Globalization of Inflation: Micro Evidence on the Imported Input Channel

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Abstract

In a world with vertical linkages, the international diffusion of shocks depends on the sensitivity of domestic prices to changes in imported inputs' prices. To measure it, we exploit a novel set of set of data matching individual production prices and import prices for about 500 French firms. We document four main results. First, the elasticity of domestic prices to imported inputs prices is 12%. Second, the transmission is much lower among firms importing inputs from a related party. Third, the sensitivity to movements in imported costs of both domestic and export prices is not statistically different. Last, the estimates imply that on average 9% of the volatility of production prices at the sectoral level is driven by changes in imported inputs' costs.

JEL Classification: F1, F4, L1

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1. Introduction

Domestic production involves a substantial amount of imported inputs. Manufacturing industries exhibit shares of foreign inputs in total costs ranging from 20 to 67 percent.[1] For this reason, vertical production linkages are crucial in explaining the international transmission of shocks in open macroeconomics.[2] Related to this issue, the intensive use of imported inputs questions the sensitivity of domestic prices to foreign ones. The strength of these effects depends on the extent to which changes in imported costs are transmitted to domestic prices. Despite its central role, direct evidence on this transmission at the firm level are very scarce.

To fil this gap, this paper investigates how movements in the price of imported inputs are passed on to domestic output prices.

The analysis relies on a novel dataset that reports monthly individual quotes for the price of imported inputs as well as production prices. Namely, we match at the firm-level the micro prices collected by the INSEE (the French statistical agency) to compute the French price indices for production, imports and exports. Thus, we observe for about 500 manufacturing firms the production prices of goods sold in the French market and abroad, and the price of their imported inputs. We document four main results. First, on average, the elasticity of domestic prices to imported inputs prices is 12%. A large part of this incompleteness in pass-through is related to the share of imported inputs used in the production process. Yet, there is an important heterogeneity across sectors that remains unexplained. Second, the transmission is much lower among firms that import inputs from a related party. Third, movements in imported costs are passed on to the same extent to both domestic and export prices. Last, we show that, on average, 9% of the volatility of production prices at the sectoral level is driven by imported cost shocks of inputs. Again there is a significant

[1] See Goldberg and Campa (2010). These figures are averages across OECD countries.

[2] di Giovanni and Levchenko (2010) find vertical linkages accounts for 30% of trade-induced business cycle correlation.

heterogeneity across sectors, the volatility explained by imported input prices ranging between 0 and 40%.

To measure firm-specific imported input price shocks, we average out import prices at the firm level. This provides us with a measure of imported costs. Changes in firms' imported costs and in their production prices are observed in every period. It allows us to estimate the elasticity of price changes with respect to changes in imported costs. Since prices are sticky, we estimate the pass-through conditional on observing a change in the output price. Controlling for competitor prices, labor costs, sectoral production prospects, and firm unobserved characteristics, we find that 25% of changes in imported costs are transmitted to domestic prices. Intuitively, firms' imported costs pass-through depends on the share of imports in total costs. We confirm it using sector level information from input-output tables. Interestingly, we do not find that output prices react asymmetrically to imported cost increases or decreases. We also compare the pass-through of imported prices for arm-length transactions and for intragroup transactions. The estimated elasticity is significantly lower, and even non significant in some specifications for intragroup import prices.

Next, we check the robustness of our results to the potential endogeneity of imported costs. Typically, a higher demand for the output may lead to an increase in demand for inputs, driving both the price of inputs and the price of output up. In our regressions, we control for changes in sectoral characteristics, including changes in sectoral demand. However, we do not have information concerning firm-specific demand. We argue that any instrumentation strategy would require firm-specific instruments. Since we cannot build such firm-specific instruments, we follow a different strategy and focus on input prices that we consider exogenous to the firm. To do so, we use the nature of the transaction associated with every import price that is reported in our dataset. In particular, we assume that the prices of inputs that importing firms declare as not specific to one supplier, are exogenous. Our assumption is that if a firm can import a given input from different suppliers, this means the

good is highly standardized. And, we can reasonably think that the price of such internationally traded good is not affected by changes in the demand of a given firm.[3] Exploiting exogenous input price changes, we find that firms, transmit on average 12% of imported costs changes into their domestic prices.

Furthermore, our data report not only domestic but also export prices. Focusing on firms that sell their products both domestically and abroad, we ask whether imported costs are passed on differently in different markets. Differences could exist because of the presence of exchange rates, differences in market shares, or differences in the competitive pressure faced by firms. In our sample, we do not find any significant difference in pass-through between domestic and export prices.

Last, we attempt to have a more macro view of our micro estimates. Namely, we ask what share of the volatility of sectoral prices can be explained by imported input prices. On average, 9% of the variance of prices is explained by import inputs. However, this hides a large variance across sectors. Namely, in the manufacturing of chemicals and chemical products, imported inputs account for 40% of price volatility. By contrast, for basic pharmaceutical products, movement in the price of imported inputs do not explain the sectoral volatility of prices at all.

Literature. This paper participates in the burgeoning literature studying individual prices (Dhyne, lvarez, Bihan, Veronese, Dias, Hoffmann, Jonker, Lnnemann, Rumler and Vilmunen 2005, Bils and Klenow 2004, Nakamura and Steinsson 2008).[4] While these papers focus on the dynamics of price changes, our paper deals with the determinants of those price changes.

In this respect, it is related to Fougere, Gautier and Bihan (2010) who look at the impact of changes in the minimum wage on restaurant prices. It is also

[3] In the same vein, we alternatively focus on goods that are classified as non differentiated according to Rauch classification. Those good are less likely to react to firm specific changes in demand. [TO BE DONE]

[4] The distinction we do between intra group prices and arm-length prices relates our work to Neiman (2010) and Bernard, Jensen, Redding and Schott (2010).

closely linked with Nakamura and Zerom (2010) and Goldberg and Hellerstein (2007) who structurally estimate the determinants of incomplete pass-through in the coffee and beer industries respectively. In contrast to these papers, we study firm-specific import cost shocks, for a wide range of industries.

In addition to its coverage (the whole manufacturing industry), our data presents several advantages. First, very few datasets combine information about production and import prices at the firm level. Information on import prices at the firm level are often approximated by unit values, based on custom data. In addition to the drawbacks linked to the quality of unit values, such data do not provide information on domestic prices or domestic unit values.[5] Second, while studies based on individual production prices data exist, to our knowledge, these data have never been merged with information about the price of imports at the firm level. Third, our data allows us to disentangle intra-firm prices from arm-length transactions, which cannot be done in studies using more aggregate sectoral data.

Most of the literature studying cost pass-through usually focuses on exchange rate pass-through (Goldberg and Knetter 1997). This offers several advantages. In particular, exchange rates are often viewed as exogenous shocks, they are widely available and apply to most of trade prices. However, they present two main drawbacks in comparison to the use of firm-specific imported input price changes. First, exchange rates directly impact trade prices. But trade prices and domestic prices may have different dynamics (Schoenle 2010), therefore the pass-through estimated from trade prices may not be similar to the cost pass-through of domestic prices. Second, the exchange rate is a particular cost. Firms may insure against it through formal insurance or through their sourcing strategies. Therefore conclusions about exchange rate pass-through may not apply to other costs, such as the cost of intermediate inputs.

Our paper is also in line with recent empirical works linking globalization

[5]Trade data are recorded at very low levels of aggregation which allows one to compute unit values. The counterpart for domestic production does not exist.

and inflation. For instance, using sectoral data, Goldberg and Campa (2010) evaluate the relative importance of the channels through which domestic inflation responds to exchange rate movements and import prices. From a calibration exercise, they show that the imported cost channel is the most important one, imported inputs accounting for between 10 and 48% of domestic prices. Auer and Fischer (2010) analyze the specific impact of imports from China on sectoral inflation in the US. They find that imports from China induce a downward pressure on US sectoral inflation. In the same vein, Benigno and Faia (2010) show that higher international pressures have a positive impact on pass-through. Instead of looking at the impact of changes in markets shares on domestic prices at the sectoral level, we analyze the impact of imported input prices on domestic prices at the firm level.[6]

Last, the paper inserts in the recent trade literature focusing on imports at the firm level. Most of this literature have underlined the beneficial impact of imported intermediate inputs on firms' productivity (Amiti and Konings 2007, Goldberg, Khandelwal, Pavcnik and Topalova 2010). In the same vein, Gopinath and Neiman (2011) use micro data to explore the mechanisms of trade adjustment during the crisis and to simulate the impact of an imported input costs shock on aggregate TFP. Here we provide new evidence on the pricing behavior of importing firms and the transmission of imported costs shocks, using monthly information on individual prices and costs.

