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CENTRE
D'ÉTUDES PROSPECTIVES
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INTERNATIONALES

No 2006 – 03
February

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# Contents

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### SUMMARY

Incomplete exchange-rate pass-through is a typical micro-based phenomenon that bears important macro-economic consequences. A number of recent papers have tried to justify incomplete pass-through within open macro-economics models. The weak sensitivity of import prices to exchange-rate movements is explained by the behavior of exporting firms, which adopt pricing-to-market strategies. Indeed, in an imperfectly competitive environment, exporting firms may find it optimal to smooth the impact that exchange-rate movements have on local currency prices, by adjusting their mark-ups. The share of currency changes that is absorbed by exporters will then depend on various parameters, such as the perceived elasticity of demand, the firm's market power in the destination market, etc.

Such microeconomic explanations of the incomplete pass-through however lack of an empirical support. Indeed, pass-through estimates are generally run on aggregate data and cannot be used to validate theoretical micro-funded models. On the other hand, available estimates at the sectoral level are limited either in terms of industry coverage or in terms of disaggregation level.

In this paper, we use the BACI database, developed at CEPII, to investigate incomplete pass-through at the product level. Because BACI displays a highly disaggregated nomenclature (the $hs6$ level), we are able to estimate the sensitivity of export prices to exchange-rate movements for more than 4,000 products. Another advantage of this database lies in its country coverage (more than 130 countries). Indeed, when pooling these bilateral data in the $hs6$ dimension, all pass-through determinants linked to the geographical dimension of the phenomenon are smoothed and we obtain product-specific coefficients, reflecting the mean behavior of all exporters around the world. Last, the bilateral dimension of these data allows us to use panel techniques with fixed effects controlling for a large array of price determinants that would be otherwise difficult to measure with accuracy at this disaggregation level.

As expected from micro-funded models, results display a strong heterogeneity across products. About half of the 4,000 estimated coefficients are suggestive of pricing-to-market behaviors whereas the other ones are not significantly different from zero. Moreover, even among these significant PTM coefficients, the size of the suggested pass-through strongly varies.

The classifications of sectors developed by Rauch (1999) and the UNIDO (BEC) allow to identify the specific features of pass-through behaviors, according to the nature of goods and the market structures. Pricing to market behaviors are shown to be stronger when the goods are traded on referenced markets, probably because referencing eases arbitrage behaviors, and forces firms to keep their prices in line with the prices on the import market. Pricing to market is also stronger for final consumption goods, probably because of a higher competitive pressures on those markets.

Last, the influence of several exporter- or importer-specific features is investigated: on average, pricing-to-market is lower in small or concentrated markets (where the risk of demand is less pronounced), and when the exporter already owns a strong market share (i.e. a strong market power).


[1]The authors are thankful to Agnès Bénassy-Quéré and Jean-Olivier Hairault for carefully commenting on previous versions of this paper.

**ABSTRACT**

Recent papers have tried to explain incomplete pass-through observed at the aggregate level by various microeconomic behaviors. This paper assesses some of these explanations, using product-level estimates of pricing-to-market coefficients obtained from a new database of bilateral international trade that covers more than 5,000 products and 130 countries. Half of the industries are found to exhibit pricing-to-market, but the magnitude of the pass-through is shown to vary widely across sectors, even at the most detailed level. Pricing-to-market is then shown to be higher in markets where arbitrage is made easier by the existence of referenced prices, and for final consumption goods. Moreover, competitive pressures faced by exporting firms are shown to affect pass-through decisions as well: firms tend to price to market all the less that their market share in the destination market is large, and that the destination markets are small or concentrated.

*JEL* classification: F1, F4
Keywords: pass-through determinants, product-level analysis, panel data, oligopolistic competition.

**LES DÉTERMINANTS STRUCTURELS DE LA RÉACTION DES PRIX AUX VARIATIONS DE CHANGE**

**RÉSUMÉ**

La transmission incomplète des variations de change aux prix à l'importation est un phénomène aux conséquences macro-économiques bien connues, résultant de comportements micro-économiques de fixation des prix en concurrence imparfaite. Récemment, plusieurs modèles de la Nouvelle Macro-économie Ouverte ont tenté de modéliser ce phénomène sur la base de comportements individuels de tarification au marché. Dans un cadre de concurrence imparfaite, on peut montrer que les firmes exportatrices peuvent avoir intérêt à lisser l'impact des mouvements de change sur les prix en monnaie locale par des ajustements de leur taux de marge. La part des variations de change absorbée par les exportateurs dépendra alors de différents paramètres structurels comme l'élasticité perçue de la demande, le pouvoir de marché de la firme sur le marché destinataire, etc.

De telles explications micro-fondées du phénomène de *pass-through* incomplet souffrent cependant d'un manque d'évidences empiriques permettant de valider ces intuitions. En effet, les estimations de coefficients de *pass-through* utilisent généralement des données agrégées qui ne permettent pas de tester les déterminants structurels mis en avant par les modèles. De plus, les quelques estimations sectorielles existantes ont une portée limitée, soit car le niveau d'agrégation des données de commerce est encore élevé, soit parce que leur couverture sectorielle est trop limitée pour que les résultats soient généralisables.

Dans cet article, nous utilisons la base de données BACI développée par le CEPII pour étudier le phénomène de *pass-through* incomplet au niveau du produit. La fort désagrégation de la base (nomenclature $sh6$) permet d'estimer la sensibilité au change des prix à l'exportation de plus de 4000 produits. La couverture géographique de la base (plus de 130 pays) permet en outre de minimiser le biais potentiel lié à la dimension géographique de ce phénomène. En effet, en empilant les données bilatérales dans la dimension $sh6$, on obtient des coefficients spécifiques à chaque produit, reflétant l'attitude moyenne des exportateurs de tout pays, quelle que soit la destination du bien. Enfin, la dimension bilatérale des données permet d'utiliser des techniques de panel avec des effets fixes contrôlant pour de nombreux déterminants non observables des prix.

Comme le suggèrent les modèles micro-fondés, on observe une forte hétérogénéité des résultats par produit. Environ la moitié des 4000 coefficients ainsi estimés mettent en évidence des comportements de tarification au marché, tandis que les autres coefficients ne sont pas significativement différents de zéro. De plus, même parmi les produits pour lesquels on identifie un phénomène de tarification au marché, l'ampleur des ajustements présente de fortes disparités.

A partir de là, l'influence de plusieurs déterminants théoriques des stratégies de tarification au marché est testée en utilisant différents indicateurs décrivant les structures de marché de chaque produit.

Les classifications de Rauch (1999) et de la CNUCED (BEC) permettent d'identifier des spécificités de comportements de *pass-through* selon la nature des biens échangés, et la structure générale des marchés sur lesquels ils sont échangés. Il apparaît que les comportements de tarification au marché sont plus prononcés lorsque les biens sont échangés sur un marché référencé, sans doute car le référencement des produits facilite les comportements d'arbitrage, obligeant les firmes à s'aligner sur le prix du marché importateur. Les comportements de tarification au marché sont également plus marqués pour les biens de consommation finale, probablement du fait d'une plus forte concurrence sur ces marchés.

On mesure enfin l'influence de caractéristiques spécifiques à chaque exportateur et/ou impor-

tateur: en moyenne, l'absorption des fluctuations de change dans les marges semble moins marquée dans des petits pays ou sur des marchés concentrés, le risque de demande étant alors limité, et lorsque l'exportateur a une part de marché (i.e. un pouvoir de monopole) suffisante.

**RÉSUMÉ COURT**

La littérature récente a tenté d'expliquer de manière micro-fondée un phénomène observé au niveau agrégé, la réaction incomplète des prix à l'importation aux variations de change. Dans cet article, nous testons la pertinence de quelques unes de ces explications, en utilisant des données bilatérales fines de commerce international, couvrant plus de 5000 produits et 130 pays. Les coefficients estimés mesurent les comportements de tarification au marché des firmes, confrontées à un risque de change. Nous montrons que la moitié des firmes adoptent de telles stratégies de prix. Cependant, l'ampleur de la transmission des variations de change aux prix à l'importation varie d'un secteur à l'autre, même au niveau le plus fin. En effet, l'absorption des mouvements de change dans les marges des firmes est plus importante sur des marchés où les comportements d'arbitrage sont facilités par l'existence de prix référencés ainsi que sur des marchés de consommation finale. En outre, l'intensité de la pression concurrentielle entre firmes exportatrices affecte les stratégies de prix : l'absorption des mouvements de change par les firmes est d'autant plus faible que leur part de marché est élevée. De même, les prix dans les marchés de petite taille ou très concentrés sont en moyenne plus sensibles aux variations de change.

Classification *JEL* : F1, F4
Mots clés: déterminants du pass-through, analyse désagrégée, données de panel, concurrence oligopolistique.

# STRUCTURAL DETERMINANTS OF THE EXCHANGE-RATE PASS-THROUGH

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## 1 Introduction

Interest in open macroeconomics has recently focused on incomplete pass-through, as studied in a new generation of "pricing-to-market" models. Indeed, the weak sensitivity of import prices to exchange rate movements has been shown to bear important macro-economic consequences for the international transmission of real shocks and currency changes.[5] Several New Open Macroeconomics models have tried to go beyond the issue of the consequences of this phenomenon to investigate its micro-foundations. These models explain the incomplete pass-through in terms of pricing-to-market[6], rationalized in specific models by certain forms of demand or technological functions. For instance, Bachetta & Van Wincoop (2005) highlight the role of the competitive structure in explaining exporters' decisions to absorb or pass currency changes into their prices: the higher the firm's market share in the destination country, the lower its incentive to absorb nominal shocks. Corsetti & Dedola (2002) study pass-through strategies in a model with distribution costs and show that these decisions are influenced by the price of local inputs. As shown by Aizenman (2004), the availability of financial instruments can affect individual pricing-to-market strategies under uncertainty with regards to the future level of transportation costs. Last, Bergin & Feenstra (1998) build a model of optimal incomplete pass-through explained by price strategies of firms facing a non-constant demand elasticity.

