Explaining incomplete exchange rate pass-through to import prices: Does globalization matter?*

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Abstract

This paper assesses the impact of globalization on exchange rate pass-through (ERPT) into import prices in three core eurozone countries. To this end, we consider various indicators of globalization and rely on both aggregated (i.e., country level) and disaggregated (i.e., good level) data. Using quarterly data since 1992, we do not find compelling evidence of a positive link between globalization and ERPT. On the contrary, our analysis at the disaggregated level provides weak evidence that part of the decline in ERPT is a result of increased trade integration. Indeed, among several global factors, only Chinese growing market share weakens the pass-through in some sectors, particularly those producing manufactured goods and machinery and transport equipment in Germany and France. Overall, our findings show that while ERPT is incomplete, it remains significant meaning that exchange rate changes still exert important pressure on domestic prices.

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Keywords: exchange rate pass-through; import prices; globalization; eurozone.

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1 Introduction

The exchange rate pass-through (ERPT from now on), understood as the extent to which an exchange rate change is reflected in import and consumer prices, is a central concept in international trade and macroeconomics, both from theoretical and empirical viewpoints (see Knetter (1989); Campa and Goldberg (2005); and Burstein and Gopinath (2013)). A large body of this literature puts forward that ERPT is incomplete and has been steadily declining over the past few decades.

The partial character of ERPT has received two main explanations: a macroeconomic justification (Monacelli (2005)) in which the incompleteness comes from nominal rigidities leading to unresponsiveness in prices in the short run, and a microeconomic explanation linking the incomplete ERPT to an increasing degree of pricing-to-market behavior of firms (Betts and Devereux (2000)). A common explanation for the decreasing ERPT is that expectations of inflation have become much more solidly anchored in recent years. Indeed, in the context of a stable and predictable monetary policy environment, nominal shocks play a vastly reduced role in driving fluctuations in prices and in the exchange rate (Taylor (2000)). Thus, a stable monetary policy environment—supported by an institutional framework that allows the central bank to pursue a credible and independent policy—contributes to explaining why even sizeable depreciations of the nominal exchange rate have exerted small effects on prices: when the inflation environment is more stable, firms resist passing exchange rate changes on to prices. Similar arguments are developed in Gagnon and Ihrig (2004), Bailliu and Fujii (2004), Devereux, Engel, and Storgaard (2004), Ihrig, Marazzi, and Rothenberg (2006), Marazzi and Sheets (2007), Bouakez and Rebei (2008), Devereux and Yetman (2010) and Dong (2012) where the size of pass-through is a function of the stance of monetary policy.

Recently, López-Villavicencio and Mignon (2016) show that both the level and volatility of inflation, as well as the adoption of an inflation target or the transparency of monetary policy decisions clearly reduce ERPT to consumer prices. However, they find that uncertainty about domestic monetary policy does not affect the pass-through to import prices. Other factors than monetary ones may thus be at play in explaining the dynamics of ERPT to import prices.

Based on this evidence, we investigate in this paper if trade integration affects the pass-through to import prices. Indeed, many authors have suggested that the process of globalization brought about important changes in the behavior of some major macroeconomic variables such as inflation, output and interest rates (Milani (2012)). In particular, the globalization hypothesis, in contrast to the traditional explana-

tion centered on monetary policy credibility, is believed to affect the pass-through of foreign marginal costs and the exchange rate into import prices.

More precisely, two theoretical effects are at play. According to the first effect, globalization affects inflation dynamics through its influence on the degree of competition. As a large fraction of consumption and intermediate goods is represented by imported goods, the overall price index becomes more sensitive to external conditions, namely the combined dynamics of nominal exchange rate and foreign marginal costs. The second channel through which globalization influences the dynamics of inflation is, indirectly, through its effect on the pricing strategies of domestic firms selling in the internal market.

While these theoretical effects are clearly established, their outcome is controversial. Specifically, both higher and lower ERPT may result from greater competition. Following Benigno and Faia (2016), greater competition implies higher ERPT. The intensity of exchange rate pass-through depends on the degree of concentration in the market and, in particular, on the share of foreign products in the market. Indeed, greater competition, due to the increase in the share of foreign products sold in a specific industry—a phenomenon strongly connected to globalization—raises the degree of exchange rate pass-through. According to Benigno and Faia (2016), there is evidence of an increase in ERPT degree exactly at the time at which the globalization process took place.

On the opposite, Gust, Leduc, and Vigfusson (2010) argue that greater competition implies lower ERPT. The main argument is that firm's pricing decisions depend on the prices set by its competitors. This feature implies that a foreign exporter finds it optimal to vary its markup in response to shocks that change the exchange rate, insulating import prices from exchange rate movements. With increased trade integration, exporters have become more responsive to the prices of their competitors and this change in pricing behavior may contribute to the observed decline in the sensitivity of import prices to the exchange rate (Gust, Leduc, and Vigfusson (2010)). Therefore, in a model with strategic complementarity, factors that lead to greater trade integration may reduce pass-through to prices. In their model, similar to Dornbusch (1987), the entry of foreign exporters, other things being equal, leads to a rise in ERPT. However, they show that following a reduction in the cost of exporting, the effects of markup adjustments that arise only along the intensive margin largely dominate the impact of entry on pass-through. Gust, Leduc, and Vigfusson (2010) provide empirical evidence linking the fall in pass-through to lower trade costs. Using industry specific measures of pass-through and trade costs, they

show that industries in which the decline in trade costs has been relatively large have also experienced quite important declines in pass-through.

However, from an empirical viewpoint, the literature that explores the link between globalization and ERPT is very scarce, especially in the non-U.S. case. Our aim in this paper is to fill this gap by running an empirical analysis focusing on countries belonging to the eurozone. As import prices constitute a major transmission channel of changes in the euro on domestic prices and, in turn, inflation and output, analyzing ERPT is of crucial importance in the context of a monetary union. The same exchange rate change may affect eurozone countries differently, depending on their openness to trade degree. Accounting for such different responses of import prices to euro exchange rate changes is important for the conduct of the single monetary policy. It is also worthy of interest with regard to the impact of entering into the union and the success of protocols and processes calling for structural reforms in the EMU. Some previous studies have been done in the euro area context among which Schroder and Hufner (2002), Anderton (2003), Hahn (2003), Campa, Goldberg, and Gonzàlez-Mínguez (2005), Campa and Gonzàlez-Mínguez (2006), Faruqee (2006), Ben Cheikh and Rault (2016). In this paper, in addition to overcoming the drawback linked to the short time sample used in these studies (with the exception of Ben Cheikh and Rault (2016)), we go further than the existing literature in various ways.