The paper proceeds as follows. The next section describes the data. Section 3. presents both aggregate facts and evidence on the dynamic of individual prices. Section 4. describes the empirical strategy. Section 5. displays the results. Section 6. examines the aggregate implications of the results. Last, Section 7. concludes.

[6]Notice that our data does not provide any information on the origin of imports. Therefore, the specific impact of China or other low-wage countries on production prices cannot be studied.

2. Data

We use three datasets in this paper. The first, OPISE, is a confidential dataset provided by the INSEE (the French statistical agency) that reports series of individual production prices and import prices used to construct the French Producer Price Index, the French Import Price Index and the French Export Price Index. This dataset has been used by Gautier (2008). The author provides empirical evidence on the frequency and the size of production price changes over the period 1995-2005.

The second dataset combines domestic and export French price indices at different level of disaggregation as well as information on labor costs, and production prospects at the sectoral level. All these information are extracted from the INSEE website.

Third, we use the French input-output matrice for year 2005 to measure the share of imported costs in total costs at the sectoral level.[7]

2.1. OPISE

Information on individual prices relies on the OPISE database built by the INSEE to construct the French PPI. The INSEE, surveys about 5,500 firms and collects about 34,000 individual prices every month.[8] Both manufacturing and service sectors are surveyed. We use data on manufacturing only which represents 4,300 firms and 30,000 individual prices. For manufacturing, three types of prices are collected. Prices of goods produced in France and sold on the domestic market that we will refer as domestic prices, prices of goods produced in France and sold on foreign markets that we will refer as export prices, and import prices. We obtained information from January 2005 to August 2010.

[7] Input-output matrices are available on the OECD website.
[8] These figures stand for 2005.

Coverage. The choice of individual prices collected by INSEE is done in two steps. The first step consists in selecting the surveyed firms. Statistical engineers study the structure of each industry on the domestic, export, and import markets. Using the EAE database (a French survey describing total sales of firms, by industry, in the domestic and foreign markets) they select the largest firms of the industry. They conserve the firms whose cumulative sales stand for more than 70% of the industry. In 2005, industries are covered at 98% (in terms of sales) for domestic prices and at 90% for export prices.

Individual prices. The second step is to choose the individual prices that are followed. The policy of the INSEE is to follow the price of representative transactions. Representative transactions are chosen during the personal visit of an engineer-pollster. The following points are taken into consideration: what is the relative importance of the different goods produced by the firm, which transactions are the most representative of price changes, how to get comparable information on transaction over time. If the firm has the same pricing policy for all its products and all its transactions, then only one representative transaction will be collected. However, if the pricing policy depends on the products, the market served, several prices will be collected every month. During the visit, some extra information is compiled by the pollster such as the description of the product, the nature of the transaction, its currency, or the value of sales. For instance, the INSEE disentangle intragroup and arm-length transaction. This distinction exists for import and export prices only. Actually, domestic prices related to intragroup transaction are not collected. These details are updated every five years. The individual weights of series in the PPI are computed from the sales declared during the visit and changes every five years as well.

The goal of this survey is to collect individual time series of prices and then aggregate them to construct the PPI. Therefore, it is important to have time series of individual prices. Times series of individual prices and the study of representative transaction are often hard to reconcile. Actually, transactions

defined as the sale of one given product to a given customer are not done all months and often disappear quickly. Therefore reported prices are sometimes mix prices. Mix prices refer to a mix of different product sold to a given buyer, or more generally a mix of the same product sold to different buyers. For import and export prices, the price can be a country mix. This type of mix refer to cases where the good is imported/exported at different prices from/to different destinations but by/to the same supplier/buyer.

In our data, the different types of mix are indicated for each series. We group the series in two types. First, the pure prices, the country mix prices, and the product mix prices are grouped together. Those transactions have the particularity to be specific to a buyer and a supplier. Second, the other series, that do not reflect the price of a *specific* transaction between a buyer and a supplier. We use this distinction to classify import prices. Namely, we argue that if firms report that a transactions is not specific to a supplier, this means that the imported good is sufficiently standardized. In that case, the buyer does not have to build a specific relationship with the supplier.

Price collect. At the end of each month, firms are invited to indicate the price of the selected transactions by mail (55%) or via internet (45%).[9] The monthly average rate of answer is 85%. Firms that do not report individual prices are subject to judiciary pursuits. If price reports are considered as "outliers", pollsters phone the firms and check the reasons explaining the difference between the reported price and the price reported the month before.

Prices. Individual production prices are mill prices reported net of VAT and include the sales and discounts. The price reported for products sold on foreign markets is the free on board (fob) price. The price of imported goods accounts for costs, insurance and freight. For import and export prices, we do not know the precise origin/destination of the transaction. However, we know for

[9]There does not exist a two-step procedure as in BLS data, where firms are first asked whether they changed their price or not.

some imports and exports whether the destination/origin country is a country of the European Union. Last, for confidentiality purposes, we do not have access to the true price level. All series are multiplied by a constant (different for each series). This is not a problem since in our specifications, we consider price changes, that are not affected by the constant shift in price levels.

2.2. Sectoral and aggregate data

Our estimation strategy makes use of several control variables at the sectoral level. To control for competitor prices, we build a sectoral prices index that exclude firm's own prices from our data. To take into account changes in demand addressed to the firms, we use the sectoral production index provided by the INSEE at the 2 digit level of the NACE nomenclature. We further control for labor costs, at the same level of disaggregation, also provided by the INSEE. In certain specifications, we control for the share of imported inputs in total output at the sectoral level. This information comes from input-output OECD tables for 2005. At some point, we also use the sectoral Herfindalh index.[10]

3. Stylized Facts

3.1. Aggregate data

To give an idea of the inflationary environment in the French manufacturing industry, we begin by documenting the trend of aggregate prices over the period 2005-2010. Figure 3 plots the evolution of import, export and domestic price indices for France. All three series are computed from prices in euro. We see that the three series are positively correlated. Interestingly, the export price series exhibit less volatility than the import and domestic series. For the three series, we observe the striking drop in prices in mid-2008, when the real effect of the crisis were felt in France.

[10] I thank Claire Lelarge for providing me with this index.

Figure 4 plots the relative export price index against the nominal effective exchange rate (NEER). The relative export price index is computed as the ratio of export price changes over domestic price changes. The NEER is from the Bank of International Settlement. It is computed as a trade weighted average of bilateral nominal exchange rates. We see a strong negative correlation between the two series, suggesting the real price of exports decrease in response to an appreciation of the euro against other currencies.

Figure 5 compares the official price index with the price index computed using our individual data and the weights reported in the dataset. In particular, the price index is computed using the whole sample of data, but also using the prices for the restricted sample of firms that report both production prices and import prices. This latter sample is the one used in our empirical analysis. We observe a strong correlation between the three series. The correlation between reconstructed indices and the official price is index is 0.95 for the index using the whole dataset, and 0.9 for the index built from the restricted sample. We also investigate the correlation between official indices and reconstructed indices, at the industry level. The correlation between official sectoral indices and indices built from the whole sample is 0.8. It drops to 0.6 for the sample restricted to firms reporting both domestic and import prices. This lower correlation is mainly driven by the furniture industry that exhibits a very small correlation of 0.2.

3.2. Item level data

We have access to the universe of manufactured products surveyed by the INSEE from January 2005 to September 2010 $i.e.$ 1,332,033 observations. We drop series lasting less than 12 months. We also drop all observations for which we do not have information about the sectoral classification of the product.[11] We are left with 1,063,961 observations. About 60% of observations are domestic

[11]There were a change in nomenclature in 2008. We are able to get information about the CPF4 revision 2008 of surveyed prices for 89% of observations.

prices, 20% are export prices and the remaining 20% are import prices. Notice that respectively 9% and 25% of export and import prices correspond to intra-group transactions. Table 1 presents the average number of observations per month available every year in our sample. We see that the number of domestic prices increased by 40%, the number of export prices has been multiplied by 2.8, and the number of import prices has been multiplied by 4.