From an empirical point-of-view however, the relevance of the micro-funded explanations of the incomplete pass-through is difficult to assert as a large majority of pass-through estimates are obtained from aggregate prices.[7] These papers highlight the strong cross-country heterogeneity in the size of the exchange rate pass-through, that may however reflect either country-specific features or composition effects. As for the industry-level estimates, they are limited either in their disaggregation level[8], thus preventing any formal structural explanation, or in their coverage[9] so that results cannot easily be generalized.

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[5]See Betts & Devereux (1996), Devereux & Engel (2003)

[6]The notion of pricing-to-market, as defined by Krugman (1987), refers to a form of price discrimination in which exporting firms adjust their mark-ups to currency changes in order to maintain their prices in local currency.

[7]See e.g. Campa & Goldberg (2004), Anderton (2003), Warmedinger (2004).

[8]For instance, Campa & Minguez (2004) work on 13 1-digit sectors, Campa & Goldberg (2004) on 5 product categories, Pollard & Coughlin (2003) on 20 3-digit manufacturing industries, and Yang (1997) on 64 3- or 4-digit sectors.

[9]Several authors, as Gagnon & Knetter (1995), Gross & Schmitt (2000) and Gil-Pareja (2003) limit their analysis to the car industry. Knetter (1993) studies a maximum of 60 $7-$digit industries, Gil-Pareja (2002) 26 $8-$digit industries, Takagi & Yoshida (2001) 20 $9-$digit sectors.

The aim of this paper is to investigate the structural dimension of incomplete pass-through. Pricing-to-market elasticities[10] are estimated at the product-level using highly disaggregated data, which are pooled across more than 130 countries. Comparing PTM coefficients across products allows to identify pricing-to-market strategies in half of the industries, with a strong heterogeneity across products with regard to the share of exchange-rate fluctuations that is absorbed by exporters. This heterogeneity is then explained either by the nature of traded goods or by the market structures in which goods are traded. Indeed, pricing-to-market tends to be all the more pronounced in markets where arbitrage is made easier by the presence of "reference prices", and for final consumption goods. Moreover, destination-specific market structures are shown to affect pass-through strategies: exporters tend to smooth exchange-rate movements all the more that their partners are large, whereas they are more able to pass exchange-rate changes in concentrated markets and where their market share is large enough. The remaining of the paper is as follows. Section 2 sets out the theoretical framework used to investigate exchange-rate pass-through, as well as some existing results concerning potential determinants of PTM decisions. The database and empirical strategy are presented in Section 3. Section 4 describes the general results and investigates the sector-specific features that are likely to explain the strong heterogeneity among product-level estimates. Section 5 concludes.

# 2 Theoretical determinants of pass-through behaviors

The observed low sensitivity of local currency import prices to exchange-rate changes has lead economists to consider the possibility that exporters may adjust their price to these fluctuations in order to maintain their competitiveness in the destination market. Such a behavior, labeled Pricing-to-Market by Krugman (1987), is obviously impossible in a perfect competitive framework since it requires that export prices are initially set above the marginal production cost. However, whenever the exporter's margin is strictly positive, pricing-to-market can become a sustainable strategy from the exporter's point-of-view, in what case the measured pass-through of currency changes into import prices will be less than one. The size of the exchange-rate pass-through will therefore depend on micro-based features, and above all on the ability of exporters to absorb exchange-rate shocks within their profit margins. This is usually formally shown within monopolistic competition frameworks (see e.g. Knetter, 1989). While this allows for an easy derivation of the optimal pricing-to-market coefficient, such a framework is nevertheless consistent with only limited pricing strategies, whereas other microeconomic features are likely to influence pass-through in export markets.

## 2.1 Theoretical framework

Assume country $i$ produces good $k$ within a monopolistic framework. The good is sold to different segmented markets $j$, where producers are therefore able to differentiate export prices according to the destination. At time $t$, the optimal destination-specific export price, in the producer's currency, can be written as:

$$P_t^{ijk} = MC_t^{ik}\mu_t^{ijk} \tag{1}$$

[10] In the following, we call pricing-to-market elasticity (PTM elasticity hereafter) the reaction of export prices (in the exporter's currency) to a one percent change in the exchange rate. Under complete pass-through, export prices should be insensitive to currency changes (zero pricing-to-market). The low sensitivity of import prices to currency changes is thus interpreted in terms of pricing-to-market strategies, i.e. a price adjustment consented by firms to stabilize prices in the destination market.

with:

- $MC_t^{ik}$ the marginal production cost, which is assumed to be identical across destinations at each period (i.e. $MC_t^{ijk} = MC_t^{ik},\ \forall j$)

- $\mu_t^{ijk}$ the producer's mark-up, which depends on the elasticity of demand to the price in local currency: $\mu_t^{ijk} = \frac{\eta_t^{ijk}}{\eta_t^{ijk}-1}$ where $\eta_t^{ijk}$ is the inverse of the price-elasticity of demand.

In the following, $\eta_t^{ijk}$ is written as a function of the price in the destination country's currency ($P_t^{ijk}/S_t^{ij}$ with $S_t^{ij}$ the bilateral exchange rate in *i*'s currency per unit of *j*'s, which increases when $i$'s currency depreciates), and possibly on demand-specific variables (summarized by the vector $Z_t^{jk}$), identified by a trend in the estimated equation.
First-differentiating optimal prices (1) with respect to the different variables yields the following expression of the exporter's price, for sales in country $j$:[11]

$$p_t^{ijk} = (1-\beta^{ijk})mc_t^{ik} + (1-\beta^{ijk})\frac{\eta^{ijk}}{\eta^{ijk}-1} + \beta^{ijk}s_t^{ij} + \gamma^{ijk}z_t^{jk} \tag{2}$$

In this equation, $\beta^{ijk} = \partial p_t^{ijk}/\partial s_t^{ij}$[12] measures the sensitivity of export prices to exchange-rate changes (therefore, it is the pricing-to-market coefficient - thereafter noted PTM) which is inversely related to the magnitude of the pass-through: it is null when the pass-through is complete and unitary when currency changes are fully absorbed into margins, leaving the local currency price unchanged (zero pass-through/full pricing-to-market).
As detailed in Knetter (1989), this coefficient depends on firms' perception of how demand elasticities change with respect to the local currency price. A sufficient condition for the pass-through to be complete is that of a constant elasticity of demand with respect to the price in the destination market ($\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}} = 0$), implying $\beta^{ijk} = 0$. With such a functional form of demand, exporting firms facing currency changes have no incentive to adjust their mark-up and consumers in the destination market bear the whole nominal shock. Under the alternative hypothesis however, the mark-up depends on the bilateral exchange rate and the optimal pass-through is incomplete. To rationalize such a behavior, suppose that $i$'s currency appreciates ($d\ln S_t^{ij} < 0$), which has a negative impact on $i$'s price competitiveness. Firms from $i$ then have an incentive to compress their export mark-up to mitigate the price impact of the exchange-rate shock and maintain their market share, in what case $\beta^{ijk}$ is positive. On the other hand, one cannot rule out the possibility of a negative PTM coefficient, leading to an over-reaction of export prices to exchange-rate movements, which would however occur for highly specific forms of demand.
Thus, in a monopolistic framework, the optimal PTM strategy solely depends on the perceived elasticity of demand: it is positive when the elasticity of demand increases with prices. In this case however, the size of the optimal pass-through is limited by the level of the elasticity of demand as the firm's ability to absorb exchange-rate variations decreases with its mark-up in more elastic markets.

[11] Lowercase letters refer to the natural logarithm of the corresponding variables. For details, see Appendix A.1.

[12] where $\beta^{ijk} = \frac{\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}}{\eta^{ijk}-1+\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}}$ with $\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}} = \frac{\partial \ln \eta_t^{ijk}}{\partial \ln (p_t^{ijk}/S_t^{ij})}$

Such a modeling of PTM however relies on the assumption of monopolistic competition. As shown by the rich literature describing PTM behaviors within some specific market structures, this is an obvious limitation. The following sub-section thus provides some intuitions about other product-specific features that could influence firms' incentive to price-to-market.

## 2.2 Other sources of incomplete pass-through

The limitation of the monopolistic competition framework in describing PTM is easily evidenced within a more general oligopolistic framework. Indeed, under oligopolistic Cournot competition, the optimal mark-up still negatively depends on the price-elasticity of demand but also increases with the producer's market share in the destination market.[13] As a consequence, the optimal price reaction to currency changes is affected by the exporter's market share[14] and the constancy of the elasticity of demand with respect to the price in local currency is no more a sufficient condition for complete pass-through. The direction of the relation between the PTM elasticity and the market share is however ambiguous. Under weak assumptions on the functional form of demand, Feenstra, Gagnon & Knetter (1996) show that the pass-through elasticity "might initially decline as market share rises, but will increase towards unity as market share approaches 100 percent".[15] Indeed, starting from a low enough market share, an increase in the exporter's market share gives the firm a wider room for maneuver to absorb exchange-rate changes through mark-up adjustments. If its initial market share is high however, a further expansion of it makes its market power so strong that its incentive to price-to-market decreases.

Several analyses also describe PTM as a pricing reaction to competitive pressures encountered by the exporting firm in the destination market. Indeed, as argued by Taylor (2000), the strengthening of competition in the destination market forces firms to follow the market price, and therefore to absorb exchange-rate changes. Such a determinant of PTM is difficult to measure empirically, but one can still hope to identify higher PTM coefficients in atomistic, low differentiated markets. In the same line, impediments to market entrance - such as sunk costs as in Baldwin & Krugman (1989) - or consumers switching costs (Froot & Klemperer (1989)) could provide the exporter with a wider room to pass exchange-rate movements into local prices, so that PTM is less likely.