First, instead of considering indifferently all countries of the euro area, we focus on three core economies, depending on their external exposure.[1] Specifically, we consider Belgium which presents the highest degree of trade openness among the core countries, France which is characterized by the lowest one, and Germany which is at an intermediate level corresponding to the European monetary union aggregate openness degree. Second, to provide a complete and robust picture, we consider various indicators of globalization: (i) an increase in the degree of trade openness, (ii) a higher intra-industry trade, (iii) a higher presence of Chinese imports over total imports,[2] and (iv) lower import tariffs. Third, as the relevance of globalization in explaining the lower pass-through is difficult to assert when using aggregated prices—at it is the case in the bulk of the literature—we also rely on disaggregated data. Using good-level data based on the one-digit Standard International Trade

[1] In addition, it is worth mentioning that a relatively low dispersion of ERPT levels is expected in the euro area, due to the convergence process implied by the monetary union (see, e.g., Ben Cheikh and Rault (2016)).

[2] This indicator based on China is used by Marazzi, Sheets, Vigfusson, Faust, Gagnon, Marquez, Martin, Reeve, and Rogers (2005) who show that Chinese booming exports to the United States play a role in explaining the low ERPT value in the U.S.

Classification (SITC) enables us to compare ERPT coefficients across goods and should allow us to identify different strategies in the industries.

Relying on quarterly data over the 1992Q1-2016Q2 period—2000Q1-2016Q2 for disaggregated data—, our main findings can be summarized as follows. First, incomplete ERPT is a general result in the sense that exchange rate changes are not fully reflected in import prices, at both aggregated and disaggregated levels. Second, interacting exchange rate changes with globalization indicators shows the absence of positive link between openness and ERPT. Moreover, at the aggregated level, the results suggest that higher trade openness tends to reduce market power of domestic firms, diminishing their profits and leading to lower ERPT in Belgium and France. Third, reasoning at the good level, ERPT degrees differ across countries, depending on their structure of imports. Fourth, there is weak evidence that globalization has impacted the degree of ERPT. Indeed, among several globalization indicators, only Chinese firms' market penetration has weakened the pass-through in some sectors, particularly those producing manufactured goods and machinery and transport equipment in Germany and France. This result reflects the wish of domestic firms to maintain their market power and protect against foreign competition in these particular sectors.

This paper is organized as follows. Section 2 briefly describes our methodology. Section 3 presents the data and some stylized facts. Section 4 displays our estimation results, and Section 5 concludes the paper.

2 Methodology

The existing literature usually models exchange rate pass-through by considering variations of the following equation:

$$\Delta mp_t = \alpha + \gamma \sum_{j=1}^{n} \Delta mp_{t-j} + \rho \Delta y_t + \lambda \Delta mc_t^* + \theta \Delta e_t + \epsilon_t \tag{1}$$

where mp represents import prices, y is a local demand factor, mc^* stands for the exporter marginal cost (i.e., the foreign production costs), e is the nominal effective exchange rate, i denotes the industry and t refers to the period. Our primary concern in this equation is the pass-through elasticity which corresponds to the coefficient on the exchange rate change, namely θ. The case $\theta = 1$ refers to a complete ERPT, corresponding to a one-for-one pass-through changes in import prices. Incomplete ERPT occurs when $\theta < 1$, i.e., when exporters adjust their markup. Equation (1) is estimated at the aggregated (i.e., country) and product level using, in the latter

case, individual fixed effects. All the variables are expressed in logarithms.

To explore the global factors' dimension of pass-through, our empirical strategy consists in extending the benchmark ERPT equation as follows:

$$\Delta mp_t = \alpha + \beta_t + \gamma \sum_{j=1}^{n} \Delta mp_{t-j} + \rho \Delta y_t + \lambda \Delta mp_t^* + \theta \Delta e_t + \theta^C (\Delta e_t \times \mathrm{C}_t) + \epsilon_t \quad (2)$$

where C is an indicator of trade integration: changes in trade openness, changes in intra-industry trade, changes in tariffs for a country's imports and changes in the weight of China in a country i's exports. In Equation (2), we interpret a significant coefficient θ^C as evidence that ERPT is affected by global factors. ERPT depending on these factors, the total effect of the exchange rate on prices is given by:

$$\text{Total ERPT}_t = \frac{\partial \Delta mp_t}{\partial \mathrm{C}_t} = (\theta + \theta^C \overline{\mathrm{C}}) \Delta e_t \quad (3)$$

where $\overline{\mathrm{C}}$ is the mean of the trade integration indicator over the whole period under study. We calculate the total effect of a one-unit increase in the exchange rate obtained using the estimates from the considered regression model.

3 Data

The period covered in the present study depends on both the availability and the level of disaggregation of data. Indeed, exchange rate pass-through estimates in the literature are usually confronted with a trade-off between sectoral disaggregation level of data and period coverage (Gaulier, Lahrèche-Révil, and Méjean (2008)). Basically, estimates based on aggregated price data allow for a larger time span coverage. However, the use of aggregated price series limits the possibility to identify the structural determinants of the pass-through (to detect differences regarding price discrimination or product differentiation for instance). Working on disaggregated price data offers more information at the product or good level, but has a cost in terms of data period availability. In this paper, we rely on both, aggregated and disaggregated data for three core eurozone countries, namely Belgium, Germany and France over the period 1992Q1-2016Q2 in the case of aggregated data, and 2000Q1-2016Q2 for a lower level of disaggregation.

We consider two measures of import prices at the aggregated level: the import price deflator extracted from the OECD database, and import unit value indexes taken

from the International Financial Statistics (IFS) database of IMF.[3] It should be noticed that most of the existing studies at the aggregated level rely on import unit value indexes whose main caveat is to be biased in case of changes in the bundle of goods. In addition, they present some volatility due to frequent quantity adjustments that may change the indexes without any change in prices, and, as noticed by Knetter (1989) and Takagi and Yoshida (2001), unit values encounter important measurement errors, making them imperfect proxies for trade prices at the country level. Import prices, which are available at a monthly frequency, do not suffer from these biases.[4] They measure actual transaction prices of imported goods and account for major phenomena such as (i) price fluctuations and changes in the demand of comparable competitive goods over time, (ii) good's price determinants (quantity of units sold, change in quality, guarantee conditions, etc.), and (iii) modification in the composition of the bundle of imported goods of the considered country. Despite the caveats of unit values at the aggregated level, we consider both import prices and unit value indexes for the sake of completeness.

Regarding the disaggregated (i.e., good) level, we rely on import unit value indexes of seven sectors (panels) from the Standard International Trade Classification (SITC) industrial good-level data obtained from the Eurostat Comext database. Sub-sections (i.e., panel members) correspond to two-digit sectors or aggregations of them (see Table 9 in Appendix). One industry has been excluded from the analysis, namely mineral fuels, lubricants and related materials (SITC 3), due to the peculiar nature of the sector.[5]

In Equation (1), both marginal costs and importer's demand characteristics are highly difficult to evaluate since they are not directly observable, so the use of proxies is common in the literature. In our specification, in the spirit of Marazzi, Sheets, Vigfusson, Faust, Gagnon, Marquez, Martin, Reeve, and Rogers (2005) and Marazzi and Sheets (2007), we take the aggregated OECD foreign Producer Price Index (PPI) as the proxy for production costs. For the local demand factor, we use the GDP as it is usually done in the literature (see, e.g., Campa, Goldberg, and Gonzàlez-Mínguez (2005)). The exchange rate corresponds to the nominal effective exchange rate provided by the Bank of International Settlements (BIS), an increase in the index indicating a depreciation.

[3]Import Unit Values for France are not available until 2001Q1. Therefore, and for comparison purposes, we do not consider this import price indicator for this country.

[4]See, e.g., Marazzi and Sheets (2007) and de Bandt and Razafindrabe (2014).

[5]In particular, the industry evolution is more likely to be related to legal changes and natural factors rather than trade.

Let us now describe our four indicators of globalization. First, at the aggregated and disaggregated levels, trade openness is defined as the sum of exports and imports over GDP. Overall trade values are collected from the IMF IFS database. Imports and exports at the SITC level are provided by the Comext database. Second, we also evaluate how China's presence in total imports may have affected the pricing decisions of exporters from other countries. We therefore consider China's imports share over total imports as well as China's share in each SITC sector (see Marazzi, Sheets, Vigfusson, Faust, Gagnon, Marquez, Martin, Reeve, and Rogers (2005)). Our third global indicator is a measure of intra-industry trade. Here, the underlying hypothesis is that increasing levels of intra-industry trade reflect higher product differentiation with respect to foreign competitors. Indeed, as shown by Caves (1998), product differentiation leads to increasing levels of intra-industry trade among countries, providing opportunities to develop new market-niches. In order to test for this hypothesis, we employ the Grubel-Lloyd index of intra-industry trade IIT (see Lipsey (1976)), which is computed as follows:

$$IIT_t = 2 \times \frac{min(M_t; X_t)}{(M_t + X_t)} \tag{4}$$

where M denotes total imports and X stands for total exports (of each SITC sector in the disaggregated analysis), in the considered country. The index ranges between zero (no intra-industry trade) and one (perfect intra-industry trade), and captures the level of product heterogeneity and trade complementarities between each sector-country pair and the trading partners. We interpret an increase in intra-industry trade as an adjustment to trade liberalization. Indeed, as suggested by Colantone, Coucke, and Sleuwaegen (2015), the IIT index is likely to grow following firms' strategic reactions to global integration, in terms of product differentiation and production off-shoring.[6]

Our last measure of globalization is based on trade tariffs at the aggregated and sectoral levels. Although tariffs represent only a fraction of overall trade costs, they remain an important underlying factor towards greater trade integration. With this respect, Gust, Leduc, and Vigfusson (2010) argue that, with lower costs, foreign exporters should reduce their prices and the home country's import share should rise. Because foreign exporters' prices fall relative to their competitors (i.e., the domestic firms), they are able to increase their markups and still gain market share. Conversely, the prices for domestic goods rise relative to their competitors, and domestic

[6]For instance, Bernard, Jensen, and Schott (2006) present evidence that companies adjust to increasing import pressure by changing their product-mix towards higher value-added goods, characterized by higher export potential and lower intensity of cost-based foreign competition. Moreover, low value-added goods are increasingly imported, in particular from low-wage countries.

firms are forced to cut their markups in reaction to stiffer competition from abroad. With higher markups on foreign goods, strategic complementarity intensifies and foreign exporters become more willing to vary their markups in response to cost shocks. Thus, according to Gust, Leduc, and Vigfusson (2010), a decline in trade costs should cause a fall in the pass-through. At the country level, data on import tariff rates for the European Union are retrieved from the UNCTAD Trade Analysis Information System (TRAINS). Data are annual and correspond to the mean effective applied tariff rate of the following non-agricultural and non-fuel products: manufactured goods, ores and metals, chemical products, machinery and transport equipment, and other manufactured goods. Next, we match each SITC sector and sub-sector, with data obtained from the Integrated Database of the World Trade Organization (WTO) at the Harmonized System (HS) 6-digit product. In particular, our measure of tariff corresponds to the average of Add Valorem Duties.[7]

Table 1 provides some descriptive statistics referring to our four different globalization indicators and their growth over the period. At the country level, Belgium is the country displaying the highest degree of trade openness. However, the level of trade exposure is increasing everywhere, particularly in Germany. At the industry level, openness is relatively higher for chemicals and related products (SITC 5) and machinery and transport equipment (SITC 7), and it has specially increased for animal and vegetable oils (SITC 4) and miscellaneous manufactured articles (SITC 8). Looking at the figures in Table 1 another trend seems to emerge: Chinese imports account for about 20 percent in miscellaneous manufactured articles and, while being much lower in other sectors such as chemicals, they have been increasing over time. This is particularly the case in machinery, even though the average tariff rate increased slightly over the period. Finally, intra-industry trade is very heterogeneous among the different sectors in the three countries but, as it is known in the literature, it tends to be higher for manufactured goods than for raw materials or primary goods.

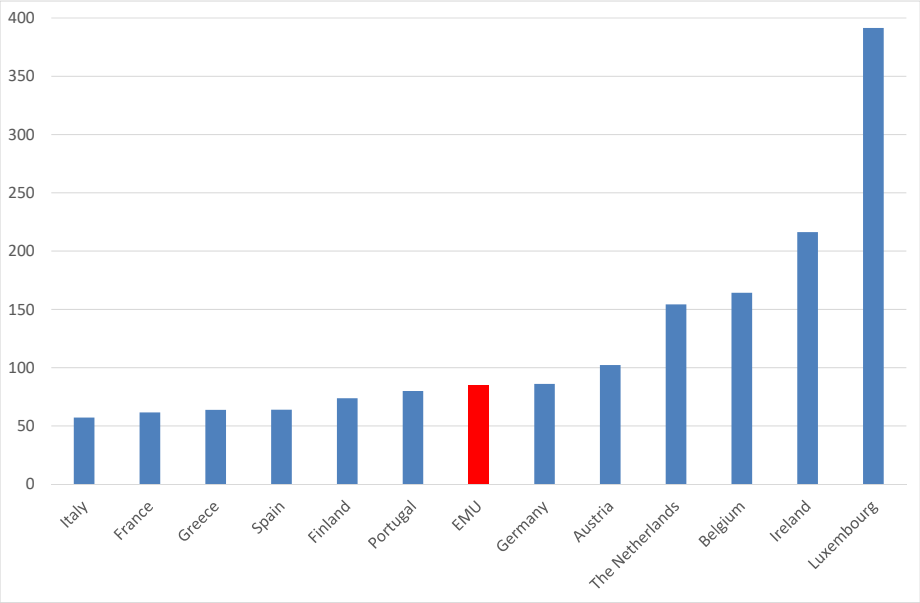
4 Results

Let us first consider the estimation of our baseline Equation (1). The corresponding results are presented in Table 2 for both import prices and import unit value indices. As shown, incomplete ERPT is a general result, confirming the findings obtained in the literature.[8] The pass-through estimates present the expected pos-

[7] We use the applied tariff which corresponds to the tariff that is actually charged on an import. The corresponding matchings are available upon request from the authors.

[8] See Menon (1995) and Engel (2002) for a survey, and Campa and Goldberg (2005), Marazzi and Sheets (2007), Bouakez and Rebei (2008) or Gust, Leduc, and Vigfusson (2010) for more recent

Figure 1: Degree of openness to trade in 2015



Note: Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Data source: World Bank.

itive and significant sign: an increase in the nominal exchange rate translates into a depreciation of the currency and should normally be followed by a rise in prices. Regarding the results obtained with the import price deflator—which does not suffer from the caveats attributed to unit values at the aggregated level—, Belgium is the country displaying the lowest ERPT coefficient: a 1% increase in the rate of depreciation of the euro raises import prices by 0.12% in Belgium. It is worth mentioning that Belgium displays the highest degree of openness among the core countries of the eurozone, as illustrated by Figure 1 for the year 2015 (see also Table 1). On the whole, our results put forward an inverse relationship between the degree of openness to trade and the level of the pass-through. Indeed, the highest ERPT coefficient is observed for France—the less opened core country—followed by Germany—displaying an intermediate degree of openness close to the EMU as a whole—and by Belgium—one of the most opened economy in Europe. Thus our findings suggest the existence of a negative link between ERPT and globalization; let us now investigate this hypothesis in more detail.

empirical studies.

4.1 Accounting for globalization

To assess the role of globalization at the country level, Table 3 reports the estimation results of Equation (2). We consider the four afore mentioned indicators in favor of globalization, namely: (i) an increase in the degree of trade openness, (ii) a higher intra-industry trade, (iii) a higher presence of Chinese imports over total imports, and (iv) lower import tariffs. Considering the three latter indicators, the interactive effect between exchange rate changes and globalization is globally non significant. This means that an increase in product differentiation with respect to foreign competitors and in the share of products from China in total imports, as well as a decline in import tariffs do not contribute to explain the incomplete ERPT to import prices.

Regarding the total effect of a one percent increase in the exchange rate, its corresponding estimate ($\theta + \theta^C$) is very close to θ, especially when considering indicators based on intra-industry trade and tariffs. It is generally significant, due to the significance of θ. Turning to the proxy based on the share of Chinese imports in the total imports, it is worth mentioning that the coefficient θ^C is negative, leading to slightly minor the total effect compared to the direct effect of exchange rate changes on import prices: $\theta + \theta^C < \theta$. However, θ^C being non significant at conventional levels, there is just very limited evidence that an increase in China's market share is associated with lower ERPT. Following Marazzi and Sheets (2007), two main explanations are at play here: (i) the effects of direct competition with China, making exporters from other countries hesitant to shift their dollar prices in response to fluctuations in their exchange rates, and (ii) the threat of potential competition from Chinese firms. While evidence regarding the pass-through effect of China's growing presence on European markets is quite weak, it is worth noticing that its impact can operate through other channels. Indeed, as recalled by Marazzi and Sheets (2007), pricing decisions of exporters from other countries may have been affected by the efforts made to remain competitive against China. Chinese economy has also proven its high capacity to win market share, making credible the threat of its potential competition and constraining other exporters from passing through exchange rates shocks. Finally, results obtained with the first indicator, based on trade openness tend to confirm our previous results in Table 2 for Belgium, with a negative θ^C coefficient.

On the whole, our results show that in most cases, the interactive effect between exchange rate changes and globalization is negative, as expected, but frequently non significant.[9] θ being larger than θ^C, our findings indicate that the direct effect of

[9]The main noticeable exception is Germany when trade openness is used as the globalization indicator. Besides the level of trade openness itself, its dynamics seems to play a role as Germany

exchange rate changes on import prices is higher than when interacting with globalization. This absence of significant positive links between openness and ERPT and the fact that the total effect compared to the direct effect of exchange rate changes on import prices is slightly lower, can be explained by the argument proposed by Gust, Leduc, and Vigfusson (2010): the high share of traded goods and high import content implied by the globalization process generate a fall in ERPT. Larger trade integration has reduced market power of the considered eurozone producing country at home, diminishing its profit margins.

is the country for which growth in trade openness is the highest (see Table 1). However, as for the two other countries, θ remains larger than θ^C.

Table 1: Descriptive statistics on globalization indicators

Country/Panel	**Trade openness**		**China's share**		**IIT**		**Tariffs**	
	Level	Growth	Level	Growth	Level	Growth	Level	Growth
Country								
Belgium	0.717	0.717	0.028	5.591	0.978	-0.007	1.951	-2.972
France	0.261	1.274	0.046	8.581	0.972	0.001	1.951	-2.972
Germany	0.334	1.978	0.048	7.959	0.951	-0.354	1.951	-2.972
Panel								
Belgium								
SITC 0-1	0.006	1.067	0.008	4.118	0.858	0.259	9.780	-0.900
SITC 2	0.003	-0.830	0.016	5.872	0.761	0.043	2.483	-0.166
SITC 4	0.001	1.762	*n.a*	*n.a*	0.810	-0.839	5.446	-0.328
SITC 5	0.026	1.364	0.015	8.615	0.814	0.156	4.638	-0.214
SITC 6	0.016	-2.122	0.063	10.089	0.888	0.394	2.697	-1.717
SITC 7	0.023	-1.728	0.055	11.508	0.890	0.159	2.622	0.483
SITC 8	0.013	2.094	0.208	4.657	0.923	0.166	3.787	0.295
France								
SITC 0-1	0.002	0.574	0.006	1.874	0.627	-0.155	9.780	-0.900
SITC 2	0.001	-1.354	0.011	1.914	0.768	0.801	2.483	-0.166
SITC 4	0.000	3.613	*n.a*	*n.a*	0.656	0.308	5.446	-0.328
SITC 5	0.005	0.280	0.017	6.259	0.899	-0.261	4.029	-0.290
SITC 6	0.003	-1.473	0.037	8.752	0.883	-0.318	2.697	-1.717
SITC 7	0.010	-2.425	0.048	10.215	0.860	-0.663	2.622	0.483
SITC 8	0.004	2.146	0.152	3.485	0.807	0.236	3.787	0.295
Germany								
SITC 0-1	0.002	2.830	0.017	3.215	0.820	0.667	9.780	-0.900
SITC 2	0.001	1.007	0.031	-1.332	0.708	0.413	2.483	-0.166
SITC 4	0.000	4.042	*n.a*	*n.a*	0.669	-1.261	5.446	-0.328
SITC 5	0.005	2.765	0.024	5.421	0.787	0.497	4.638	-0.214
SITC 6	0.004	-0.088	0.085	8.302	0.911	0.022	2.697	-1.717
SITC 7	0.018	0.948	0.079	9.328	0.662	-0.386	2.622	0.483
SITC 8	0.006	2.791	0.206	3.504	0.699	0.991	3.787	0.295

Notes: (a) This table reports the average values of the four globalization indicators over the considered period; (b) IIT stands for intra-industry trade.

Table 2: ERPT coefficients at the country level. Import deflator and import unit value index

	Import deflator	**Import Unit Value**
	Coeff.	Coeff.
	(t-stat)	(t-stat)
Belgium	0.119	0.768
	(1.70)	(6.32)
France	0.289	$n.a$
	(4.63)	
Germany	0.285	0.395
	(6.82)	(6.79)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (1); (b) Corresponding t-statistics are given between parentheses.

Table 3: Global factors and ERPT coefficients at the country level

	Growth in trade openness			**Growth in China's imports share**			**Growth in intra-industry trade**			**Growth in tariffs**		
	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$
	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff.
Import Deflator												
Belgium	0.085 (1.17)	−0.005 (−0.46)	0.079 (1.15)	0.145 (1.57)	−0.003 (−0.48)	0.144 (1.62)	0.115 (1.67)	−0.003 (−0.05)	0.115 (1.68)	0.221 (2.61)	0.007 (2.04)	0.214 (2.58)
France	0.266 (5.67)	−0.001 (−0.13)	0.259 (5.51)	0.428 (3.93)	−0.014 (−1.59)	0.320 (4.67)	0.283 (4.42)	0.019 (0.50)	0.284 (4.47)	0.326 (4.65)	0.003 (1.15)	0.315 (4.68)
Germany	0.242 (5.63)	0.010 (2.47)	0.264 (6.46)	0.310 (5.84)	−0.002 (−0.61)	0.290 (6.16)	0.298 (7.48)	0.001 (0.00)	0.296 (7.46)	0.326 (6.96)	0.003 (1.59)	0.323 (7.02)
Import Unit value												
Belgium	0.837 (8.27)	−0.033 (−2.66)	0.802 (8.23)	0.798 (5.72)	−0.013 (−1.62)	0.721 (6.11)	0.767 (6.49)	0.040 (0.45)	0.771 (6.53)	0.842 (6.12)	0.008 (1.50)	0.834 (6.16)
France	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*	*n.a*
Germany	0.294 (4.96)	0.017 (2.91)	0.331 (5.95)	0.407 (5.66)	−0.004 (−0.76)	0.371 (5.82)	0.397 (7.34)	0.010 (0.45)	0.392 (7.23)	0.431 (6.84)	0.005 (1.87)	0.426 (6.89)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2); (b) Corresponding t-statistics are given between parentheses.

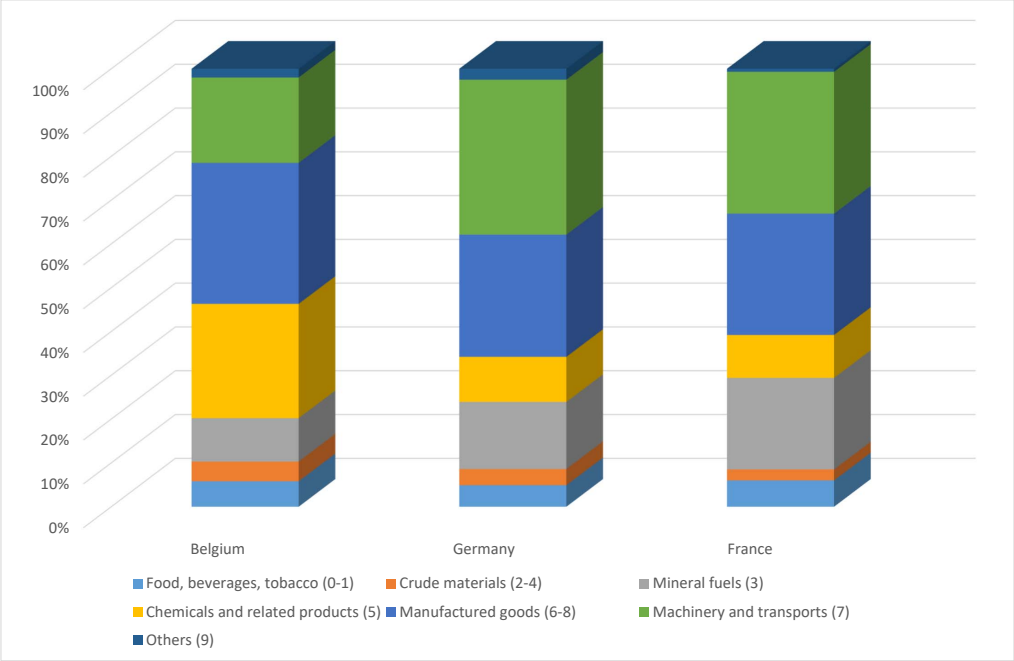
4.2 Using disaggregated data: accounting for the good level

To complement our previous country-level results, let us now estimate ERPT into import prices at a disaggregated level, using the one-digit level of disaggregation in the SITC classification. Analyzing ERPT at the good level allows us to account for the fact that the shift in the composition of imports towards goods whose prices are less sensitive to exchange rate changes has contributed to the pass-through decline. The corresponding results are reported in Table 4.[10] As shown, for all industries but SITC 4, the pass-through coefficients are positive and significantly different from zero. Moreover, with the exception of SITC 8 in Belgium, ERPT is incomplete, the estimated ERPT coefficients being lower than 1. However, the estimates strongly vary depending on the type of goods. The highest ERPT coefficients are generally obtained for goods belonging to STIC 2, STIC 8 and STIC 7 which are the sectors the most commodity-intensive. On the whole, the exchange rate effect on the prices of imported goods comes principally through its indirect effect on commodity prices: in commodity-intensive sectors, foreign producers have strong market power and face very weak domestic competition, and, consequently, the world price passed on when the exchange rate fluctuates. The declining share of commodity-intensive goods for which ERPT is higher than for other goods, may thus explain the declining pass-through reported in several studies (see, e.g. López-Villavicencio and Mignon (2016) and the references therein). For some industries, such as those concerned with manufactured goods (SITC 6), the pass-through strongly differs between countries—the value of ERPT degree for Belgium being two times that of France. This can be explained by the fact that these industries are more oriented towards product differentiation, leading to distinct ERPT degrees in different countries.

Figure 2 reports the structure of imports according to the type of product for our three considered countries. The share of manufactured goods ranks at the first place in the imports structure of Belgium, which is the industry for which the estimated ERPT is the highest across the three countries. The ERPT degrees for industries belonging to SITC 7 and 4 are also quite high in Belgium, which correspond to sectors that are of importance in the Belgian import structure. Turning to Germany and France, the highest ERPT degrees are observed for industries belonging to SITC 8 and 7, which also play a key role in the import structure of these two countries. On the whole, these findings highlight the existence of a relationship between ERPT degree and the structure of imports of the considered countries.

[10]Note that at the disaggregated level we use panel data techniques with fixed effects. The equations are then estimated for each SITC sector and the panel members are the divisions in each Section.

Figure 2: Import structure by product in 2015



Note: Data source: Eurostat.

Table 4: ERPT coefficients at the good level (SITC classification)

Country	SITC 0 - 1 Coeff. (t-stat)	SITC 2 Coeff. (t-stat)	SITC 4 Coeff. (t-stat)	SITC 5 Coeff. (t-stat)	SITC 6 Coeff. (t-stat)	SITC 7 Coeff. (t-stat)	SITC 8 Coeff. (t-stat)
Belgium	0.209 (2.84)	0.706 (4.61)	0.229 (0.81)	0.481 (4.56)	0.390 (4.65)	0.494 (5.50)	1.036 (11.88)
France	0.188 (4.31)	0.374 (4.14)	0.185 (1.34)	0.257 (4.23)	0.180 (3.97)	0.369 (8.15)	0.431 (10.81)
Germany	0.227 (4.14)	0.291 (2.98)	0.100 (0.58)	0.281 (3.65)	0.114 (2.35)	0.473 (7.99)	0.737 (13.31)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (1); (b) Corresponding t-statistics are given between parentheses; (c) SITC 0 and 1: Food, Beverages and tobacco, SITC 2: Crude materials, inedible, except fuels, SITC 4: Animal and vegetable oils, fats and waxes, SITC 5: Chemicals and related products, SITC 6: Manufactured goods, SITC 7: Machinery and transport equipment, SITC 8: Miscellaneous manufactured articles.

4.3 Accounting for globalization at the good level

Tables 5 to 8 display the estimation results at the disaggregated level of Equation (2). As shown, the interactive term is generally negative, but non significant in most cases, especially when considering indicators based on tariffs and intra-industry trade.

The most interesting findings are obtained with the China-based globalization indicator, illustrating also the importance of reasoning at the disaggregated level. Indeed, consider for instance Germany in the case of an increase in the share of Chinese imports in total imports. The interactive term is negative and significant for four types of goods, namely STIC 2 (crude materials, inedible, except fuels), 5 (chemicals and related products), 6 (manufactured goods) and 7 (machinery and transport equipment) which correspond to sectors in which China is highly competitive. This means that an increase in the share of China tends to weaken ERPT in Germany, reflecting a threat from competition with China in these sectors. This is also the case in France regarding goods belonging to STIC 6 and 7. Given that German's machinery and transport equipment sector plays a central role worldwide, these findings concerning STIC 7 are perfectly logical in the aim of Germany to preserve its market shares.

These results regarding manufactured goods and, to a lesser extent, machinery and transport equipment, are in line with the economic development and emergence of China. Indeed, the manufactured goods sector plays a key role in the Chinese economy since (i) it contributes, with the construction sector, nearly half of China's GDP, and (ii) it is highly competitive and export-oriented.

Overall, these results illustrate that while there is no compelling evidence that globalization has increased the degree of ERPT, Chinese firms' market penetration tends to have reduced the pass-through in some sectors, particularly those producing manufactured goods and machinery and transport equipment in Germany and France. Those findings may reflect the wish of domestic firms to preserve their market power and protect against foreign competition.

Table 5: ERPT and growth in trade openness at the good level

	Belgium			**France**			**Germany**		
	θ	θ^C	Total effect $\theta + \theta^C$	θ	θ^C	Total effect $\theta + \theta^C$	θ	θ^C	Total effect $\theta + \theta^C$
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
SITC	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
0-1	0.187	0.010	0.198	0.171	−0.007	0.168	0.215	0.001	0.218
	(2.62)	(1.57)	(2.77)	(4.08)	(−1.42)	(4.00)	(3.99)	(0.17)	(4.08)
2	0.654	−0.007	0.660	0.334	0.000	0.334	0.297	−0.003	0.292
	(4.74)	(−0.86)	(4.77)	(1.86)	(−0.03)	(1.86)	(3.62)	(−0.74)	(3.56)
4	0.489	0.016	0.517	0.334	−0.004	0.331	0.085	0.008	0.119
	(1.52)	(0.90)	(1.57)	(4.17)	(−0.92)	(4.16)	(0.40)	(0.71)	(0.56)
5	0.477	−0.010	0.463	0.329	−0.013	0.297	0.385	−0.010	0.358
	(4.52)	(−1.21)	(4.49)	(4.57)	(−2.80)	(4.99)	(5.34)	(−1.72)	(5.20)
6	0.337	−0.012	0.363	0.106	−0.008	0.101	0.115	−0.005	0.116
	(4.27)	(−1.85)	(4.64)	(2.57)	(−1.74)	(2.46)	(2.25)	(−1.04)	(2.25)
7	0.501	0.002	0.498	0.333	−0.002	0.332	0.482	−0.009	0.474
	(5.54)	(0.26)	(5.48)	(7.19)	(−0.60)	(7.15)	(7.92)	(−1.47)	(7.98)
8	1.195	−0.014	1.166	0.413	0.006	0.425	0.860	−0.010	0.832
	(10.67)	(−1.14)	(10.88)	(7.30)	(0.75)	(8.20)	(11.99)	(−1.16)	(12.43)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2); (b) Corresponding t-statistics are given between parentheses.

Table 6: ERPT and growth in intra-industry trade at the good level

	Belgium			**France**			**Germany**		
	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
SITC	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
0-1	0.213	−0.006	0.212	0.166	−0.002	0.166	0.229	−0.005	0.226
	(2.89)	(−0.46)	(2.87)	(3.77)	(−0.35)	(3.79)	(4.14)	(−0.50)	(4.09)
2	0.705	0.001	0.706	0.380	0.010	0.378	0.281	−0.011	0.276
	(4.60)	(0.07)	(4.56)	(4.19)	(1.11)	(4.17)	(2.85)	(−1.75)	(2.80)
4	0.380	−0.003	0.375	0.320	0.015	0.318	0.121	−0.008	0.131
	(1.13)	(−0.11)	(1.15)	(1.68)	(1.01)	(1.67)	(0.58)	(−0.75)	(0.63)
5	0.476	−0.006	0.472	0.218	0.010	0.044	0.306	0.005	0.308
	(4.50)	(−0.33)	(4.65)	(3.58)	(1.86)	(0.29)	(4.03)	(0.42)	(4.05)
6	0.381	0.029	0.392	0.193	0.015	0.188	0.113	−0.006	0.113
	(4.52)	(1.63)	(4.67)	(4.23)	(1.07)	(4.16)	(2.21)	(−0.47)	(2.20)
7	0.467	0.023	0.470	0.367	−0.011	0.374	0.490	−0.001	0.489
	(5.21)	(3.21)	(5.26)	(8.10)	(−1.28)	(8.23)	(8.46)	(−0.08)	(7.13)
8	1.275	0.006	1.276	0.480	0.001	0.480	0.843	−0.001	0.838
	(11.61)	(0.23)	(11.69)	(9.30)	(−0.02)	(9.26)	(12.39)	(−0.04)	(10.95)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2); (b) Corresponding t-statistics are given between parentheses.

Table 7: ERPT and growth in China's imports at the good level

	Belgium			**France**			**Germany**		
	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$	θ	θ^C	Total effect $\theta+\theta^C$
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
SITC	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
0-1	0.293	−0.003	0.282	0.187	0.003	0.192	0.295	−0.001	0.291
	(3.27)	(−1.68)	(3.17)	(3.51)	(1.07)	(3.59)	(4.74)	(−0.75)	(4.70)
2	0.574	0.003	0.589	0.195	0.001	0.197	0.205	−0.005	0.212
	(3.56)	(1.03)	(3.71)	(2.01)	(0.54)	(2.03)	(2.18)	(−2.38)	(2.26)
4	$n.a$			$n.a$			$n.a$		
5	0.655	−0.004	0.628	0.328	0.001	0.331	0.379	−0.005	0.345
	(6.97)	(−1.97)	(6.42)	(4.75)	(0.32)	(5.02)	(5.26)	(−1.99)	(5.12)
6	0.388	0.002	0.404	0.242	−0.006	0.189	0.242	−0.006	0.179
	(4.25)	(0.66)	(4.70)	(4.87)	(−2.81)	(4.16)	(4.87)	(−2.82)	(4.16)
7	0.633	0.001	0.648	0.396	−0.003	0.370	0.482	−0.009	0.396
	(9.85)	(0.61)	(10.78)	(8.59)	(−2.55)	(8.21)	(7.92)	(−2.46)	(5.61)
8	1.308	−0.008	1.270	0.569	−0.005	0.552	0.895	−0.004	0.880
	(11.21)	(−1.17)	(11.69)	(10.89)	(−1.40)	(11.02)	(12.71)	(−1.09)	(11.84)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2); (b) Corresponding t-statistics are given between parentheses.

Table 8: ERPT and growth in import tariffs at the good level

	Belgium			**France**			**Germany**		
	θ	θ^C	Total effect $\theta + \theta^C$	θ	θ^C	Total effect $\theta + \theta^C$	θ	θ^C	Total effect $\theta + \theta^C$
SITC	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
0-1	0.199 (2.63)	0.008 (0.55)	0.192 (2.55)	0.157 (4.00)	−0.006 (−0.94)	0.163 (4.16)	0.220 (3.91)	−0.004 (−0.37)	0.223 (3.98)
2	0.656 (3.06)	−0.105 (−1.55)	0.673 (3.16)	0.446 (3.81)	−0.055 (−1.46)	0.455 (3.89)	0.307 (2.44)	−0.079 (−1.97)	0.320 (2.55)
4	0.224 (0.68)	−0.317 (−1.53)	0.328 (1.02)	0.195 (1.27)	−0.116 (−1.18)	0.079 (0.40)	0.149 (0.81)	−0.154 (−1.25)	0.200 (1.07)
5	0.490 (4.58)	0.000 (−0.37)	0.490 (4.58)	0.508 (7.78)	0.009 (0.15)	0.512 (7.64)	0.336 (4.40)	0.000 (0.90)	0.336 (4.40)
6	0.502 (4.67)	−0.004 (−0.28)	0.509 (4.80)	0.244 (4.24)	−0.003 (−0.48)	0.250 (4.41)	0.141 (2.32)	−0.008 (−0.98)	0.154 (2.57)
7	0.522 (5.28)	0.003 (0.03)	0.523 (4.88)	0.390 (7.92)	−0.001 (−0.01)	0.390 (7.61)	0.508 (7.75)	0.009 (0.15)	0.512 (7.63)
8	1.086 (12.65)	−0.032 (−0.54)	1.077 (12.36)	0.419 (10.11)	−0.028 (−1.01)	0.411 (9.76)	0.746 (13.33)	0.004 (0.11)	0.749 (11.66)

Notes: (a) This table reports the estimated ERPT coefficients from Equation (2); (b) Corresponding t-statistics are given between parentheses.

5 Conclusion

Assessing the degree of exchange rate pass-through (ERPT) into import prices in eurozone countries is worthy of investigation. Indeed, import prices being a key channel through which exchange rate changes influence domestic prices and, in turn, inflation and output, evaluating the degree of ERPT is a key issue within the context of a monetary union. The same variation in the euro exchange rate change may affect eurozone countries differently, depending on their openness to trade degree. We tackle this issue in the present paper by analyzing ERPT into import prices for three core eurozone countries, namely Belgium, France and Germany, which are characterized by various openness degrees. With protectionism on the rise the question becomes even more relevant.

While it is intuitively expected that ERPT and openness degrees are positively linked, we do not find support for this hypothesis as we show that globalization has not caused an increase in ERPT. On the contrary, our findings are more in line with the view that higher openness may increase competition for market share, leading to lower ERPT in certain sectors. Indeed, reasoning at the good level—using the one-digit Standard International Trade Classification—, we show that Chinese firms' market penetration has weakened the pass-through in some sectors, particularly those producing manufactured goods and machinery and transport equipment in Germany and France. Given this result, it is not surprising to fail to find strong support in favor of a link between ERPT and the degree of trade openness. Indeed, contrary to what the theoretical literature suggests (e.g. Gust, Leduc, and Vigfusson (2010)) a limited portion of the decline in ERPT is a result of factors that lead to greater trade integration.

On the whole, our results show that while ERPT into import prices is incomplete, it remains significant meaning that exchange rate changes still exert important pressure on domestic prices in the considered eurozone economies. In addition, the responses of import prices to euro exchange rate variations differ across countries and sectors, a characteristic which has to be taken into account for the conduct of the single monetary policy.

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6 Appendix

Table 9: SITC classification

Section (Panel) and Division (Panel members)
0. Food and live animals
00 - Live animals
01 - Meat and meat preparations
02 - Dairy products and birds' eggs
03 - Fish (not marine mammals), crustaceans, etc.
04 - Cereals and cereal preparations
05 - Vegetables and fruit
06 - Sugars, sugar preparations and honey
07 - Coffee, tea, cocoa, spices, and manufactures thereof
08 - Feeding stuff for animals (not including unmilled cereals)
09 - Miscellaneous edible products and preparations
1. Beverages and tobacco
11 - Beverages
12 - Tobacco and tobacco manufactures
2. Crude materials, inedible, except fuels
21 - Hides, skins and furskins, raw
22 - Oil-seeds and oleaginous fruits
23 - Crude rubber (including synthetic and reclaimed)
24 - Cork and wood
25 - Pulp and waste paper
26 - Textile fibres
27 - Crude fertilizers and crude minerals
28 - Metalliferous ores and metal scrap
29 - Crude animal and vegetable materials, n.e.s.
4 - Animal and vegetable oils, fats and waxes
41 - Animal oils and fats
42 - Fixed vegetable fats and oils, crude, refined or fractionated
43 - Animal or vegetable fats and oils, processed, etc
5 - Chemicals and related products, n.e.s.
51 - Organic chemicals
52 - Inorganic chemicals
53 - Dyeing, tanning and colouring materials
54 - Medicinal and pharmaceutical products
55 - Essential oils, etc
56 - Fertilizers
57 - Plastics in primary forms
58 - Plastics in non-primary forms
59 - Chemical materials and products, n.e.s.
6 - Manufactured goods classified chiefly by material
61 - Leather, leather manufactures, n.e.s., and dressed furskins
62 - Rubber manufactures, n.e.s.
63 - Cork and wood manufactures (excluding furniture)
64 - Paper, paperboard and articles of paper pulp, of paper or of paperboard
65 - Textile yarn, fabrics, made-up articles, n.e.s., and related products
66 - Non-metallic mineral manufactures, n.e.s.
67 - Iron and steel
68 - Non-ferrous metals
69 - Manufactures of metals, n.e.s.
7 - Machinery and transport equipment
71 - Power-generating machinery and equipment
72 - Machinery specialized for particular industries
73 - Metalworking machinery
74 - General industrial machinery and equipment
75 - Office machines and automatic data-processing machines
76 - Telecommunications and sound-recording and reproducing apparatus and equipment
77 - Electrical machinery, apparatus and appliances, n.e.s.
78 - Road vehicles (including air-cushion vehicles)
79 - Other transport equipment
8 - Miscellaneous manufactured articles
81 - Prefabricated buildings; sanitary, plumbing, etc
82 - Furniture, and parts thereof, etc
83 - Travel goods, handbags and similar containers
84 - Articles of apparel and clothing accessories
85 - Footwear
87 - Professional, scientific and controlling instruments and apparatus
88 - Photographic apparatus, equipment and supplies and optical goods, etc
89 - Miscellaneous manufactured articles, n.e.s.