The dataset consists of 27,547 series of price, reported by 4,456 firms. Among these firms, 37% report only domestic prices, 22% report only import prices and more than 9% report the price of their imports and their domestic prices - more than half reporting also their export prices (see Table 2). Firms reporting domestic prices do so for 4.3 products on average. The average number of exported and imported products is respectively 3.4 and 3.7 (see Table 3). The maximum duration we observe a price is 69 months. The average number of month we observe a price is 42 for domestic prices, 34 for export prices, and 35 for import prices.

Table 4 presents the currency of transaction of the different trade prices. One can see that the vast majority of both imports and exports are in Euro.

Table 5 documents the frequency and the implied duration of price changes. The frequency is a simple average of frequencies computed at the item level. The implied duration is given by the inverse of the frequency. Those frequencies are provided at the sectoral level, for domestic, export and import prices. Two facts emerge from this table. First, we observe an important heterogeneity in the frequency of price changes across sectors. For instance, prices change on average every 1.3 months for food products and every 22 months for basic pharmaceutical products. This heterogeneity is line with previous studies (see Nakamura & Steinsson 2008). Second, comparing the sectors where prices are reported for domestic, import and export prices, we see that on average export and import prices are stickier than domestic prices. This is particularly true when considering durable products.

Figure 2 plots the monthly share of price changes over time. We see that the

share of positive price changes is a bit higher than the share of negative ones. Interestingly the share of price changes looks stable over time suggesting that, at the aggregate level, prices are staggered. It is worth to note that we observe a strong seasonal pattern in the dynamic of individual prices. At the beginning of each year, the share of price changes increases. These price changes are mostly positive. **[comments]**

4. Empirical strategy

4.1. Measuring the sensitivity of domestic prices to imported input prices

This section details our strategy to measure the sensitivity of domestic prices to imported input prices. To estimate this elasticity, we run the standard pass-through regression - traditionally used to quantify exchange rate pass-through. Since our prices exhibit substantial stickiness, we follow Gopinath and Rigobon (2008) by measuring pass-through conditional on observing a change in the price of output. Therefore, changes in the dependent variables are explained by changes in our explanatory variables since the last output price change. The main determinants of price changes are labor costs, input' prices, competitor' prices and production. Competitor prices are a proxy for both competition and the price of domestic intermediate inputs. At the end, we estimate:

$$\Delta_{t,\tau} p_{fkpt} = \alpha \Delta_{t,\tau} z_{ft} + \beta \Delta_{t,\tau} X_{kt} + u_{fkp} + \epsilon_{fkpt} \tag{1}$$

where f, k, p, t index the firm, its sector, its product and the period respectively. The period $[t-\tau, t]$ is the period elapsed since the last price change. $\Delta_{t,\tau} Y$ is the change in variable Y between dates t and $t-\tau$. p is the logarithm of the output price, z is the logarithm of the price of imported inputs, X is a vector of control variables and u is a firm-product fixed effect.

The pass-through is complete if changes in imported costs are fully passed-through into output prices *eg.* if α is equal to one. For several basic reasons, we do not expect this pass-through to be one. First of all, the extent of pass-through should be limited by the share of imported inputs entering in the production process. For instance, if imported inputs account for one fourth of firm' costs, we do not expect more than one fourth on imported costs changes to be passed on to prices. To measure this effect, we interact the change in imported input prices with the share of imported inputs in the firm's industry.[12] The regression becomes:

$$\Delta_{t,\tau} p_{fkpt} = \alpha \Delta_{t,\tau} log(z_{ft}) \times io_k + \eta io_k + \beta \Delta_{t,\tau} X_{kt} + u_{fkp} + \epsilon_{fkpt}$$

where io is the share of imported inputs used in industry k. The sensitivity of output prices to input prices depends on the share of imported inputs used in the industry is given by α. This channel is close to the local cost channel emphasized by the exchange rate pass-through literature.

Another channel that could reduce or increase pass-through is the substitution between foreign and domestic inputs. In particular, if the price of imported inputs increases, firms could substitute them with domestic ones. This mechanically reduces the pass-through. Conversely, if imported input prices decrease, firms could substitute their domestic inputs with the foreign ones, which is expected to increase the pass-through. Therefore, this substitution effect has an asymmetrical impact on pass-through: imported input price increases being less transmitted than in a configuration without substitution, and imported input price decreases being more transmitted. A basic test of such effect is therefore to measure whether the prices react asymmetrically to price increases and price decreases.

Pass-through may also be reduced because firms adjust their markups following a change in their costs. A basic way to account for this effect is to control

[12] We have no information on the share of imported inputs at the firm level.

for the level of competition in the industry. We do so in some specifications by interacting the Herfindahl index with the input price changes. We expect the pass-through to be lower in industries with a strong level of competition.

The last traditional channel explaining incomplete pass-through is non constant marginal costs. If a change in the price of inputs is associated with a change in the quantities of output produced by the firm, and if the firm experience increasing marginal cost, then this could affect the pass-through. The impact of this channel on the degree of pass-through is unclear in our case.

Our data distinguish production prices of goods produced in France and sold in France, and goods produced in France and sold abroad. We call the latter export prices. A first way to contrast the transmission of input price changes into domestic and export prices is to run regression (2) on domestic and export prices separately. However, differences in estimated coefficients can be due to differences in firm pricing behavior, but also to composition effects. In particular, not all firm exports, and exporting firms do not sale the same bundle of products on domestic and export markets. To deal with such between-firm composition effects, we proceed in two steps. First, we aggregate prices at the 4-digit sector-level for each firm. We do so to be sure that we compare price changes for firms selling the same type of goods domestically and abroad. Second, we focus on firms serving the same type of goods in both the domestic and the foreign markets. Then we estimate:

$$\Delta_{t,\tau} p^m_{fkt} = \alpha \left(\Delta_{t,\tau} z_{ft}\right) + \alpha_{exp} \left(1 - D\right) \left(\Delta_{t,\tau} z_{ft}\right) + \beta \Delta_{t,\tau} X^m_{kt} + u_{fk} + \epsilon_{fkt} \qquad (2)$$

Where the superscript m indicate whether the price is for a good sold domestically or abroad and D is a dummy equal to one if it is a domestic price.

The average effect of a change in imported costs is given by α. The difference in the effect to domestic and export prices is given by α_{exp}.

4.2. Endogeneity

In our specifications, endogeneity may arise because an omitted variable. In particular, an idiosyncratic demand shock to the firm may affect the price of both inputs and output. On the one hand, following a positive demand shock, a firm should increase its output price. On the other hand, this increase in demand for output should induce higher profits and a increase in the demand for inputs. Therefore, input prices could increase for two reasons. First, if the price of inputs is set after a bilateral bargaining between the supplier and the firm, the perspective of higher profits may lead to an increase in the price of inputs as long as the supplier has some bargaining power. The second mechanism is simply that firm' demand for input increases which increases the price of inputs.

In that case, not taking into account this omitted variable would lead to an upward bias in our pass-through estimate. It is worth to note that other mechanisms can suggest that in fact we face an downward bias. In particular, the increase in demand for inputs may lead to lower prices for these inputs if there are some forms of second-degree price discrimination. The firm demands more inputs, bargains over the price of these inputs, and finally manage to get lower prices per unit because it buys more units.

Importantly, the mechanisms leading to an upward bias suggest some specificity in the relationship between buyers and sellers. If the input is standardized i) there is no bargaining between the the supplier and the buyer that could induce a price increase after an increase is demand for the input, and ii) the idiosyncratic increase in demand from the buyer is not likely to raise the price of a standardized input. Therefore, our strategy to get ride of endogeneity is to focus on inputs that do not involve any specific link between the buyer and the seller. We consider that price changes for these inputs maybe considered as exogenous for the firm.

To do so, we need to disentangle specific and non specific transactions. Statistical agencies want to follow the price of representative transactions. By rep-

resentative they mean, the same product traded between the same two parties every month. Nevertheless, particularly for imports, firms sometimes report that they import the same product from a different supplier every month, or from different suppliers each month. This means that those products are quite standardized, and that there is no specific relationship between the supplier and the buyer. Thus, changes in the price of those inputs may be considered as exogenous for the firms. Fortunately, the INSEE reports whether the transaction is specific to a supplier or not. Then, we focus on the sample of inputs imported through a non supplier-specific transaction. We consider that, for this sample, changes in imported inputs prices are exogenous to the firm.

An alternative way to focus on inputs that change their price exogenously consists in using the Rauch classification. This classification categorizes goods in three types: differentiated products, reference prices and homogenous goods. We expect the price changes for reference and homogenous inputs to be exogenous for the firms.

Another methodology that could be used to deal with endogeneity is to find an instrument for the change in input prices. It appears very hard to build valid instruments from our dataset. The best instrument we could think of would be firm and time specific. The only variable in our database that is firm specific and not correlated directly with output prices are lagged values of import price changes. However, in our data, input price changes are almost not correlated with their lagged value. We should therefore use sector and time specific instruments. However, those instruments (such as exchange rate movements) also affect competitors input prices and in turns competitors output prices. Therefore, our instruments would not impact output price only through the input prices but also through competitors prices. This greatly limits the validity of this type of instruments. For this reason, we decide to focus on inputs for which we consider price changes as exogenous.

5. Results

5.1. Imported costs pass-through into domestic prices

First results. The main results are displayed in Tables 6 and 7. The tables report respectively the results for imported inputs through arm-length transactions and exogenous arm-length transactions.

In the first columns, changes in output prices are explained by changes in firm imported inputs' prices (since the last output price change) and fixed effects. Fixed effects are a combination of 4 digit sector $\times$ period. They measure at every period, changes in firms' environment that are sector-specific. Like in all regressions, reported standard errors are clustered in the firm $\times$ period dimension which is the dimension of the main explanatory variable. The first column of Table 6 shows that 29% of changes in imported costs are transmitted into domestic prices. This effect is significant at the 1% level. This finding holds when considering non specific "*exogenous*" arm-length transactions (Table 7, column 1). The coefficient is lower but highly significant (0.13). This suggests an upward bias when considering non exogenous cost changes.

Columns 2 to 4 of Tables 6 and 7 introduce sector specific determinants of price changes. Namely, we add changes in competitor prices, in labor costs and in production (columns 2 and 3), but also changes in competitors imported costs (column 4). All these specifications include product$\times$firm fixed effects and period fixed effects. As expected, competitors' prices have a strong positive and significant effect on output prices in all our specifications. The effect of labor costs is positive but never significant. This can be explained by the fact that an important source of wage variations are changes in the minimum wages, that are decided at the national level and are therefore captured by our period fixed effects. Changes in our index of production turn to have a very low coefficient that is never significantly different from zero. For arm-length domestic prices (Table 6 column 2), the estimated elasticity of prices to imported costs is close to 0.24. For what we call exogenous arm-length changes in import

prices, the effect is a much smaller than in the previous specification. Namely, we measure that 13% of imported input prices changes are passed on to domestic prices.

In the different specifications, the estimated elasticity of competitors' prices is twice as large as the elasticity for imported inputs price changes. To avoid mis-interpretations of this gap in terms of magnitude of the two coefficients, we display in column 3 of Tables 6 and 7, the results of regressions of the same variables but standardized. Thus, we can interpret the coefficients as reflecting the impact of a one standard deviation of the explanatory variables on the explained variable. When considering all arm-length transaction, we find that almost 14% of a one standard deviation in imported prices is passed on to domestic prices. Interestingly, 14% of a one standard deviation in competitors prices is passed on to domestic prices, reversing the magnitude of coefficients we had before. However, this is not robust to the sample of exogenous price changes. Actually, in that case, 5.9% of a one standard deviation in imported costs are passed on to domestic prices against 13.6% for competitors prices.

In the fourth column of those tables, we control for the change in competitors import prices. The variable is not significant and does not influence the other coefficients.

Arm-length vs intra-group transactions. Previous estimates have focused on arm-length transactions. Nevertheless, a large part of international trade occurs within firms. We reproduce previous estimates, but focusing on changes in the prices of imports from related parties. When controlling for sector fixed effects, it appears that changes in costs are not transmitted at all into domestic prices (Table 8, col. 1). Since our sample on intra-firm transaction is strongly reduced, it may be that the very small and insignificant effect we find out is due to the lack of variance, all being captured by industry$\times$period fixed effects. When relaxing this strong fixed effects structure (columns 2-4), the coefficient turns significant. However, the estimated effect is much smaller than for arm-length

transactions. It suggests that around 6.5% of imported costs are passed on to domestic prices when the transaction occurs within related parties. A striking (and unexplained) result is the negative impact of changes in production we get for this sample, in all the specifications.

5.2. Heterogeneity in imported costs pass-through

Until now, we have measured the average impact of imported costs on domestic prices. However, we expect the degree of transmission to differ across industries, because of differences in their structure of production. We study this heterogeneity in the next paragraphs. Results are list in Table 9 for all arm-length prices and in Table 10 for exogenous arm-length price changes.

Asymmetry. The first columns of Tables 9 and 10 investigate whether positive and negative import price changes are passed on to the same extent to output prices. For all arm-length transactions (Table 9, col 1), coefficients on both import price increases and import price decreases are positive, but the coefficient on price decreases in imprecisely measured. The coefficient on price decrease is one and a half times as large as the coefficient on price increase. However, standard errors are large, and we cannot reject the equality of coefficients (F-stat:1.53). For exogenous changes in import prices, both coefficients remain positive and significant. Furthermore, the gap between the two is much lower, and one cannot reject the equality of coefficient (F-stat=0.26). Thus, our results suggest that overall, firms pass on positive and negative costs shocks to their domestic prices in the same extent. As discussed before, this symmetry suggests there is no major substitution between imported and domestic inputs, at the monthly frequency we look at.

Sector characteristics. The first sectoral characteristic we control for is the share of imported inputs in total production costs. To do so, we pre-multiply the changes in imported costs by the share of imported inputs in sectoral pro-

duction. The second column of Table 9 presents the results we get for the entire sample of arm-length transactions. The estimated elasticity on imported input price changes weighted by the sectoral share of imported inputs is of 1.474. The standard error is large, and the coefficient is not statistically different from one. This suggests that the incompleteness in pass-through we measured before was mainly driven by the share of imported inputs in firms' total costs. The first column of Table 10 reports the estimation for the sample of exogenous imported price changes. The elasticity is 0.76. It is much higher than in the regressions not taking into account the share of imported inputs. Overall, these results suggest that a large part of the incompleteness in imported costs pass-through is due to the share of imports used in the production process.

The second characteristic we want to control for is the structure of competition. We do so by interacting changes in imported costs with the Herfindahl index of the sector. The third columns of Table 9 and 10 both show the effect is not significant. This suggests that the structure of sectoral competition does not affect the pass-through of imported costs into domestic prices.

Sensitivity to the frequency of price changes. Gopinath and Itskhoki (2010) show that exchange rate pass-through is higher for goods with frequent price changes. We test whether we find such correlation in our data. We also investigate whether the pass-through depends on the frequency of price changes of the imported inputs. We compute the frequency of price changes at the item level, dividing the number of price changes by the number of observations we observe the series. Those frequencies are then interacted with imported costs changes.

In table 9, columns 4 and 5 present the results for all arm-length prices. The coefficients of those interaction terms are positive, but only the coefficient on the frequency of input price changes is significant. This suggests that i) firms changing more often their prices do not pass on a larger share of changes in imported costs, but ii) firms tend to pass on larger share of costs changes, when

the price of inputs change more frequently. However, coefficients are much smaller and no more significant when focusing on the sample of exogenous price changes (Table 10, columns 4 and 5).

Heterogeneity across industries. Table 12 lists the coefficients on imported inputs we estimates, for different sectors, depending on the type of imports (arm-length, exogenous, intra-firm). A first glance at this table reveals that there is an important heterogeneity in the degree of transmission of imported costs to domestic prices. Overall, we also see that the degree of transmission is much lower for intra-firm than for arm-length transactions. We describe the results for exogenous arm-length transactions, which are the most representative in our view. First, most of the estimated coefficients are not significant. The weak statistical significance is explained in some cases by the very low number of observation used to measure pass-through. This is the case in sectors where most of transactions for imports involve a specific supplier: motor vehicles, computer electronic and optical products, or pharmaceutical industry. By contrast, chemical industry, food and beverages, electrical equipment, metal products, and textile and apparel the pass through is above 8% and the estimated coefficient is highly significant.

5.3. Imported costs pass-through domestic vs export prices

Previous estimates investigate how imported price changes are passed on to domestic prices. However, firms use inputs to produce goods sold in the local market but also to produce goods sold in foreign markets. Domestic and foreign markets differ for several reasons: the presence of exchange rates for non euro countries, the intensity of competition, differences in market shares. For these reasons, we could expect firms to transmit differently changes in their costs into domestic and export prices. It's what we study in Tables 13 and 14. In the first column, we measure pass-through on the entire sample, including both domestic and export prices. Since we have aggregated firms' prices at the firm and

4-digit sector-level, this regression is a way to check that this aggregation does not give totally different results. In the two tables, the estimated coefficients are in line with previous estimates. In the second column, we restrict the sample to firms that produce for the domestic and the foreign markets. Actually our strategy of identification requires to focus on this type of firms. Coefficients have the same magnitude as in the first column. Then we interact input price changes with the dummy that is equal to one for exported prices (columns 3, 4, 5). We also control for the change in nominal effective exchange rate (NEER) (column 4) and an interaction between the NEER, the change inputs prices and the export dummy (column 5). The only significant interaction is the interaction between changes in the price of imported inputs and the dummy for exports in Table 13. However, when considering exogenous input price changes, the coefficient turns not significant and becomes very small. This suggests firms pass on imported costs in the same extent to domestic and export prices.

6. Aggregate implications

6.1. Strategy

Individual price changes are mainly the fact of idiosyncratic shocks. The low R^2 we have in our different specifications confirm it. However, we could expect this idiosyncratic shocks to cancel out in the aggregate (Bergin, Glick and Wu 2010). At the sectoral level, we could therefore expect that a larger fraction of price volatility will be explained by measurable variables. In particular, in this section, we ask what share of sectoral price volatility can be explained by imported input prices. To address this issue we proceed in three steps. First, we estimate the elasticity of output prices with respect to imported input costs by industry using our firm-level data. Second, conditional on observing a change in the output price, we compute the predicted size of this output price change driven solely by a change in imported cost. Therefore, we have at every period

micro output price changes, and counterfactual price changes predicted by import price movements. In a third step, we build two sectoral indices using actual and predicted price changes.[13] Then, we measure what share of sectoral price changes is related to import price movements. Namely, we regress the sectoral price index on the predicted-by-imports sectoral price index. The R^2 of this regression provides us with a measure of the variance in sectoral domestic prices explained by imported inputs.

6.2. Findings

Results are presented in Figure 6. Like in our sectoral estimations of imported costs pass-through, we observe an important heterogeneity in the share of price volatility explained by imported inputs. The average share of the variance in prices (measured by the R^2) explained by imported inputs is 0.09, but this is mainly driven by chemical products, for which imported inputs explained 41% of price volatility. In sectors such as rubber and plastic products, and wood and paper products, import prices also contribute to a substantial share of sectoral volatility (more than 10 percent). In the other industries the contribution of imported prices is much smaller. A glance at the data suggests that the very small contribution of imported inputs' prices to sectoral inflation is explained by the substantial stickiness of import prices. Actually, it appears that production prices change more frequently than import prices. Therefore, a large fraction of price changes cannot be explained by those import prices. More precisely, in the data, 70 percent of import price changes are less frequent than domestic price changes. When focusing on the sample of exogenous price changes, 80 percent of import prices are more sticky than domestic prices.

[13] Micro prices are aggregated using the weights used in the construction of the PPI.

7. Conclusion

This paper investigates the transmission of imported costs to domestic prices using highly detailed data on imported input prices and production prices at the firm level.

On average, 12% of imported input price shocks are passed on to domestic prices. However, there is a significant heterogeneity in the degree of pass-through among industries. One explanation for this heterogeneity is that industries vary in their use of imported inputs. But, a large part of the heterogeneity remains unexplained. Interestingly, we do not find any evidence of heterogeneity in pass-through for domestic and export prices. This suggests that demand conditions are not so important to explain cost pass-through. We also show that price changes of transaction occurring between related parties are much less passed on to domestic prices. This suggests that the inflationary pressure of imports also depends on whether the imports occurs within firms boundaries or not.

We end up our analysis by showing that on average, 9% of the sectoral price volatility is explained by the volatility of imported costs. Once again there is a strong heterogeneity across sectors. In addition to the share of imported inputs in total costs, the volatility of demand and local costs is another mechanism that can explain this heterogeneity. Actually, if the price of local costs or the demand is highly volatile relative to import prices, they may be the driving force of domestic prices, muting the sensitivity of production price to imported costs.

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Table 1: Average monthly number of observations over years

Year	Domestic	Exports	Imports	Total
2005	6,961	1,435	915	9,310
2006	8,521	2,351	2,501	13,373
2007	9,716	3,207	3,083	16,006
2008	10,650	3,938	3,695	18,283
2009	10,694	4,263	4,064	19,021
2010	9,459	3,823	3,612	16,895

Notes: This table reports the average number of observations collected every month for years 2005 to 2010. We disentangle observations for prices of good produced in France and sold in France (domestic), goods produced in France and sold abroad (exports) and goods produced abroad and sold in France (imports). The last column is the sum of the three others.

Table 2: What prices do firms report?

Status	# of obs.	Percent
Domestic only	1,310	35.07
Exports only	107	2.86
Imports only	699	18.71
Dom.& Exp.	1,040	27.84
Dom. & Imp.	216	5.78
Imp. & Exp.	36	0.96
Dom. & Imp. & Exp.	327	8.76
Total:	3,735	100

Notes: This table reports the number and the share of firms that report domestic, export and import prices.

Table 3: Number of products per firms

Status	P10	P90	Median	Mean	Standard Deviation
Domestic	1	9	3	4.5	4.4
Exports	1	7	2	3.5	3.4
Imports	1	8	3	4.0	5.2

Notes: This table reports the 10th and 90th percentiles, the median, the mean and the standard deviation of the number of products reported by firms reporting domestic, import or export prices.

Table 4: Currency of transactions

	Exports		Imports	
Currency	Euro area	Rest of the world	Euro area	Rest of the world
EUR	0.92	0.03	0.86	0.80
USD	0.03	0.09	0.04	0.08
Other	0.00	0.02	0.02	0.01
Non reported	0.06	0.87	0.09	0.12

Notes: This table reports the share of export and import transactions denominated in Euro, in US Dollar, and in other currencies in our sample. Observations for which we do not have information are classified as "non reported".

Table 5: Frequency and monthly duration of price changes

	Domestic		*Exports*		*Imports*	
Sector	Freq.	Dur.	Freq.	Dur.	Freq.	Dur.
Extraction of petroleum and gas					1.0	1.0
Mining of coal and lignite					0.9	1.1
Mining of metal ores					0.9	1.1
Water collection, treatment and supply	0.2	4.9				
Manuf of tobacco products	0.1	10.0			0.1	7.6
Other mining and quarrying	0.8	1.3	0.6	1.6		
Printing and reprod. of recorded media	0.1	11.3	0.1	10.4		
Repair and installation of machinery	0.1	8.2	0.3	3.2		
Electricity, gas, steam and ac supply	0.4	2.3	1.0	1.0	1.0	1.0
Basic metals	0.8	1.3	0.8	1.3	0.9	1.1
Basic pharmaceutical products	0.0	22.0	0.1	13.0	0.1	19.6
Chemicals and chemical products	0.7	1.4	0.6	1.7	0.4	2.7
Coke and refined petroleum products	0.8	1.2	1.0	1.0	0.7	1.5
Computer, electronic and optical prod.	0.4	2.3	0.4	2.8	0.3	3.0
Electrical equipment	0.7	1.3	0.3	3.9	0.3	3.8
Fabricated metal products	0.5	2.0	0.3	3.5	0.2	5.3
Furniture	0.3	3.0	0.3	3.4	0.1	17.5
Leather and related products	0.2	6.6	0.2	4.9	0.3	2.9
Machinery and equipment n.e.c.	0.3	3.8	0.2	6.0	0.1	10.9
Motor vehicles and trailers	0.2	6.4	0.1	8.1	0.2	6.2
Other non-metallic mineral products	0.7	1.4	0.5	2.0	0.2	5.3
Other transport equipment	0.2	4.7	0.2	5.9	0.1	14.4
Paper and paper products	0.5	2.2	0.6	1.8	0.3	3.8
Rubber and plastic products	0.4	2.5	0.4	2.4	0.1	10.0
Textiles	0.5	1.9	0.5	2.0	0.2	6.4
Wearing apparel	0.2	5.7	0.1	15.3	0.3	3.8
Wood products, except furniture	0.3	3.1	0.6	1.6	0.2	4.8
Beverages	0.7	1.4	0.5	2.0	0.1	13.4
Food products	0.8	1.3	0.6	1.6	0.3	3.1
Other manufacturing	0.6	1.6	0.2	4.0	0.4	2.8
Average	0.53	3.3	0.38	4.6	0.36	5.2

Notes: This table reports the frequency of price changes and the implied duration for 2 digit sectors. Frequencies are first computed at the item level, and then aggregated at the sectoral level. Implied duration is simply the inverse of the frequency. The total average frequency and duration are computed as the average of these two variables for sectors where we have information about domestic, export and import prices.

Table 6: Domestic prices and imported input prices

	(Δ log. output price)			
	(1)	(2)	(3)	(4)
Inputs	0.292***	0.238***	0.138***	0.245**
	(0.110)	(0.088)	(0.051)	(0.096)
Labor costs		0.382	0.061	0.292
		(0.299)	(0.048)	(0.358)
Comp. prices		0.322***	0.141***	0.463***
		(0.053)	(0.023)	(0.073)
Production		0.005	0.015	0.005
		(0.008)	(0.022)	(0.010)
Comp. costs				0.035
				(0.025)
Fixed effects	sect.×period		period - firm×product	
Std var.	No	No	Yes	No
Observations	33,120	33,120	33,120	25,897
R^2	0.063	0.025	0.025	0.029
rho	0.779	0.380	0.380	0.380

This table investigates the impact of imported input prices on domestic output prices i) within firm by including firm fixed effects and controlling for sector×period fixed effects (col. 1) and ii) within firm-product pairs by including firm×product fixed effects and period fixed effects (col. 2-4). It focuses on the entire sample of arm-length transactions. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the change in competitors prices within 2-digit sectors ($Comp.prices$), the change in competitors prices within 2-digit sectors ($Comp.costs$), the change in labor cost and the change in sectoral production ($production$). A YES line $Stdvar.$ means that variables have been standardized. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 7: Domestic prices and *exogenous* imported input prices

	(Δ log. output price)			
	(1)	(2)	(3)	(4)
Inputs	0.131***	0.128***	0.059***	0.116***
	(0.030)	(0.026)	(0.012)	(0.029)
Labor costs		0.362	0.058	0.261
		(0.342)	(0.055)	(0.409)
Comp. prices		0.312***	0.136***	0.479***
		(0.055)	(0.024)	(0.075)
Production		-0.004	-0.011	-0.008
		(0.006)	(0.016)	(0.007)
Comp. costs				0.024
				(0.026)
Fixed effects	sect.×period		period - firm×product	
Std var.	No	No	Yes	No
Observations	25,144	25,144	25,144	19,292
R^2	0.021	0.027	0.027	0.036
rho	0.592	0.462	0.462	0.487

This table investigates the impact of imported input prices on domestic output prices i) within firm by including firm fixed effects and controlling for sector×period fixed effects (col. 1) and ii) within firm-product pairs by including firm×product fixed effects and period fixed effects (col. 2-4). It focuses on the entire sample of arm-length transactions that we consider as exogenous for the firm. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the change in competitors prices within 2-digit sectors ($Comp.prices$), the change in competitors prices within 2-digit sectors ($Comp.costs$), the change in labor cost and the change in sectoral production ($production$). A YES line $Stdvar.$ means that variables have been standardized. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 8: Domestic prices and imported input prices, related parties

	(Δ log. output price)			
	(1)	(2)	(3)	(4)
Inputs	-0.018	0.065*	0.024*	0.054
	(0.031)	(0.034)	(0.013)	(0.036)
Labor costs		0.264	0.042	-0.046
		(0.360)	(0.057)	(0.368)
Comp. prices		0.480***	0.210***	0.381***
		(0.112)	(0.049)	(0.119)
Production		-0.024**	-0.066**	-0.033**
		(0.011)	(0.031)	(0.013)
Comp. costs				0.100*
				(0.059)
Fixed effects	sect.×period		period - firm×product	
Std var.	No	No	Yes	No
Observations	12,296	12,296	12,296	9,674
R^2	0.007	0.034	0.034	0.028
rho	0.401	0.248	0.248	0.233

This table investigates the impact of imported input prices on domestic output prices i) within firm by including firm fixed effects and controlling for sector×period fixed effects (col. 1) and ii) within firm-product pairs by including firm×product fixed effects and period fixed effects (col. 2-4). It focuses on imports from related parties. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the change in competitors prices within 2-digit sectors ($Comp.prices$), the change in competitors prices within 2-digit sectors ($Comp.costs$), the change in labor cost and the change in sectoral production ($production$). Positive and negative changes in imported inputs prices are disentangle in variables $Max(0, Inputs)$ and $Min(0, Inputs)$. A YES line $Stdvar.$ means that variables have been standardized. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 9: Domestic prices and imported input prices, interaction terms.

	(Δ log. output price)				
	(1)	(2)	(3)	(4)	(5)
Max(0,Inputs)	0.188**				
	(0.076)				
Min(Inputs,0)	0.291				
	(0.182)				
Sh. IO × Inputs		1.474***			
		(0.553)			
Inputs			0.343**	0.107	-0.033
			(0.149)	(0.070)	(0.084)
HHI × Inputs			-1.043		
			(0.805)		
Freq(Outputs) × Inputs				0.164	
				(0.170)	
Freq(Inputs) × Inputs					0.403*
					(0.234)
Fixed effects	period - firm×product				
Observations	33,120	31,363	29,171	33,120	33,120
R^2	0.025	0.026	0.024	0.025	0.028
rho	0.380	0.372	0.394	0.380	0.382

This table investigates the impact of imported input prices on domestic output prices within firm-product pairs by including firm×product fixed effects and period fixed effects. It focuses on arm-length transactions. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the changes in imported input's prices interacted with the share of imported inputs in total costs at the sectoral level ($Sh.IO$), with the sectoral Herfindahl index (HHI), and the frequency of output and input price changes ($Freq(Outputs)$ and $Freq(Inputs)$). In the first column, we separate out positive and negative changes in imported inputs prices: variables $Max(0, Inputs)$ and $Min(0, Inputs)$. We also control for the change in competitors prices within 2-digit sectors, the change in labor cost and the change in sectoral production. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 10: Domestic prices and *exogenous* imported input prices, interaction terms.

	(Δ log. output price)				
	(1)	(2)	(3)	(4)	(5)
Max(0,Inputs)	0.136***				
	(0.039)				
Min(Inputs,0)	0.117**				
	(0.049)				
Sh. IO × Inputs		0.755***			
		(0.178)			
Inputs			0.109***	0.187***	0.104
			(0.042)	(0.065)	(0.065)
HHI × Inputs			0.373		
			(0.363)		
Freq(Outputs) × Inputs				-0.079	
				(0.082)	
Freq(Inputs) × Inputs					0.041
					(0.088)
Fixed effects	period - firm×product				
Observations	25,144	23,877	21,775	25,144	25,144
R^2	0.027	0.025	0.021	0.028	0.027
rho	0.462	0.447	0.494	0.462	0.462

This table investigates the impact of imported input prices on domestic output prices within firm-product pairs by including firm×product fixed effects and period fixed effects. It focuses on arm-length transactions with exogenous prices changes. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the changes in imported input's prices interacted with the share of imported inputs in total costs at the sectoral level ($Sh.IO$), with the sectoral Herfindahl index (HHI), and the frequency of output and input price changes ($Freq(Outputs)$ and $Freq(Inputs)$). In the first column, we separate out positive and negative changes in imported inputs prices: variables $Max(0, Inputs)$ and $Min(0, Inputs)$. We also control for the change in competitors prices within 2-digit sectors, the change in labor cost and the change in sectoral production. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 11: Domestic prices and imported input prices, related parties, interaction

	(Δ log. output price)				
	(1)	(2)	(3)	(4)	(5)
Max(0,Inputs)	0.044				
	(0.067)				
Min(Inputs,0)	0.071*				
	(0.039)				
Sh. IO × Inputs		0.410**			
		(0.164)			
Inputs			0.013	-0.108***	-0.079*
			(0.044)	(0.024)	(0.043)
HHI × Inputs			0.418		
			(0.622)		
Freq(Outputs) × Inputs				0.230**	
				(0.091)	
Freq(Inputs) × Inputs					0.442***
					(0.137)
Fixed effects	period - firm×product				
Observations	12296	11731	11366	33120	4945
R^2	0.034	0.036	0.028	0.014	0.073
rho	0.248	0.209	0.288	0.379	0.074

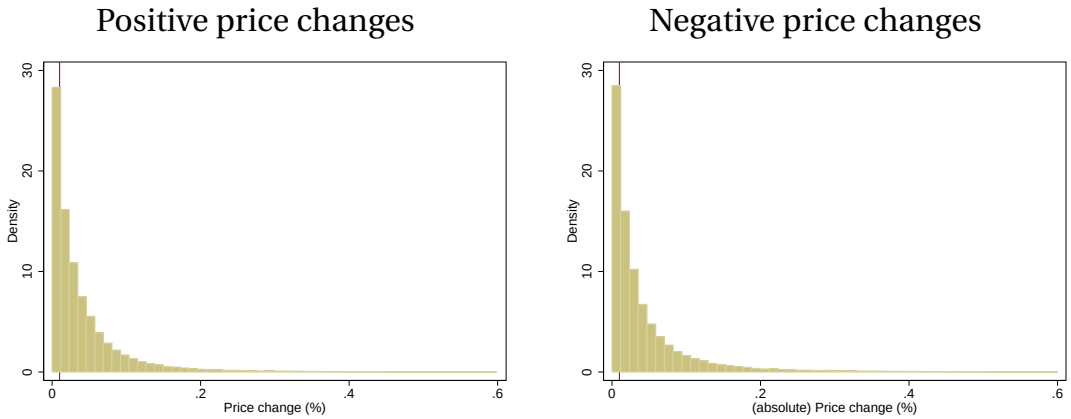
This table investigates the impact of imported input prices on domestic output prices within firm-product pairs by including firm×product fixed effects and period fixed effects. It focuses on imports of inputs from related parties. The dependent variable is the first difference in the logarithm of output prices computed for each product firm and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the changes in imported input's prices interacted with the share of imported inputs in total costs at the sectoral level ($Sh.IO$), with the sectoral Herfindahl index (HHI), and the frequency of output and input price changes ($Freq(Outputs)$ and $Freq(Inputs)$). In the first column, we separate out positive and negative changes in imported inputs prices: variables $Max(0, Inputs)$ and $Min(0, Inputs)$. We also control for the change in competitors prices within 2-digit sectors, the change in labor cost and the change in sectoral production. Changes in explanatory variables are changes since the last price change. Standard errors (in parenthesis) are clustered in the firm×period dimension. ^{c}, ^{b}, ^{a} indicate significance at 10%, 5% and 1%.

Table 12: Output prices and imported inputs prices, by industry

Explained variable: $\Delta log(output\ price)$										
Type of transaction:	*Arm-length*			*Arm-length*			*Intragroup*			
Type of price changes:	*All*			*Exogenous*			*All*			
Variable:	Input price	std	Obs.	Input price	std	Obs.	Input price	std	Obs.	share IO
Industry										
Textile and apparel	**0.65**	0.17	3878	**0.24**	0.11	1762	0	0	62	0.21
Motor vehicles, trailers and semi-trailers	0.51	0.46	361	**-0.88**	0.29	41	0	0	29	0.25
Electrical equipment	**0.11**	0.06	4506	**0.13**	0.07	3325	0.06	0.06	1697	0.21
Rubber and plastic products	0.09	0.06	3432	-0.03	0.07	1927	0.03	0.05	1054	0.26
Food and beverage	**0.08**	0.03	11559	**0.09**	0.04	7718	0.20	0.15	3740	0.08
Wood and paper	**0.07**	0.03	1401	0.03	0.04	908	-1.21	0.77	84	0.11
Chemical industry	**0.07**	0.03	8568	**0.15**	0.05	4134	**0.20**	0.07	2975	0.22
Metal products	0.03	0.04	4721	**0.14**	0.07	2057	0.01	0.08	992	0.15
Machinery and equipment n.e.c.	-0.06	0.06	4774	-0.07	0.09	1986	**-0.09**	0.05	975	0.16
Computer, electronic and optical products	**-0.40**	0.22	462	0.00	0.00	19	-0.05	0.59	123	0.21
Pharmaceutical	-0.52	0.44	87	-0.38	0.39	79	0.49	0.26	106	

Changes in output price are explained by the changes in the price of imported inputs either for (intragroup or for arm-length transactions) since the last price changes. Controls: wages, production, competitor prices. Fixed effect: period and firms. Note that we run two separate regressions: one for arm-length transactions and the others for intragroup transactions.

Figure 1: Size of price changes



Price changes are computed as the aboslute value of $100(p_t/p_{t-1} - 1)$. The red line shows 1% change. We only consider price changes different from zero.

Table 13: Domestic and export prices, and imported input prices

	(Δ log. output price)				
	(1)	(2)	(3)	(4)	(5)
Inputs	0.202***	0.214***	0.291***	0.291***	0.291***
	(0.049)	(0.062)	(0.102)	(0.102)	(0.102)
Comp. prices	0.567***	0.582***	0.574***	0.573***	0.573***
	(0.050)	(0.066)	(0.065)	(0.065)	(0.065)
Production	-0.004	-0.000	-0.000	-0.000	-0.000
	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
Labor costs	0.594**	0.536**	0.528**	0.545***	0.551***
	(0.276)	(0.218)	(0.207)	(0.206)	(0.202)
Export × Inputs			-0.184*	-0.185*	-0.186*
			(0.106)	(0.106)	(0.106)
NEER				-0.145	-0.144
				(0.216)	(0.215)
Export × Inputs × NEER					0.580
					(3.412)
Fixed effects	period - firm				
Sample	All	serve domestic and export markets			
Observations	12322	7091	7091	7091	7091
rho	0.157	0.074	0.074	0.075	0.071

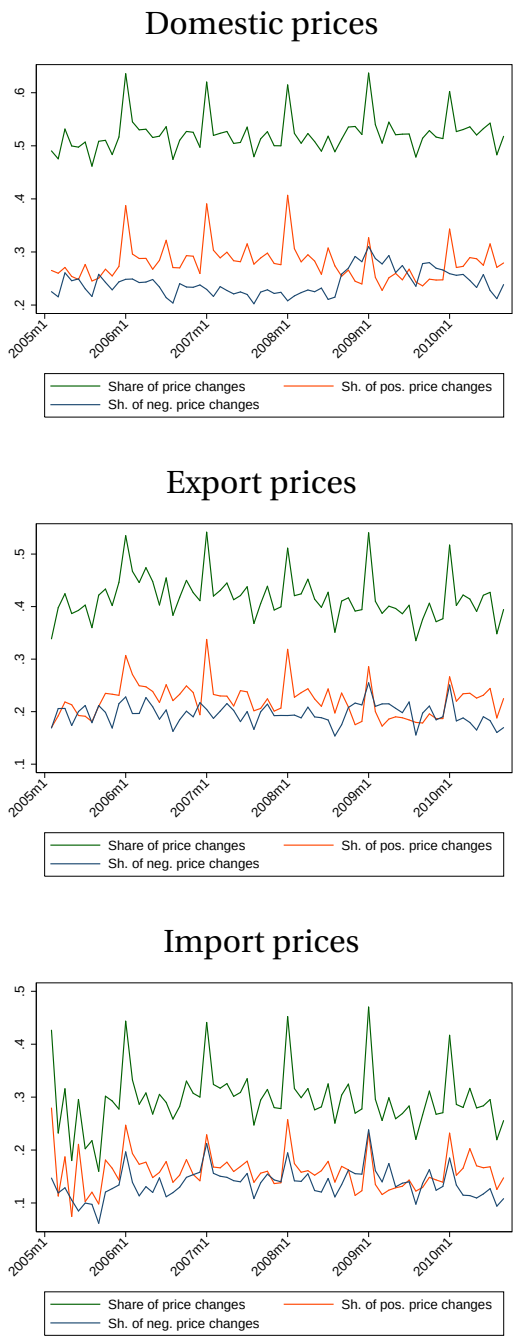
This table investigates the difference in transmission of imported input prices to domestic and export output prices within firm-product pairs by including firm×product fixed effects and period fixed effects. It focuses on arm-length transactions. The dependent variable is the first difference in the logarithm of output prices computed for each sector, firm, and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the change in labor costs ($labor$), the change in sectoral production ($Production$), the change in competitors' costs ($Comp.costs$), the change in the nominal effective exchange rate ($NEER$) faced by exporters, a dummy equal to one if the output price is exported, and interactions between these variables. Changes in explanatory variables are changes since the last price change. Robust standard errors in parenthesis. ^{c}, ^{b}, ^{a} indicates significance at 10%, 5% and 1%.

Table 14: Domestic and export prices, and exogenous imported input prices

	(Δ log. output price)				
	(1)	(2)	(3)	(4)	(5)
Inputs	0.126***	0.097***	0.097***	0.097***	0.105***
	(0.024)	(0.021)	(0.031)	(0.031)	(0.031)
Comp. prices	0.502***	0.463***	0.463***	0.462***	0.460***
	(0.047)	(0.043)	(0.043)	(0.043)	(0.043)
Production	-0.007	-0.003	-0.003	-0.003	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Labor costs	0.554*	0.472**	0.478**	0.490**	0.495***
	(0.320)	(0.194)	(0.193)	(0.191)	(0.150)
Export × Inputs			0.001	0.001	-0.006
			(0.041)	(0.041)	(0.041)
NEER				-0.067	-0.071
				(0.127)	(0.123)
Export × Inputs × NEER					-2.668
					(3.552)
Fixed effects	period - firm				
Sample	All	serve domestic and export markets			
Observations	9,192	5,305	5,305	5,305	5,305
rho	0.076	0.043	0.034	0.030	0.000

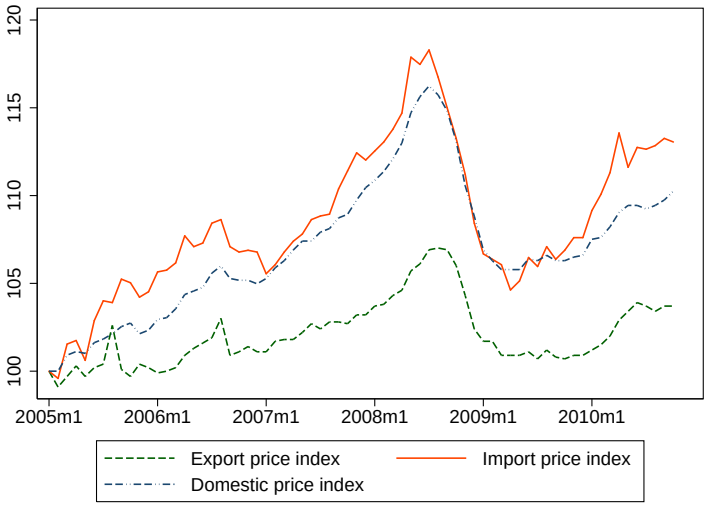
This table investigates the difference in transmission of imported input prices to domestic and export output prices within firm-product pairs by including firm×product fixed effects and period fixed effects. It focuses on exogenous price changes in arm-length transactions. The dependent variable is the first difference in the logarithm of output prices computed for each sector, firm, and month. Explanatory variables are the changes in the prices of imported inputs ($Inputs$), the change in labor costs ($labor$), the change in sectoral production ($Production$), the change in competitors' costs ($Comp.costs$), the change in the nominal effective exchange rate ($NEER$) faced by exporters, a dummy equal to one if the output price is exported, and interactions between these variables. Changes in explanatory variables are changes since the last price change. Robust standard errors in parenthesis. ^{c}, ^{b}, ^{a} indicates significance at 10%, 5% and 1%.

Figure 2: Share of price changes over time



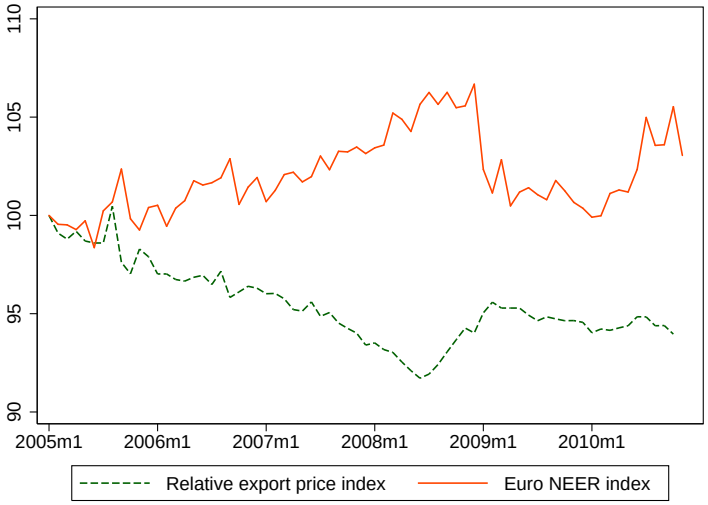
The graphs plots the monthly share of price changes, positive price changes and negative price changes for domestic sales, exports, and imports. The first month (01/2005) of the sample is dropped because changes cannot be computed.

Figure 3: French domestic and trade price indices



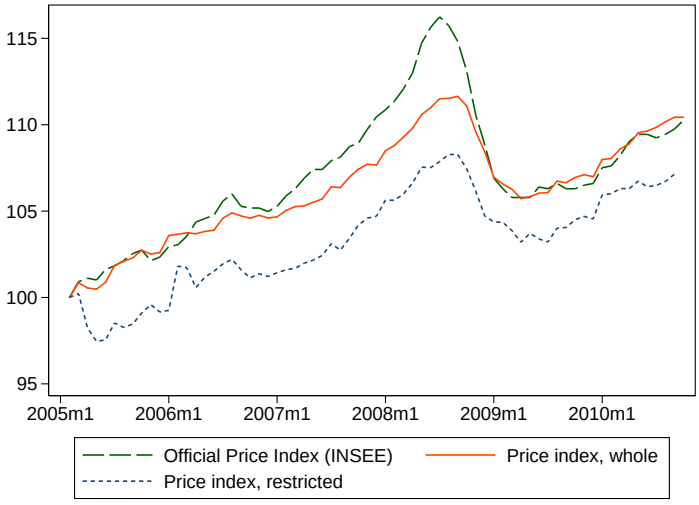
Source: INSEE.

Figure 4: Real export prices and nominal exchange rate



Source: The nominal effective exchange rate is from the Bank of International Settlements. For France, it is computed over 58 countries as a weighted average of bilateral exchange rates of the euro using the Turner and Vant dack weighting scheme. See: $http : //www.bis.org/statistics/eer/index.htm$. The real export price is computed as the ratio of export to domestic price indices. These two indices are from the INSEE.

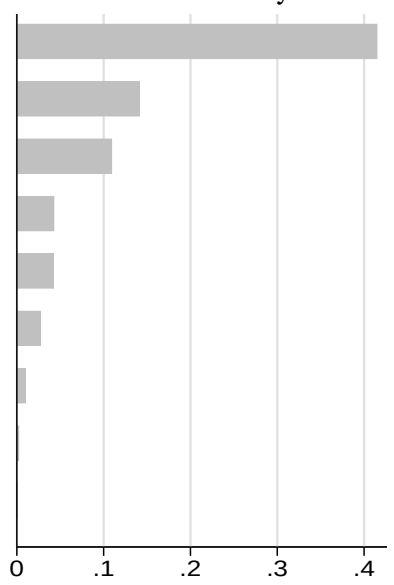
Figure 5: Official vs reconstructed price indices



This figure compares inflation in the manufacturing industry measured by the INSEE with the inflation we obtain using our individual data. The dashed line is the price index computed from all the whole dataset. The dotted line is the price index computed from the sample of firms reporting both production prices and import prices.

Figure 6: Share of the volatility of domestic prices explained by imported inputs

Vol.	Sh. IO	*Manufacturing of:*
0.41	0.22	Chemical products
0.14	0.26	Rubber and plastic products
0.11	0.11	Wood and paper
0.04	0.15	Metal products
0.04	0.08	Food and beverage
0.03	0.21	Electrical equipment
0.01	0.21	Textile and apparel
0	0.16	Machinery and equipment n.e.c.
0		Pharmaceutical
Mean:	*Mean:*	
0.09	0.16	



This table lists the share of sectoral price volatility explained by imported input prices. The share if measured by the R^2 of a regression of a monthly sectoral price index on the monthly predicted-by-import prices sectoral price index. R^2 are listed in the first column and plotted in the fourth one. The second column gives the share of imported inputs used in production in every sector. The third column indicates the label of the sectors we consider.