Pricing-to-market can also emerge in relation to the firm-specific technological function. For instance, Devereux, Engel & Storgaard (2004) and Patureau (2004) underline the influence of the cost structure, arguing that an incomplete pass-through strategy is less costly if marginal costs also covary with exchange rates.[16] On the other hand, Corsetti & Dedola (2002) explain incomplete pass-through by the existence of distribution costs in the destination market that affect pricing strategies. Last, pricing-to-market can also depend on the availability of

[13] See Varian (1978).

[14] More precisely, under oligopolistic competition,

$$\beta^{ijk} = \frac{\omega_t^{ijk}(\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}})}{\eta_t^{ijk} - \omega_t^{ijk} + \omega_t^{ijk}(\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}})}$$

with $\omega_t^{ijk} = \frac{Q_t^{ijk}}{\sum_i Q_t^{ijk}}$ *i*'s market share in *j* and $\xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}} = \frac{\partial \ln \omega^{ijk}}{\partial \ln P_t^{ijk}/S_t^{ij}}$

[15] With our notations, this means that one expects the relation between an exporter's market share $\omega_t^{ijk}$ and her optimal PTM coefficient $\beta^{ijk}$ to be first positive until a given market share threshold after what $\beta^{ijk}$ should decrease.

[16] This particular determinant cannot however be investigated in the following as the estimated equation controls for any cost change using fixed effects.

financial products that limit the exposure of exporters' profits to exchange-rate fluctuations, as in Friberg (1998) or Aizenman (2004).
These papers all show that, once departure from the perfect competitive framework is allowed, firms may feel incentives to price-to-market, even when facing constant elasticity of local demand. Both the determinants of such a decision and the magnitude of the PTM coefficient rely on various microeconomic determinants that the following, product-level, empirical study investigates.

# 3 Data and empirical strategy

## 3.1 From the theoretical model to the estimated equations

According to the monopolistic competition model, pass-through coefficients should be estimated within the framework of the following equation[17]:

$$d\ln P_t^{ijk} = (1-\beta^{ijk})d\ln MC_t^{ik} + \gamma^{ijk} d\ln Z_t^{jk} + \beta^{ijk} d\ln S_t^{ij} \tag{3}$$

where:

- $\beta^{ijk}$ is the pricing-to-market coefficient, which is specific to the exporter (*i*), the country of destination (*j*) and the product (*k*),
- $P_t^{ijk}$ is the export price, in the exporter's currency,
- $MC_t^{ik}$ is the exporter- and product-specific marginal cost in the exporter's currency,
- $Z_t^{jk}$ is a set of importer-specific features of the sectoral demand, influencing price decisions,
- and $S_t^{ij}$ is the nominal bilateral exchange rate between $i$ and $j$.

Both marginal costs and importer's demand characteristics are highly difficult to evaluate, and even more at the product level. Fixed effects are thus used as proxies, which leads to the following empirical equation:

$$d\ln P_t^{ijk} = \alpha^{ik} fix_t^{ik} + \delta^{jk} fix^{jk} + \beta^{ijk} d\ln S_t^{ij} + \epsilon_t^{ijk} \tag{4}$$

where $fix_t^{ik}$ and $fix^{jk}$ are fixed effects that respectively account for $it$- and $j$-specific determinants of price changes. $fix_t^{ik}$ therefore catches, among others, marginal cost changes or evolutions of the competition among firms located in $i$, that influence price decisions of firms producing $k$ in $i$. As far as the importing country is considered, the fixed effect ($fix^{jk}$) has a restricted dimension because of data constraints: we are forced to assimilate the growth of country-specific features ($d\ln Z_t^{jk}$) to a linear trend and a residual ($\epsilon_t^{ijk}$).[18]
In order to accurately identify the structural determinants of pass-through, the number of dimensions of the equation has to be reduced. Therefore, PTM elasticities are estimated

[17] In the following, PTM coefficients are estimated from equations in first differences to limit the risk of spurious regressions if some explanatory variables, notably exchange rates, were non-stationary.

[18] This hypothesis seems preferable, as it allows to keep an $it$ fixed effect, which is likely to catch marginal cost developments in country $i$ better than such variables as the production price index or unit labor costs, which are (imperfect) measures of marginal costs. Moreover, the $it$ fixed effect catches the impact of exchange-rate changes on marginal costs, thus cleaning up the estimate of the exchange-rate pass-through. Our PTM estimates thus only reflect the sensitivity of margins to exchange-rate movements.

for each product $k$ by pooling all bilateral prices. This allows to estimate sector-specific PTM coefficients, that omit the potential heterogeneity of PTM decisions across exporters as well as among importers. Hence, the baseline equation for identifying this "mean" PTM coefficient is the following:[19]

$$d\ln P_t^{ijk} = \alpha^k fix_t^{ik} + \delta^k fix^{jk} + \beta^k d\ln S_t^{ij} + \epsilon_t^{ijk} \tag{5}$$

This equation is estimated at the product-level using weighted OLS, thus assuming the $it$- and $j$-specific effects to be fixed. Indeed, as our country coverage is exhaustive, assuming random effects would not be appropriate. The weighting scheme is based on the value of each bilateral flow, with two-period weights as in the computation of Tornqvist price indices:

$$w_t^{ijk} = 0.5\left(\frac{V_{t-1}^{ijk}}{V_{t-1}} + \frac{V_t^{ijk}}{V_t}\right) \tag{6}$$

with our usual notations for countries and sector subscripts and $V_t^{ijk}$ the value of the considered trade flow in dollar. $V_t$ is world trade at time $t$.

## 3.2 The data

Exchange-rate pass-through estimates in the literature are usually confronted with a trade-off to be made between the sectoral disaggregation level of data and the country coverage. Basically, estimates using aggregate price data allow for a larger country coverage and higher frequency of data. However, price data is not much reliable in this case, as pointed out by Lavoie & Liu (2004): the use of aggregate price series might bias the PTM estimates, as it is then impossible to disentangle between PTM reflecting price discrimination and PTM reflecting product differentiation.[20]

Working on disaggregated price data offers an alternative solution, as the aggregation bias should then be minimized. However, this choice has a cost in terms of the data frequency, since highly disaggregated data is mostly available on an annual basis, thus constraining to study "long-run" rather than "short-run" pass-through.[21] Moreover, in most existing studies, this has also a cost in terms of the country coverage, as product-level reliable data is essentially available for a small number of developed countries. As our empirical strategy requires to pool data across countries, this would create a selection bias.

In this paper, we use a new trade database, which provides an alternative solution to available datasets. Indeed, the BACI database, developed at CEPII, provides with trade data drawing on the most detailed available level of disaggregation (the $hs6$ level), obtained from the United Nations COMTRADE database.[22] Data are harmonized in order to allow for a reconciliation of import and export declarations, and trade flows are reported both in value and

[19] Here, indices $k$ are not set to indicate that estimates use heterogeneous coefficient panel methods. They rather mean that, as this equation is estimated separately for each product, the obtained coefficients are product-specific.

[20] Lavoie & Liu (2004) show that this latter "pseudo-PTM" can be sizeable for aggregated price series when vertical differentiation is important.

[21] Indeed, the incomplete pass-through is a short-run phenomenon, which effects vanish when producers adjust their price or the exchange rate returns to its former value. Several studies thus use cointegration methods to disentangle short-run and long-run pass-through. According to Campa & Goldberg (2004), the long-run is reached after one year.

[22] The $hs6$ level is the highest possible level of disaggregation with an exhaustive geographical coverage. For more details on the content and building of the BACI database: http://www.cepii.fr/anglaisgraph/bdd/baci/baci.pdf

quantity. The whole database covers more than 130 countries and 5, 000 products during the 1989-2003 period with an annual frequency.
The product-level price series $P_t^{ijk}$ used as the dependent variable in our estimations are computed using unit values, i.e. FOB trade values divided by harmonized quantities (in tons). These unit values are denominated in current US dollars. Converting these variables into the exporter's currency using the nominal exchange rate would however not change the picture since the $i/\$$ nominal exchange rate is controlled for by the fixed effects $fix_t^{ik}$. Unit-values may suffer from measurement errors, even at this disaggregation level, leading to a bad estimation of pass-though coefficients at the product level. A number of precautionary measures are implemented to circumscribe the impact of such data problems. First, the fixed effects control for unobserved systematic errors.[23] Moreover, only the coefficients that are estimated with a sufficient level of robustness are taken into account in the micro-level analysis. Namely, we only consider the coefficients for which a sufficient number of observations (500) is available for the whole estimation period. This quite demanding constraint allows to drop estimates which are computed with a too limited degree of freedom. The choice of the exchange-rate variable is not trivial either. While theory suggests to use nominal exchange-rate data, the empirical literature generally deflates this series by a measure of the general price level in the destination market[24](see Gagnon & Knetter (1995) or Knetter, 1989, 1993). This choice aims at identifying pure exchange-rate shocks, as opposed to exchange-rate variations that respond to general inflation. Similar definitions are used in Takagi & Yoshida (2001), Gil-Pareja (2003), Parsley (2002) and Athukorala & Menon (1994). Last, in order to ensure the highest quality for estimates, some filtering is imposed to the series: episodes of very high exchange-rate volatility are excluded by constraining annual (nominal) exchange-rate changes to lie between -50 and 50%.

# 4 Pricing-to-market for the whole sample

In this section, we present results of the estimation of (5) at the product-level $k$. Keeping only estimates obtained from more than 500 observations still leaves more than 4419 product-specific coefficients available. Descriptive statistics concerning this sample are displayed in Table 1.

Table 1: Pricing to market at the product level, summary statistics

| | Mean | | Lower quartile | | Median | | Upper quartile | |
|---|---|---|---|---|---|---|---|---|
| | Unweighted | Weighted* | Unweighted | Weighted* | Unweighted | Weighted* | Unweighted | Weighted* |
| PTM coef. | 0.115 | 0.036 | -0.075 | -0.123 | 0.142 | 0.098 | 0.333 | 0.311 |
| (Stud.) | (1.321) | (1.195) | (-0.528) | (-1.070) | (1.198) | (1.105) | (3.020) | (3.664) |
| Nb.Obs. | 4419 | | | | | | | |

* The weighting scheme is based on the value of exports. See Footnote 21.
Restrictions: number of available bilateral flows at the hs6 level > 500,
exchange-rate changes ranging between -50% and +50%
*Source: Authors' calculations.*

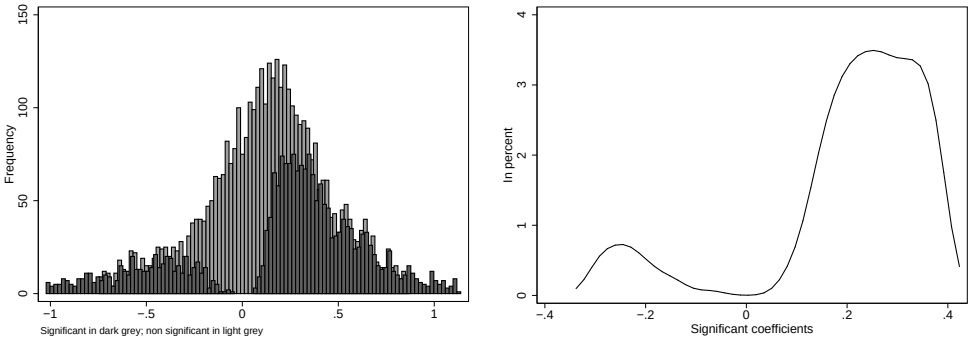
[23] As importer-fixed effects are restricted in their time dimension, one cannot rule out the possibility that trends in the importing country characteristics bias the estimates. Here, the data are binding, and no alternative solution is available.

[24] Note that, in presence of exporter-time fixed effects, an equivalent correction using the price level in the exporting country is unnecessary.

The results are somewhat different whether weighted[25] or unweighted statistics are used. The unweighted statistics are usually of higher magnitude, which suggests that PTM is lower in large sectors (defined in terms of exported values). Consistent with previous findings, estimates suggest that the pass-through is quite high in the long-run: the average PTM coefficient of .115 implies a pass-through rate of almost 90%.

This result requires some qualification however, given the rather high number of non-significant PTM coefficients (see Figure 1). Indeed, nearly half of estimates are not significantly different from zero, meaning that export prices are not sensitive to currency changes.[26] This suggests that the incomplete pass-through phenomenon is limited to the other half of products. Once non-significant PTM coefficients are dropped, the unweighted median PTM coefficient is increased to almost 30%. Moreover, the hypothesis of full PTM ($\beta^k = 1$) cannot be rejected in 308 of the 4419 considered $hs6$ industries.

Figure 1: Share of significant and non-significant estimated coefficients (at the 5% significance level) and distribution of significant estimated coefficients (from the $5^{th}$ to the $95^{th}$ percentile)




*Source: Authors' calculations*

This general picture highlights the strong heterogeneity in PTM across products. Even for the 50% of coefficients for which significant PTM is found, illustrated in the second graph of Figure 1, the inter-quartile range ([0.12;0.49]) still implies a wide dispersion of PTM coefficients.

Because drawing short insights from more that 4,000 coefficients is quite difficult, a first step is to have a look on wider categories, in order to gauge whether large-sector specificities can be outlined.

This is what is done in Table A.1. in the Appendix, where information on the PTM coefficients at the $hs2$ level is displayed. This information relates to the share of significant coefficients, the median PTM coefficient, and the standard error computed over the $hs6$ coefficients of each $hs2$ category. There is clear evidence of strong heterogeneity across $hs2$ categories in terms of their median estimate. The largest PTM coefficient is obtained for products of the "Fur skins and artificial fur" $hs2$ category, for which (weighted) the median coefficient across $hs6$ sectors is 0.60. The lowest one is obtained for the "Ships, boats and

[25] Here, the weighting scheme relies on the traded value of each product throughout the estimation period. Indeed, we can no more use Tornqvist weights (6) which have a time dimension, contrary to estimates.

[26] Here as in the rest of the paper, we call significant those coefficients that pass the Student test at the 5% level.

floating structures" industry with a coefficient of -1.40. However, as shown by the share of significant coefficients in each category, which generally lies around 50%, and the high variance of $hs6$ coefficients inside each $hs2$ category, these statistics hide a strong heterogeneity between $hs6$ sectors of a given category.
Because of this heterogeneity within $hs2$ categories, investigating the structural dimension of pricing-to-market cannot be done on the basis of these median estimates, but has to be undertaken at the most disaggregated level. The huge number of studied products however makes the project tricky. As an illustration, consider Table A.2. which displays significant PTM estimates for which the hypothesis of full PTM ($\beta^k = 1$) cannot be rejected. The heterogeneity of industries that are gathered together is obvious, and no intuition arises as to the features that could lead the corresponding firms to fully absorb exchange-rate movements into their margins. To further deepen the analysis, two alternative strategies are implemented. In a first step, the products are brought together within a limited number of (exogenously chosen) sub-samples, reflecting either the nature of the goods or the kind of market structures featuring production. In a second step, trade data are used to build market structure indicators, which influence on PTM strategies is then tested.

# 5 Determinants of pass-through behaviors

As stated in Section 2, a number of product- or even firm-specific features might affect PTM. Some of them are linked to the price-elasticity of demand. As the price sensitivity is likely to vary across products, one can think of such an argument to explain the dispersion of PTM estimates across $hs6$ products. On the other hand, the intensity of competitive pressures faced by firms in their export markets is often presented as an important determinant of pass-through. Contrasting with the previous one, this determinant is likely to vary across exporters or importing markets in a given sector. Both kinds of determinants are studied in the following.

## 5.1 Organized versus differentiated products markets

Market organization is likely to indirectly influence pricing strategies through its impact on the feasibility of arbitrage: for instance, the less transparent a market with regard to the whole supply of goods available for consumption, the easier it is for firms to pass exchange rate movements and make maximum profits on their sales. To investigate for such PTM determinants, we use two classifications that split goods into categories according either to the organization of markets or to the nature of traded products. The first one was built by Rauch (1999), the second by the UNO (Broad Economic Classification - thereafter BEC).
The classification developed by Rauch is based on the structure of the market where goods are traded. This classification gathers 5-digit SITC industries into three categories, depending on whether the goods are: (a) traded in an organized exchange, and therefore treated as "homogeneous" (W), (b) not traded in an organized exchange, but having some quoted "reference price" (R), such as in industry publications, (c) not having any quoted prices, and therefore treated as "differentiated" (D). The Broad Economic Classification (BEC) developed by the UNO provides an alternative classification scheme for traded products, where goods can be split into 5 categories, i.e. final consumption, investment, primary products, parts and components and transformed products. It is therefore possible to investigate and compare PTM in these various product categories.
Because the two classifications are not completely orthogonal, looking at PTM in each category independently would not yield very informative results. Therefore, the categories are

Table 2: Distribution of pricing-to-market coefficients within the BEC-Rauch classifications

| | Number of coefficient | Share of signif. coefficients (%) |
|---|---|---|
| Differentiated goods / Final consumption goods | 605 | 51.2 |
| Differentiated goods / Investment goods | 378 | 33.3 |
| Differentiated goods / Primary products | 40 | 47.5 |
| Differentiated goods / Parts and components | 198 | 39.4 |
| Differentiated goods / Transformed products | 675 | 48.3 |
| Referenced prices / Final consumption goods | 55 | 60.0 |
| Referenced prices / Primary products | 57 | 36.8 |
| Referenced prices / Transformed products | 630 | 48.6 |
| Organized markets / Final consumption goods | 19 | 47.4 |
| Organized markets / Investment goods | 3 | 66.7 |
| Organized markets / Primary products | 37 | 37.8 |
| Organized markets / Transformed products | 70 | 40.0 |

*Source: Authors' calculations*

interacted. The PTM estimates at the product level are then split into the resulting 15 categories. Because some of them are empty, only 12 categories were eventually used. It is therefore possible to investigate the impact of the market structure on the PTM coefficients estimated at the product level, depending on the Rauch/BEC category to which each product belongs. 2,700 products are included in the analysis[27], for which at least 500 observations where available when estimating PTM coefficients.
Table 2 shows how these coefficients are distributed across the 12 available items of the crossed classification. Differentiated goods dominate the sample, but there are also a good deal of transformed products sold on referenced markets. As shown in the second column, the share of significant coefficients lies between 35 and 60%, and significant coefficients are overwhelming for final consumption goods sold on referenced markets[28] - although there are very few of these.

Under monopolistic competition, one would expect pricing-to-market to be less important on differentiated markets, where firms own a monopoly power and the demand is less price-elastic. However, the expectation is less clear under oligopolistic competition, where firms could feel an incentive to adjust their margins, in order to stay in the market when adverse exchange-rate changes occur. On the other hand, referenced markets should be characterized by strong pricing-to-market, because of a higher price sensitivity of consumers, who can easily compare varieties. These arbitrage behaviors might lead firms to keep in line with the market price. Last, organized markets should be characterized by complete pass-through, as the corresponding prices result from adjustments in the world demand and supply, and are

[27] A number of $hs6$ sectors could not be matched with Rauch's SITC nomenclature. As a consequence, the number of available coefficients is considerably reduced in comparison with the 4,419 estimates commented in the previous section.

[28] As there are only three coefficients for investments goods sold on organized markets, one can ignore this category.

Table 3: Pricing-to-market coefficients and the BEC-Rauch classifications

| | n | Weighted mean | Low. quartile | Median | Upp. quartile |
|---|---|---|---|---|---|
| Diff + final cons | 605 | 0.260 | 0.163 | 0.345 | 0.408 |
| Diff + investment goods | 378 | -0.067 | -0.163 | 0.072 | 0.269 |
| Diff + primary products | 40 | 0.358 | 0.092 | 0.320 | 0.628 |
| Diff + parts and components | 198 | 0.001 | -0.105 | 0.016 | 0.131 |
| Diff + transformed products | 675 | 0.200 | 0.031 | 0.230 | 0.345 |
| Ref + final cons | 55 | 0.168 | 0.036 | 0.160 | 0.300 |
| Ref + primary products | 57 | 0.170 | -0.015 | 0.143 | 0.320 |
| Ref + transformed products | 630 | 0.209 | 0.079 | 0.060 | 0.351 |
| Org + final cons | 19 | 0.173 | 0.009 | 0.214 | 0.348 |
| Org + investment goods | 3 | 0.515 | 0.505 | 0.505 | 0.583 |
| Org + primary products | 37 | -0.002 | -0.098 | 0.017 | 0.049 |
| Org + transformed products | 70 | 0.020 | -0.051 | 0.022 | 0.075 |

*Source: Authors' calculations.*

therefore orthogonal to bilateral exchange-rate changes.

As far as the BEC classification is concerned, one can also expect different kinds of consumers (final consumers, firms, etc.) to be differently sensitive to price changes. However, the direction of the results is difficult to foresee. Indeed, as far as final consumption goods are concerned, differentiation should provide firms with a higher market power, allowing them to pass exchange-rate movements onto prices; but competitive pressures can also be strong on these markets so that firms are constrained by their competitors' pricing decisions.

Primary products are generally sold on organized markets, where prices are set by international demand. If prices are denominated in a reference currency, which is not the currency of the exporter, producers cannot depart from the reference price, and they entirely bear the impact of the fluctuations between their currency and the currency of denomination of contracts. Therefore, the measured pass-through should be nil.

Parts and components are highly specific goods sold to firms. When the production of components is outsourced, competition among providers could force them to price-to-market; but transfer pricing strategies in intra-firm relations could also lead to unexpected results.[29] Finally, transformed products and investment goods are too heterogeneous categories for results to be foreseen.

Summary statistics of PTM behaviors by product type are displayed in Table 3. Pricing-to-market coefficients are the highest for investment goods sold on organized markets. This could be consistent with strong transparency in such markets, however cautiousness is needed in drawing conclusions, given the very limited number of observations. Pricing-to-market is also sizeable for transformed products sold on organized markets, which is another indication that organized markets tend to increase price transparency, and consequently the incentives for firms to keep in line with market prices when setting their own prices. Here, the results can be considered as more reliable, given the large number of observations, and the fact that PTM is large over all quartiles of the distribution of product-specific PTM estimates. Finally, PTM is also large for the two other sectors that gather a large number of estimates, i.e. differentiated products for final consumption and differentiated, primary products. Here, the large magnitude of PTM coefficients would be consistent with oligopolistic

[29] See evidences of the impact of transfer pricing on measured PTM in Rangan & Lawrence (1993).

market structures, where firms try to remain in the market by adjusting their margins to exchange-rate changes. Large PTM coefficients are also consistent, for final consumption goods, with strong competitive pressures forcing firms to keep their prices in line with those of their competitors. Finally, the size of PTM in parts and components (centered around zero) is consistent with the argument that PTM estimated on trade flows among vertically linked firms could be biased by transfer prices.

In order to further deepen the analysis, the impact of a product belonging to a given category of the Rauch-BEC classification is econometrically investigated. Dummy variables are built for each item of each classification, and their explanatory power for the magnitude of PTM estimates is investigated through an OLS regression in which the observations (i.e. the estimated PTM coefficients $\hat{\beta}^k$) are weighted by the inverse of the estimated standard error.[30] As the dummies describe the whole dataset, they cannot be included all together in the equation. Therefore, a constant is added in the equation and the impact of the interacted categories is analyzed in relation to a given category of each classification (namely, the organized markets and the transformed products). The estimates yield the following results:[31]

$$\begin{array}{lllllll} \hat{\beta}^k = 0.07^{*} + 0.06n + 0.11^{***}r + 0.07^{***}C - 0.11^{***}K - 0.00P - 0.22^{***}PC, & & & & & & R^2 = 3.8\% \\ (.035) & (.037) & (.037) & (.020) & (.029) & (.039) & (.034) \end{array} \tag{7}$$

where $n$ refers to differentiated products, $r$ to referenced prices, $C$ is for final consumption goods, $K$ for investment goods, $P$ for primary goods and $PC$ for Parts and components.

Although the $R^2$ is very low, this confirms previous findings that pricing-to-market tends to be more important for reference-price markets than in organized markets. Moreover, in comparison with transformed goods, PTM behaviors are significantly more pronounced towards final consumers and much lower for investment goods as well as parts and components.

## 5.2 Bilateral Market structures

Beyond the nature of the goods sold in each sector, the competitive pressure faced by each firm in each of her export markets is also able to influence pass-through strategies. This implies that the product-level coefficients estimated so far can still hide some heterogeneity across destination markets. This question is investigated in the following, using product-level market structure indicators built out of trade data.

### 5.2.1 Using trade data to measure market structures

The bilateral dimension of the BACI database allows us to build a number of market structure indicators, to explore the oligopolistic competition dimension of pass-though. Here, we focus more particularly on three market-structure variables.

The first indicator, noted $MKSH_t^{ijk}$, is the market share of country $i$ in market $j$ for product $k$ at time $t$. It can be considered as a proxy for the exporter's pricing power in the destination country. As suggested by Feenstra et al. (1996) or Bachetta & Van Wincoop (2005), pricing-to-market should be affected by the producer's market share in the destination market, in a non-linear way however. The indicator is computed as follows:

$$MKSH_t^{ijk} = \frac{M_t^{ijk}}{M_t^{\cdot jk}} \tag{8}$$

[30] This weighting scheme is chosen in order for badly estimated coefficients to have lower weight in the regression.

[31] Figures under brackets are the estimated standard errors of the coefficients.

with $M_t^{ijk}$ denoting the value of product $k$ imported by $j$ from the country $i$ and $M_t^{.jk}$ the total amount of product $k$ imports by country $j$. Note that this definition of market share does not account for local competitors.
The second indicator, denoted $SIZE_t^{ijk}$ describes the weight of market $j$ in country $i$'s exports:

$$SIZE_t^{ijk} = \frac{X_t^{ijk}}{X_t^{i.k}} \tag{9}$$

with $X_t^{ijk}$ the amount of $i$'s exports of product $k$ towards $j$'s market and $X_t^{i.k}$ the total value of its exports of product $k$. Here, the underlying hypothesis is that, as demand-related risks increase with the relative size of the partner country, exporters may be less reluctant to absorb exchange-rate changes to preserve their position in a large market than in a smaller one (see Lee (1995) for a theoretical relation between PTM and the size of countries).
The last indicator is a Herfindhal index, which summarizes the concentration of supply in the destination market, therefore the degree of competitive pressure. This indicator, which relies on the assumption that each national representative firm is a monopoly[32], ranges from 0 to 1 and increases with concentration. It is computed as follows:

$$HERF_t^{jk} = \sum_i \left( MKSH_t^{ijk} \right)^2 \tag{10}$$

As in the case of market shares, the relation between the Herfindhal index and PTM elasticities is not clear. Starting from an atomistic market, an increase in the market concentration allows firms to have higher mark-ups, then a wider room of manoeuvre to absorb exchange-rate movements. On the other hand, when the market becomes concentrated enough, collusive behaviors give firms a pricing power to pass exchange-rate movements.

### 5.2.2 Results

The previously described indicators are interacted with exchange-rate changes, in order to properly catch their impact on PTM coefficients. As these indicators are probably colinear[33], three distinct estimates are conducted at the product-level, each one studying the impact of one of them. Because the degree of freedom in the estimations is generally low, the market structure variables are only used in level, even though the theoretical effect is not necessarily linear. The estimated equations are the following:

$$d\ln P_t^{ijk} = \alpha + \beta_1^k d\ln S_t^{ij} + \beta_2^k MKSH_t^{ijk} d\ln S_t^{ij} + \nu_t^{ik} + \mu^{jk} + \epsilon_t^{ijk} \tag{11}$$

$$d\ln P_t^{ijk} = \alpha + \beta_1^k d\ln S_t^{ij} + \beta_3^k SIZE_t^{ijk} d\ln S_t^{ij} + \nu_t^{ik} + \mu^{jk} + \epsilon_t^{ijk} \tag{12}$$

$$d\ln P_t^{ijk} = \alpha + \beta_1^k d\ln S_t^{ij} + \beta_4^k HERF_t^{jk} d\ln S_t^{ij} + \nu_t^{ik} + \mu^{jk} + \epsilon_t^{ijk} \tag{13}$$

and we expect $\beta_1^k \geq 0$, $\beta_2^k \geq 0$ if $MKSH_t^{ijk}$ is low enough but $\beta_2^k \leq 0$ for large market shares, $\beta_3^k \geq 0$, $\beta_4^k \leq 0$ for a concentrated enough market, $\beta_4^k \geq 0$ in atomistic markets. Table 4 displays the summary statistics of the product-level estimates, that are also illustrated in Figure 2.

[32] Hence, national firms only compete on the destination market.

[33] The colinearity may be especially pronounced between $MKSH_t^{ijk} d\ln S_t^{ij}$ and $HERF_t^{jk} d\ln S_t^{ij}$, as the correlation between these series is 0.80.

Table 4: Product-level PTM coefficients and market structures

| Model | Estimates | Mean | Lower quartile | Median | Upper quartile | Share of sign. (%) |
|---|---|---|---|---|---|---|
| Equation (11) | $\beta_1^k$ | 0.163 | -0.129 | 0.172 | 0.453 | 45 |
| | | (1.054) | (-0.605) | (1.010) | (2.676) | |
| | $\beta_2^k$ | -0.095 | -0.667 | -0.083 | 0.488 | 45 |
| | | (-0.268) | (-1.983) | (-0.296) | (1.420) | |
| Equation (12) | $\beta_1^k$ | 0.108 | -0.167 | 0.127 | 0.356 | 50 |
| | | (0.948) | (-0.848) | (0.954) | (2.738) | |
| | $\beta_3^k$ | 0.145 | -0.645 | 0.123 | 0.902 | 52 |
| | | (0.522) | (-1.700) | (0.342) | (2.420) | |
| Equation (13) | $\beta_1^k$ | 0.198 | -0.177 | 0.208 | 0.565 | 46 |
| | | (1.053) | (-0.664) | (0.934) | (2.703) | |
| | $\beta_4^k$ | -0.174 | -0.870 | -0.149 | 0.514 | 44 |
| | | (-0.440) | (-2.078) | (-0.394) | (1.224) | |

Restrictions: number of flows by product>500,
Exchange rate changes between -50 and 50%.
*Source: Autors' calculations.*

Whatever the structural indicator, the interaction with the exchange rate yields a significant coefficient in about half of the industries. This low rate of significance is however not surprising as the tested effects are derived from specific frameworks that might not fit all products. Once insignificant coefficients are ignored, results are however generally consistent with expectations.

On average, the "pure" PTM coefficient ($\hat{\beta}_1^k$) is positive, whatever the considered set of estimations (relying on 11, 12 or 13). When controlling for the effects of the exporter's market share and the concentration of the destination market, the mean PTM coefficient $\beta_1^k$ is even higher than in the benchmark estimation of Section 4. This means that the pricing-to-market phenomenon is still significant at the product level, even when controlling for these structural dimensions.

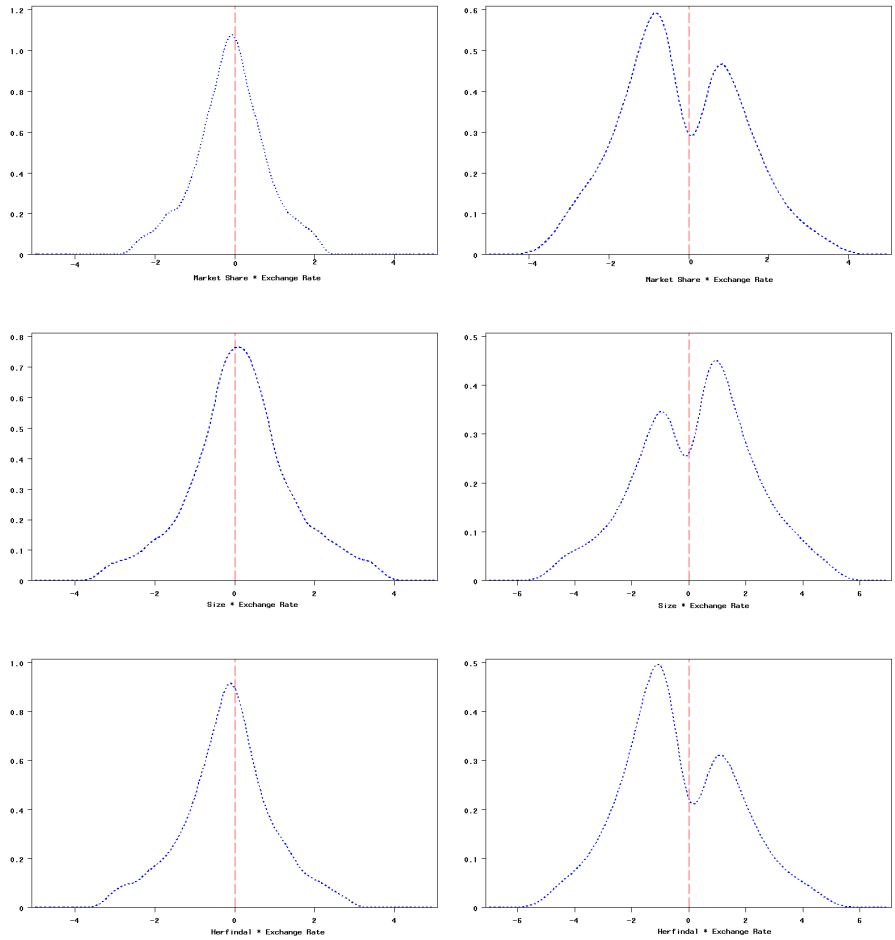
As shown by the estimation of (11), a higher market share dampens PTM at the product level for more than half the products, and this share increases when insignificant coefficients are dropped (the median coefficient then shifts to -0.46). This suggests that the monopoly power bestowed on a firm by a large market share dominates its reaction to currency changes, leading her to price less to market.

The influence of the destination market size is investigated through equation (12). On average, export towards important partners exhibit a higher degree of PTM, consistently with the idea that the demand risk in "large" markets (relatively to the total value of an individual firm's exports) prompts firms to price-to-market. When unsignificant coefficients are dropped, the median coefficient $\hat{\beta}_3^k$ increases to 0.56.

Last, PTM tends to be less pronounced in concentrated markets, in which collusive behaviors are more likely to arise. When insignificant coefficients are dropped from the distribution, the median coefficient affected at this interacted variable is equal to -0.74.

These results therefore tend to confirm that structural determinants connected to market structures - i.e. to oligopolistic competition - are in play when pricing-to-market is designed. Of course, these forces are not in play in each individual product-market, which explains the strong heterogeneity of results across products. On average however, PTM seems to depend on market structures: it is all the lower that the exporter owns a large market share in the destination market or that the destination market is concentrated, whereas exporters are less reluctant to absorb currency changes when the destination is large in terms of demand.

Figure 2: PTM micro-estimates, including or not non-significant estimates




*Source: Authors' calculations.*

# 6 Conclusion

Exchange-rate pass-through is a typical micro-based phenomenon that bears macro-economic consequences. A large literature has been devoted to estimate the sensitivity of various national price indexes to currency changes, thereby investigating the consequences on external

exposure. On the other hand, the origin of the incomplete pass-through phenomenon is often disregarded in empirical studies. This paper uses a highly disaggregated database to study the product dimension of this phenomenon, through the estimation of pricing-to-market coefficients at the most detailed product-level (4419 estimated PTM elasticities).

According to the average value of product-level estimates, on average 11.5% of the currency shock is absorbed into the exporter's mark-up during the year following an exchange-rate change. This quite sizeable long-run pricing-to-market coefficient however hides a strong heterogeneity across products, even among $hs6$ products of a given $hs2$ category. Thus, incomplete pass-through is identified for roughly half of the products, with however strong discrepancies in terms of magnitude.

Investigating the structural determinants of this heterogeneity leads to some additional conclusions. First, pricing-to-market is shown to be more marked within referenced-price markets, probably because of the pressure exerted by consumers' arbitrage. Moreover, the magnitude of the pricing-to-market seems to depend on the identity of the buyer: currency changes are more likely to be absorbed by firms in final consumption good markets than for products sold to firms. Beyond these features, the specific market structures encountered by each exporter in each destination country also seem to affect pricing decisions. Estimates suggest that, on average, pricing-to-market is less pronounced in concentrated (i.e. lowly competitive) markets and where the exporter already has a large market share, which could mean that firms with a sufficient pricing power are more able to pass exchange-rate movements into local currency prices. By contrast, high PTM coefficients are more likely to be observed in large markets, from the individual exporter's point-of-view. This suggests that the perceived risk of demand may be important in explaining pass-through decisions.

Consistent with the conclusions of recent, micro-funded models of incomplete pass-through, structural factors turn out to be important in explaining the behavior of prices when exchange rates fluctuate. Detailing the mechanisms at work behind this result is constrained by data availability: even at the most detailed product-level, the number of structural factors that can be built is limited, and often relies on strong assumptions. More precisely, trade data compel each exporting country to be assimilated to a representative firm facing the "mean" market structures. This is obviously a strong assumption, that constraints our ability to identify the impact of market structures on pricing decisions. The next step of this research will consequently be to investigate pass-through strategies at the firm rather than at the country level.

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# A.1. Theoretical framework

## Pricing-to-market in a monopolistic competition framework

Suppose country $i$ produces good $k$ within a monopolistic framework. The good is sold to different segmented markets $j$, where producers are therefore able to differentiate export prices according to the destination. At time $t$, the optimal destination-specific export-price , in the producer's currency, can be written as:

$$P_t^{ijk} = MC_t^{ik}\mu_t^{ijk}$$

with

- $MC_t^{ik}$ the marginal production cost, which is supposed to be identical across destinations ($MC_t^{ijk} = MC_t^{ik}, \forall\ j$)
- $\mu_t^{ijk}$ the producer mark-up, which depends on the elasticity of demand to the price in local currency:

$$\mu_t^{ijk} = \frac{\eta_t^{ijk}(P_t^{ijk}/S_t^{ij}, Z_t^{jk})}{\eta_t^{ijk}(P_t^{ijk}/S_t^{ij}, Z_t^{jk}) - 1}$$

  where $\eta_t^{ijk}$ is the price-elasticity of demand, which depends on the price in the importer's currency ($P_t^{ijk}/S_t^{ij}$ with $S_t^{ij}$ the bilateral exchange rate in $i$'s currency per unit of $j$'s), and possibly on demand-specific variables (summarized by the vector $Z_t^{jk}$).

First-differentiating with respect to the different variables leads to the following expression for the exporter's price, specific to the market $j$[34]:

$$p_t^{ijk} = (1-\beta_{MC}^{ijk})mc_t^{ik} + (1-\beta_{MC}^{ijk})\ln\left(\frac{\eta^{ijk}}{\eta^{ijk}-1}\right) + \beta_{MC}^{ijk}s_t^{ij} - \gamma_{MC}^{ijk}z_t^{jk}$$

where $\beta_{MC}^{ijk} = \frac{\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}}{\eta_t^{ijk}-1+\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}}$ with $\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}} = \frac{\partial \ln \eta_t^{ijk}}{\partial \ln P_t^{ijk}/S_t^{ij}}$

and $\gamma_{MC}^{ijk} = \frac{\xi^{\eta^{ijk}}_{Z_t^{jk}}}{\eta_t^{ijk}-1+\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}}$ with $\xi^{\eta^{ijk}}_{Z_t^{jk}} = \frac{\partial \ln \eta_t^{ijk}}{\partial \ln Z_t^{jk}}$

In this equation, $\beta_{MC}^{ijk} = \frac{\partial p_t^{ijk}}{\partial s_t^{ij}}$ measures the sensitivity of export prices to exchange-rate changes (therefore, it is the pricing-to-market coefficient - thereafter noted PTM) which is inversely related to the magnitude of the pass-through: it is null when the pass-through is complete and unitary when currency changes are fully absorbed into margins, leaving the local currency price unchanged. As detailed in Knetter (1989), this coefficient depends on the firms' perception of how demand elasticities change with respect to the local currency price. A sufficient condition for the pass-through to be complete is that of a constant behavior of the elasticity of demand, with respect to the price in the destination market ($\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}} = 0$). Under the alternative hypothesis, when the mark-up depends on the bilateral exchange rate, the optimal pass-through is incomplete. In particular, mark-up adjustments partially offset exchange-rate changes when the PTM coefficient is positive. Since, from the second-order

[34]Lowercase letters refer to the natural logarithm of the corresponding variables.

condition[35], $\xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}$ is positive when the price-elasticity is positive, one can expect this to occur when the elasticity of demand with respect to the local price is strong enough (namely when $\eta_t^{ijk} > 1 - \xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}$). On the other hand, even if less likely, one cannot rule out the possibility of a negative pass-through coefficient, leading to an over-reaction of export prices to exchange rate movements, which is optimal with an increasing but weak elasticity of demand ($\eta_t^{ijk} < 1 - \xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}$).
Thus, in a monopolistic framework, the optimal pass-through depends on the perceived elasticity of demand: in most cases, it is positive when the price-elasticity is increasing in the local price. However, as shown next, generalizing the theoretical framework leads to a richer explanation of pass-through strategies, that does not entirely rely on the perceived elasticity of demand but also on market structures. Such an explanation could help to explain part of the cross-country heterogeneity in pass-through strategies observed on narrowly defined prices.

## Oligopolistic competition

The monopolistic competition framework is only a special case of oligopolistic competition. Further generalizing the theoretical framework, by taking oligopolistic competition into account, is therefore of interest. Moreover, the oligopolistic framework is better suited to the available data. Because data availability forces to identify each exporting country to a representative firm, the number of producers for a given product is de facto constrained, and the market is therefore better described by an oligopolistic competition hypothesis.
In an oligopolistic framework under Cournot competition, the optimal margin depends on the price elasticity of demand as well as on the market share of $i$'s representative firm in the destination market $j$:

$$\mu_t^{ijk} = \frac{\eta_t^{ijk}}{\eta_t^{ijk} - \omega_t^{ijk}}$$

with $\omega_t^{ijk} = \frac{Q_t^{ijk}}{\sum_i Q_t^{ijk}}$ $i$'s market share in $j$ and $Q_t^{ijk}$ the demand addressed by $j$ to the producer $i$.
Using the same method and notations as previously, the destination-specific export price equation is the following:

$$p_t^{ijk} = (1-\beta_{OC}^{ijk})mc_t^{ik} + (1-\beta_{OC}^{ijk}) \ln\left(\frac{\eta^{ijk}}{\eta^{ijk} - \omega^{ijk}}\right) + \beta_{OC}^{ijk} s_t^{ij} - \frac{\xi^{\eta^{ijk}}_{Z^{jk}} - \xi^{\omega^{ijk}}_{Z^{jk}}}{\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}}} \beta_{OC}^{ijk} z_t^{jk}$$

where

$$\beta_{OC}^{ijk} = \frac{\partial p_t^{ijk}}{\partial s_t^{ij}} = \frac{\omega_t^{ijk}(\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}})}{\eta_t^{ijk} - \omega_t^{ijk} + \omega_t^{ijk}(\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}})}$$

is the theoretical PTM coefficient and

$$\xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}} = \frac{\partial \ln \omega_t^{ijk}}{\partial \ln(P_t^{ijk}/S_t^{ij})}$$

is the sensitivity of the market share to the local price, which is a priori negative.

[35] The second-order condition of the profit maximization can be written as: $2\eta_t^{ijk} \leq \xi^{\eta^{ijk}}_{P_t^{ijk}/S_t^{ij}}$

In an oligopolistic framework, $\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} = 0$ is no more a sufficient condition for complete pass-through. $\beta^{ijk}_{OC} = 0$ requires the price sensitivity of the demand elasticity to equal the elasticity of the exporter's market share to price changes, which is unlikely. On the contrary, $\beta^{ijk}_{OC}$ should be positive if the demand is elastic enough.[36]
In such a setting, the optimal pass-through still depends on the perceived elasticity of demand but also on the exporter's market share in the foreign market. The direction of this relation is however ambiguous, as

$$sign\left(\frac{\partial \beta^{ijk}}{\partial \omega^{ijk}}\right) = sign\left(\eta_t^{ijk}(\xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} - \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}}) - \omega_t^{ijk}\frac{\partial \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}}}{\partial \omega^{ijk}}(\eta_t^{ijk} - \omega_t^{ijk})\right)$$

In the general case, the sign of this derivative is positive, i.e. pricing-to-market is more pronounced when the market share of the exporter grows. This relation is due to the fact that the exporter's mark-up increases with her market share, which gives her a wider room for maneuver to absorb exchange-rate shocks. However, if the price-elasticity of the market share is increasing in the market share ($\frac{\partial \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}}}{\partial \omega^{ijk}} > 0$) and the price-elasticity of demand is low enough, compared to the market share, the sign of this derivative can reverse. One could then possibly observe a negative relation between $\beta^{ijk}_{OC}$ and $\omega_t^{ijk}$, in a framework of quasi-monopoly and low demand elasticity (for instance, in high-grade sectors). In that case, the producer need not adjust her prices to exchange-rate changes, since the demand risk is low. Under weak assumptions on the functional form of demand, Feenstra et al. (1996) show that the pass-through elasticity *"might initially decline as market share rises, but will increase towards unity as market shares approaches 100 percent"* and find some evidence of such a bell shape relation in the automobile industry.

## A.2 Source and definition of data

Real exchange rates are computed using nominal exchange rates ($e$) and consumer price indexes ($P$) (source: World Bank, World development indicators), and defined as follows:

$$S_t^{ij} = \frac{e_t^{ij} P_t^j}{P_t^i}$$

A rise stands for a depreciation of currency $i$ against $j$ in real terms.
Unit values are used as trade prices, and taken from the BACI database. They are computed as the ratio of the traded value on the traded quantity (in tons):

$$IVU_t^{ijk} = \frac{V_t^{ijk}}{Q_t^{ijk}}$$

with:

- $V_t^{ijk}$ the value of the trade flow of product $k$ sold by $i$ to $j$ at time $t$,
- and $Q_t^{ijk}$ the quantity (in tons) of traded products.

These variables are constructed from COMTRADE data, which are harmonized in order to allow for a reconciliation of import and export declarations. For more details on the content and building of the BACI database: http://www.cepii.fr/anglaisgraph/bdd/baci/baci.pdf.

[36] $\beta^{ijk}_{OC} > 0$ as long as $\eta_t^{ijk} > \omega_t^{ijk} - \xi^{\eta^{ijk}}_{P^{ijk}/S^{ij}} + \xi^{\omega^{ijk}}_{P^{ijk}/S^{ij}}$.

**Table A.1 . Pricing to market at the hs2 level**

| Hs2 | Label | Signif. coef.* | Weighted Med.PTM | Standard Error |
|---|---|---|---|---|
| 01 | Live animals | 7/12 | 0.56 | 0.84 |
| 02 | Meat and edible meat offal. | 29/47 | 0.34 | 0.27 |
| 03 | Fish and crustacean, mollusc & other aquatic invertebrate | 58/84 | 0.38 | 0.76 |
| 04 | Dairy prod. birds‘ eggs. natural honey. edible prod nes | 17/25 | 0.14 | 0.26 |
| 05 | Products of animal origin, nes or included. | 6/11 | 0.21 | 0.73 |
| 06 | Live tree & other plant. bulb, root. cut flowers etc | 4/12 | 0.10 | 0.86 |
| 07 | Edible vegetables and certain roots and tubers. | 29/55 | 0.02 | 0.35 |
| 08 | Edible fruit and nuts. peel of citrus fruit or melons. | 32/49 | 0.13 | 0.31 |
| 09 | Coffee, tea, mat- and spices. | 17/31 | 0.06 | 0.42 |
| 10 | Cereals. | 12/16 | -0.08 | 0.45 |
| 11 | Prod mill indust. malt. starches. inulin. wheat gluten | 13/25 | 0.14 | 1.35 |
| 12 | Oil seed, oleagi fruits. miscell grain, seed, fruit etc | 25/38 | 0.07 | 0.45 |
| 13 | Lac. gums, resins & other vegetable saps & extracts. | 5/10 | 0.34 | 0.18 |
| 14 | Vegetable plaiting materials. vegetable products nes | 4/7 | -0.11 | 0.54 |
| 15 | Animal/veg fats & oils & their cleavage products. etc | 29/50 | 0.07 | 0.43 |
| 16 | Prep of meat, fish or crustaceans, molluscs etc | 17/24 | 0.13 | 0.53 |
| 17 | Sugars and sugar confectionery. | 11/15 | -0.05 | 0.99 |
| 18 | Cocoa and cocoa preparations. | 7/11 | 0.24 | 0.35 |
| 19 | Prep of cereal, flour, starch/milk. pastrycooks‘ prod | 12/16 | 0.24 | 0.27 |
| 20 | Prep of vegetable, fruit, nuts or other parts of plants | 30/43 | 0.20 | 0.20 |
| 21 | Miscellaneous edible preparations. | 12/15 | 0.30 | 0.39 |
| 22 | Beverages, spirits and vinegar. | 12/21 | 0.24 | 0.60 |
| 23 | Residues & waste from the food indust. prepr ani fodder | 12/21 | 0.00 | 0.78 |
| 24 | Tobacco and manufactured tobacco substitutes. | 3/8 | -0.19 | 0.49 |
| 28 | Inorgn chem. compds of prec met, radioact elements etc | 70/158 | 0.13 | 0.46 |
| 29 | Organic chemicals. | 153/274 | 0.16 | 0.69 |
| 30 | Pharmaceutical products. | 15/27 | 0.43 | 0.91 |
| 31 | Fertilisers. | 13/23 | 0.27 | 0.46 |
| 32 | Tanning/dyeing extract. tannins & derivs. pigm etc | 24/45 | 0.19 | 0.19 |
| 33 | Essential oils & resinoids. perf, cosmetic/toilet prep | 13/30 | 0.20 | 0.21 |
| 34 | Soap, organic surface-active agents, washing prep, etc | 14/23 | 0.17 | 0.19 |
| 35 | Albuminoidal subs. modified starches. glues. enzymes. | 6/13 | 0.15 | 0.22 |
| 36 | Explosives. pyrotechnic prod. matches. pyrop alloy. etc | 4/8 | 0.27 | 0.39 |
| 37 | Photographic or cinematographic goods. | 17/31 | 0.38 | 0.78 |
| 38 | Miscellaneous chemical products. | 36/55 | 0.20 | 0.31 |
| 39 | Plastics and articles thereof. | 86/123 | 0.14 | 0.40 |
| 40 | Rubber and articles thereof. | 39/66 | 0.17 | 0.66 |
| 41 | Raw hides and skins (other than furskins) and leather. | 12/29 | 0.24 | 0.31 |
| 42 | Articles of leather. saddlery/harness. travel goods etc | 13/20 | 0.01 | 1.04 |
| 43 | Furskins and artificial fur. manufactures thereof. | 4/11 | 0.60 | 0.53 |
| 44 | Wood and articles of wood. wood charcoal. | 37/62 | 0.12 | 0.59 |
| 45 | Cork and articles of cork. | 3/7 | 0.41 | 0.21 |
| 46 | Manufactures of straw, esparto/other plaiting mat. etc | 4/6 | 0.29 | 0.52 |
| 47 | Pulp of wood/of other fibrous cellulosic mat. waste etc | 11/18 | 0.17 | 0.22 |
| 48 | Paper & paperboard. art of paper pulp | 74/108 | 0.20 | 0.50 |
| 49 | Printed books, newspapers, pictures and other product | 6/19 | -0.04 | 0.43 |

| | | | | |
|---|---|---|---|---|
| 50 | Silk. | 4/8 | 0.30 | 0.19 |
| 51 | Wool, fine/coarse animal hair, horsehair yarn & fabric | 18/32 | 0.20 | 0.39 |
| 52 | Cotton. | 54/113 | 0.10 | 0.58 |
| 53 | Other vegetable textile fibres. paper yarn & woven fab | 7/20 | 0.14 | 0.43 |
| 54 | Man-made filaments. | 37/65 | 0.10 | 0.93 |
| 55 | Man-made staple fibres. | 55/110 | 0.14 | 0.49 |
| 56 | Wadding, felt & nonwoven. yarns. twine, cordage, etc | 13/27 | 0.15 | 0.33 |
| 57 | Carpets and other textile floor coverings. | 11/22 | -0.14 | 0.54 |
| 58 | Special woven fab. tufted tex fab. lace. tapestries etc | 19/36 | -0.12 | 0.61 |
| 59 | Impregnated, coated, cover/laminated textile fabric etc | 12/24 | 0.05 | 0.38 |
| 60 | Knitted or crocheted fabrics. | 10/17 | -0.00 | 0.32 |
| 61 | Art of apparel & clothing access, knitted or crocheted. | 52/102 | 0.25 | 0.62 |
| 62 | Art of apparel & clothing access, not knitted/crocheted | 76/113 | 0.30 | 0.55 |
| 63 | Other made up textile articles. sets. worn clothing etc | 37/57 | 0.28 | 0.60 |
| 64 | Footwear, gaiters and the like. parts of such articles. | 13/29 | 0.22 | 0.48 |
| 65 | Headgear and parts thereof. | 2/8 | 0.04 | 0.35 |
| 66 | Umbrellas, walking-sticks, seat-sticks, whips, etc | 5/6 | 0.43 | 0.24 |
| 67 | Prepr feathers & down. arti flower. articles human hair | 2/6 | 0.06 | 0.61 |
| 68 | Art of stone, plaster, cement, asbestos, mica/sim mat | 21/46 | 0.17 | 0.53 |
| 69 | Ceramic products. | 6/28 | 0.18 | 0.56 |
| 70 | Glass and glassware. | 24/56 | -0.01 | 0.45 |
| 71 | Natural/cultured pearls, prec stones & metals, coin etc | 2/2 | -0.11 | 0.50 |
| 72 | Iron and steel. | 102/181 | 0.12 | 1.04 |
| 73 | Articles of iron or steel. | 66/117 | 0.17 | 0.37 |
| 74 | Copper and articles thereof. | 27/55 | 0.12 | 0.60 |
| 75 | Nickel and articles thereof. | 4/14 | 0.06 | 0.33 |
| 76 | Aluminium and articles thereof. | 17/34 | 0.02 | 0.29 |
| 78 | Lead and articles thereof. | 4/8 | -0.10 | 0.53 |
| 79 | Zinc and articles thereof. | 4/10 | 0.02 | 0.32 |
| 80 | Tin and articles thereof. | 1/7 | 0.01 | 0.64 |
| 81 | Other base metals. cermets. articles thereof. | 4/23 | 0.12 | 0.51 |
| 82 | Tool, implement, cutlery, spoon & fork, of base met etc | 23/65 | -0.01 | 0.35 |
| 83 | Miscellaneous articles of base metal. | 23/36 | 0.27 | 0.31 |
| 84 | Nuclear reactors, boilers, mchy & mech appliance. parts | 198/484 | 0.02 | 0.54 |
| 85 | Electrical mchy equip parts thereof. sound recorder etc | 148/256 | -0.42 | 0.72 |
| 86 | Railw/tramw locom, rolling-stock & parts thereof. etc | 4/13 | 0.10 | 0.84 |
| 87 | Vehicles o/t railw/tramw roll-stock, pts & accessories | 38/76 | 0.21 | 0.66 |
| 88 | Aircraft, spacecraft, and parts thereof. | 4/10 | 0.03 | 0.97 |
| 89 | Ships, boats and floating structures. | 7/15 | -1.40 | 2.81 |
| 90 | Optical, photo, cine, meas, checking, precision, etc | 54/130 | 0.07 | 0.64 |
| 92 | Musical instruments. parts and access of such articles | 8/19 | 0.08 | 0.99 |
| 93 | Arms and ammunition. parts and accessories thereof. | 5/11 | 0.29 | 1.73 |
| 94 | Furniture. bedding, mattress, matt support, cushion etc | 16/37 | 0.02 | 0.35 |
| 95 | Toys, games & sports requisites. parts & access thereof | 25/43 | 0.24 | 1.13 |
| 96 | Miscellaneous manufactured articles. | 19/47 | 0.02 | 0.44 |

* Number of coefficients that are significantly different from zero (at the 5% level) compared with the number of estimated coefficients in the hs2 category.
*Source: Authors' calculations.*

**Table A.2 . Sample of industries exhibiting nearly unitary PTM coefficients**

| **Hs6** | **Label** | $\hat{\beta}^k$ |
|---|---|---|
| 030240 | Herrings, fresh or chilled, excluding livers and roes | 0.95 |
| 030269 | Fish nes, fresh or chilled excluding livers and roes | 1.01 |
| 051191 | Fish, shellfish & aquatic invert prod nes | 1.00 |
| 090700 | Cloves (whole fruit, cloves and stems) | 1.01 |
| 190520 | Gingerbread and the like | 0.99 |
| 210130 | Chicory & other coffee substitutes roasted & extracts | 0.99 |
| 282736 | Zinc chloride | 0.98 |
| 282751 | Bromides of sodium or of potassium | 0.99 |
| 283322 | Aluminium sulphate | 1.05 |
| 283510 | Phosphinates (hypophosphites) & phosphonates (phosphites) of metals | 0.99 |
| 290529 | Unsaturated monohydric acyclic alcohols nes | 0.97 |
| 290719 | Monophenols nes | 0.99 |
| 290919 | Acyclic ethers nes. derivatives of acyclic ethers | 1.00 |
| 293390 | Heterocyclic components with nitrogen hetero-atom(s) only, nes | 1.05 |
| 293890 | Glycosides & their salts,ethers,esters & other derivatives,nes,in bulk | 0.96 |
| 300432 | Adrenal cortex hormones, in dosage | 0.98 |
| 310551 | Fertilizers containg nitrates & phosphates, nes, in pack weighg</=10kg | 1.04 |
| 370251 | Film for colour photo sens, unexp, in rolls,w</=16mm & le</=14 m, nes | 1.00 |
| 370400 | Photo plates,film,paper,paperboard & textiles,exposed but not developed | 1.04 |
| 370610 | Cinematograph film, exposed & developed, of a width of 35 mm or more | 0.98 |
| 480429 | Paper, sack kraft, in rolls, o/t unbl, uncoated | 1.00 |
| 480820 | