic outlook database and value added using a sectoral deflator from the EU-Klems data. Increasing Returns to Scale (IRS) sectors are the sectors for which the sum of capital and labor coefficients is significantly larger than 1.

Firm-specific ratios (liquidity). Four firm-level financial ratios are built using balance-sheet information from the BRN database.

1. *Working Capital Requirement ratio.* Defined as working capital requirement over long-term resources. The working capital requirement is the minimum amount of resources that a company requires to effectively cover the usual costs and expenses necessary to operate the business. It is computed as the difference between the liquid assets and the current liabilities. Long-term resources are defined as the sum of equity and non-current liabilities. The latter includes medium-and long-term debt, that is standard and convertible bonds, as well as financial debts with a due date after one year.

2. *Self-Financing ratio.* Defined as retained profits over long-term resources. Retained profits are defined as the cash flow minus dividends paid to shareholders.

3. *Short-term debt ratio.* Defined as current liabilities (less than a year) over the sum of current and non-current liabilities. Current liabilities include, among others, accounts payable, deferred income and tax and Social Security liabilities.

4. *Long-term debt ratio.* Defined as non-current liabilities (more than a year) over the sum of current and non-current liabilities.

Services exports. We use a firm-level dataset on export of services which covers the period 1999-2007. We use this data to identify firms exporting services at least once. The services covered in the dataset fall into the Mode I classification by the GATS, covering all services exchanged between residents and non-residents across the borders. The data come either directly from the company itself, or from commercial banks declarations. It records for each firm the annual amount of its transactions, the nature of the service traded and the partner country.

Multinationals. We identify the firms which are affiliated to a business group or to a MNC using a dataset called LIFI containing information about financial linkages of firms located in France and allows identifying those firms which are affiliated to a multinational group. This dataset is constructed by the French national statistical institute (INSEE). The LIFI dataset is used in different papers, and in particular Defever and Toubal (2013). The dataset covers the period 1993-2007.

Shares of intermediaries. As we do not have direct information on the share of intermediaries by sector, we have proceeded as follows to construct sector-specific shares of intermediaries. The construction of these indicators contains three steps. First, we identify in the customs the firms which are intermediaries, through their main sector classification provided in the balance-sheet data. Second, we match the HS6 product codes with 3-digit NACE sector classification. Third, for each of these 3-digit sectors, we compute the share of intermediaries, either in total export values or in the total number of exporters. We therefore end up with two sector-specific, time-varying indicators representing the importance of intermediaries in the sector given the products exported by this sector.

Others. Industry Domestic Sales$_{kt}$ and Number of firms$_{kt}$ are computed as the sectoral domestic sales minus the firm's own sales, that is: $\log(Y_{kt} - Y_{it})$, and as the number of firms operating in the firm's industry.

A.2 Instruments and controls for domestic demand

Foreign and domestic demands addressed to the firms: baseline instruments. Our preferred instrument is the sum of foreign imports in the product-destination served by the firm in year t, weighted by the share of each product-destination in the firm's total export over the period. A product is defined at the 6-digit (HS6) level. Import data comes from BACI (CEPII). Denoting ω_{ijp} the average share of each product p and destination j in firm i's exports over the period, and $M_{jp,t}$ the imports of destination j of product p during year t, this variable is computed as:

$$FD_{it} = \sum_{j,p} \omega_{ijp} M_{jp,t} \tag{6}$$

The mirror of this variable for domestic demand is:

$$DD_{it} = \sum_{p} \omega_{ip} M_{FR,p,t} \tag{7}$$

where $M_{FR,p,t}$ denotes the French imports of product p during year t. Alternatively, we use similar instruments and controls focusing on the firm's core product, defined as the HS-4 product with the highest average value of exports over the period. ω_{ij}^{core} is the weight of destination j in firm's i core product exports. We compute:

$$FD_{it}^{core} = \sum_{j} \omega_{ij}^{core} M_{j,t}^{core} \tag{8}$$

And the mirror of this variable is DD_{it}^{core}, ie the French imports for each firm i core product in t.

Beginning of the period weights. In table 8, we compute instruments similar to those defined by equations (13) and (7) above but use beginning-of-the-period weights, i.e. ω_{ijp} and ω_{ip} are computed the first year or the first two years the firm exports over the 1995-2001 period.

Sector and location-sector specific weights. In the estimations reported in Table 9 columns 1 to 4, our instruments use sector-specific weights (columns 1 and 2) or location-sector specific weights (columns 3 and 4). These alternative weights are expected to address the issue of firm selection in foreign markets.

First, information about the export structure of the firms' main sector of activity (3-digits) is used to compute weights reflecting the share of the HS6 product and country of destination in sector k's total exports in France. Alternatively, we construct sector-specific weights using the frequency of the product-destination cell in sector k exports; i.e. the number of firm-level export flows corresponding to a product and a destination over the total number of firm-level export flows of the sector. The sector weights are then used to compute the alternative instrument for firms' exports:

$$FD_{kt} = \sum_{j,p} \omega_{kjp} M_{jp,t} \tag{9}$$

Firm-level information is only used to allocate firms in different sectors, but the weights used to compute the instruments cannot be affected by firm selection in foreign markets. Table 9 mentions exactly when the weights used to construct the instrument reflect the share of the product-destination in the sector's total exports, or the frequency of that product-destination cell in sector k's exports.

In Table 9, columns (3) and (4), we also use information about the location of the firm in France, where the location is identified for each firm by its "département" of location. French

départements are administrative areas, which are subsets of the French "régions". Denoting by l the "département" of location, our instrument becomes:

$$FD_{kl,t} = \sum_{j,p} \omega_{kljp} M_{jp,t} \tag{10}$$

Firm-specific tariffs. We use information on tariff to construct alternative instruments for export sales. Firm-specific tariffs are computed as:

$$t_{it}^{X} = \sum_{j,p} \omega_{ijp} t_{jp,t} \tag{11}$$

where $t_{jp,t}$ represents the MFN tariff of destination j in product p. The data comes from the ITC. Similar results are obtained with bound tariffs.

Exposure to civil wars. We construct two variables reflecting the exposure of a given firm i to a civil war in country j. The first is a dummy variable that equals 1 if at least one the destinations to which the firm exported in $t-1$ experiences a civil war in year t. The second equals the sum of the number of civil wars the destination served by the firm, weighted by the share of exports in these destinations in $t-1$:

$$War_{it}^{X} = \sum_{j} \frac{X_{ij,t-1}}{X_{i,t-1}} CW_{j,t} \tag{12}$$

where $CW_{j,t}$ is a dummy that equals 1 if the destination j experienced a civil war in t. The data on civil wars comes from the Correlates of War (CoW).

Transport costs. We adapt the methodology of Hummels *et al.* (2013) to our data. More precisely, we have computed for each firm a time-varying measure of transportation costs using information on oil prices, distance to the destinations served by the firm, weight-value ratios of its shipments, and transportation mode. Contrary to Hummels *et al.* (2013), we do not have direct information on the transport mode, so we use a proxy from Cristea *et al.* (2013) who provide estimates of the share of trade using each transportation mode (air, rail, road, sea) by sector and country-pairs. Using this data, we associate each product and destination to a main transport mode, defined as the mode with the highest share in the Cristea *et al.* (2013) data. We then follow the methodology proposed by Hummels *et al.* (2013), who construct shipment-specific transportation costs using data on oil prices, distance and beginning-of-period weight to value ratio. More precisely, we compute transport costs as:

$$\tau_{ijpt} = \beta_0^{jp} + \beta_1^{jp} \frac{Q_{jp0}}{X_{jp0}} + \beta_2^{jp} \ln(\text{oil}_t) + \beta_3^{jp} \ln(\text{Dist}_j) + \beta_4^{jp} \ln(\text{Dist}_j) \times \ln(\text{oil}_t)$$

where $\frac{Q_{ijp0}}{X_{ijp0}}$ is the weight-to-value ratio of exports of product p to destination j at the beginning of the period, oil_t is the oil price in year t and Dist_j is the distance to the destination country (from CEPII). The coefficients β_i^{jp}, $i = 0, ..., 4$ are product-destination-transport mode specific, and taken from Hummels *et al.* (2013)[45]. Following Hummels *et al.* (2013), we then

[45] See their online appendix, section 2, for more details.

aggregate the transport costs by firm-year using beginning-of-the-period weights:

$$\tau_{it} = \sum_{jp} \omega_{ijp} \tau_{ijpt} \tag{13}$$

where ω_{ijp} is the share of each product p and destination j in firm i's exports at the beginning of the period.

Instruments for imports. We create instruments for firm-level imports using a similar variable as for exports. Firms' imports are instrumented using the foreign supplied addressed to the firm, FS_{it}. More precisely, we compute the sum of the foreign exports in the product-destination from which the firm imports goods during year t, X_{jpt}, weighted by the share of each product-destination in the firm's total imports over the period η_{ijp}. A product is defined at the 6-digit (HS6) level, η_{ijp}. Export data comes from BACI (CEPII). This variable is computed as:

$$FS_{it} = \sum_{j,p} \eta_{ijp} X_{jp,t} \tag{14}$$

Exposure to the 1997-1998 Asian crisis. We construct a variable similar to the one proposed for civil wars:

$$Crisis_{it}^{X} = \sum_{j^*} exp_{it} Crisis_{j,t} \tag{15}$$

where $Crisis_{j,t}$ is a dummy variable that equals 1 after 1997 for the five Asian countries that were hit the most by the Asian crisis (Thailand, Korea, Philippines, Indonesia, Malaysia) and exp_{it} is a dummy variable that equals 1 if the firm exported to one of these countries in 1995 or 1996.

B Instruments: first stages

Table 15: Baseline results: first stage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	ln export sales					Δ ln export sales	
Instrument	FD_{it}				FD^{core}_{it}	FD_{it}	
ln Instrument$_{it}$	0.398^{a}	0.404^{a}	0.379^{a}	0.515^{a}	0.283^{a}		
	(0.039)	(0.038)	(0.037)	(0.044)	(0.034)		
Δ ln Instrument$_{it}$						0.216^{a}	0.146^{a}
						(0.032)	(0.034)
ln Domestic demand$_{it}$	0.091^{a}		0.103^{a}	0.112^{a}	0.127^{a}		
	(0.029)		(0.030)	(0.029)	(0.031)		
Δ ln Domestic demand$_{it}$						0.097^{b}	0.089^{c}
						(0.040)	(0.054)
ln Number of firms$_{kt}$	0.364^{c}						
	(0.186)						
ln Industry domestic sales$_{kt}$	0.139^{a}						
	(0.046)						
Observations	143515	143515	143515	143515	143515	107113	101414
Firm FE	Yes	Yes	Yes	Yes	Yes	No	Yes
Year dummies	Yes	No	No	No	No	No	No
Sector × year dummies	No	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. This table contains the first stage estimates of Table 4. The instruments are the following. In columns (1), (2), (3), (4), (6), (7): foreign demand in HS6 products exported by the firm (FD_{it} in the main text) - instrument taken in first difference in columns (6) and (7); in column (4): foreign demand for the core (HS4) product exported by the firm (FD^{core}_{it} in the main text).

Table 16: Additional first stage estimations

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Dep. Var.	ln export sales								
Instruments									
ln FD_{it}	0.359^{a}								
	(0.040)								
War_{it}^{X}	-0.093^{b}								
	(0.041)								
ln t_{it}^{X}		-0.009^{b}							
		(0.004)							
ln $t_{i,t-1}^{X}$		-0.001							
		(0.003)							
ln τ_{it}			-0.076^{b}						
			(0.035)						
Asian crisis$_{97-01}$*Exposed$_{i}$				-0.040^{a}					
				(0.014)					
ln FD_{it}^{0}					0.110^{a}				
					(0.021)				
ln $FD_{it}^{0,1}$						0.150^{a}			
						(0.030)			
ln FD_{kt}							0.266^{a}		
							(0.054)		
ln $FD_{k,t}^{f}$								0.602^{a}	
								(0.145)	
ln $FD_{kl,t}$									0.027^{a}
									(0.008)
Observations	114514	85163	89743	143515	109971	80899	138469	138469	137715

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. This table contains the first stage estimates of the following regressions. Columns (a) and (b): Table 5, columns (2) and (4); columns (c): Table 6, column (2); column (d): Table 12, column (6); column (e) and (f): Table 8, columns (2) and (5); columns (g) to (i): Table 9, columns (1), (2) and (4). All estimations include firm fixed effects and sector × year dummies and domestic demand. See the data appendix for more details on the computation each of the instruments.

C Additional tables

Table 17: Baseline results, excluding imports from France from the computation of the instrument

	(1)	(2)	(3)	(4)	(5)	(6)
Estimator	2SLS				2SLS	
Dep. Var.	ln dom. sales				Δ ln dom. sales	
ln Export sales$_{it}$	0.143^{a}	0.229^{a}	0.149^{a}	0.015		
	(0.032)	(0.031)	(0.029)	(0.023)		
ln Number of firms$_{kt}$	0.285^{a}					
	(0.083)					
ln Industry domestic sales$_{kt}$	0.113^{b}					
	(0.047)					
ln Domestic demand$_{it}$	0.107^{a}		0.116^{a}	0.121^{a}		
	(0.022)		(0.018)	(0.018)		
ln Export sales$_{it}$ $\times$ export ratio$_{i0}$				0.616^{a}		
				(0.144)		
Δ ln Export sales$_{it}$					0.269^{a}	0.420^{a}
					(0.066)	(0.121)
Δ ln Domestic demand$_{it}$					0.080^{a}	0.064^{a}
					(0.016)	(0.021)
Observations	143492	143492	143492	143492	107101	101404
Firm FE	Yes	Yes	Yes	Yes	No	Yes
Year dummies	Yes	No	No	No	No	No
Sector $\times$ year dummies	No	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap stat.	68.95	72.00	65.82	34.27	25.61	8.75

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations but (6) (first differences) include firm fixed effects. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. The instrument is the foreign demand in HS6 products exported by the firm (FD_{it} in the main text) - instruments taken in first difference in columns (5) and (6) - from which we have excluded the import from France.

Table 18: Channels of transmission: exogenous changes in exports and liquidity

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	Cash flow ratio				
ln Export sales$_{it}$	0.034^{a}	0.046^{a}	0.086^{a}	0.039^{a}	0.043^{a}
	(0.007)	(0.009)	(0.016)	(0.008)	(0.011)
ln Export sales$_{it}$ × WCR$_{i0}$		-0.027^{a}			
		(0.010)			
ln Export sales$_{it}$ × SFR$_{i0}$			-0.552^{a}		
			(0.116)		
ln Export sales$_{it}$ × LT Debt$_{i0}$				-0.021	
				(0.016)	
ln Export sales$_{it}$ × ST Debt$_{i0}$					-0.011^{c}
					(0.006)
ln Domestic demand$_{it}$	0.013^{a}	0.014^{a}	0.011^{b}	0.014^{a}	0.014^{a}
	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Observations	126141	116602	118864	111838	108295
Kleibergen-Paap stat.	110.74	54.24	47.20	48.83	44.86

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. 2SLS estimations. All estimations include firm fixed effects and sector×year dummies. The instrument used for exports is the foreign demand in HS6 products exported by the firm as defined in the main text. Cash flow ratio: cash flow over investment capital (equal to equity plus medium-and long-term debt). WCR: working capital requirement ratio; SFR: self-financing ratio; (LT Debt / Tot. Debt): long-term debt over total debt; (ST Debt / Tot. Debt): short-term debt over total debt. All these indicators are taken at the beginning of the period. See main text and appendix for more details on the computation of these variables.

Table 19: Effect of changes in exports on unit costs and price cost margins:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln ULC$_{it}$		ln UCC$_{it}$		ln PCM$_{it}$		ln TFP$_{it}$	
ln export sales$_{it}$	-0.081^{b}	-0.013	-0.099^{b}	0.028	0.154^{b}	0.030	0.103^{a}	0.038
	(0.037)	(0.024)	(0.048)	(0.031)	(0.060)	(0.053)	(0.031)	(0.026)
ln domestic demand$_{it}$	-0.061^{a}	-0.064^{a}	-0.094^{a}	-0.099^{a}	0.043	0.045^{c}	0.070^{a}	0.072^{a}
	(0.018)	(0.018)	(0.021)	(0.021)	(0.029)	(0.027)	(0.018)	(0.018)
ln Export sales$_{it}$× export ratio$_{i0}$		-0.328^{b}		-0.600^{a}		0.656^{a}		0.344^{a}
		(0.131)		(0.164)		(0.155)		(0.091)
Observations	135561	135561	131392	131392	109656	109656	109656	109656
Kleibergen-Paap stat.	103.98	62.15	97.12	57.89	93.49	51.78	93.49	51.78

Robust Standard errors, clustered by industry, in parentheses. ^{c} significant at 10%; ^{b} significant at 5%; ^{a} significant at 1%. All estimations include firm fixed-effects and sector×year dummies. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 16.4 is all estimations. ULC$_{it}$: unit labor cost; UCC: unit cost of capital; PCM: price cost margin.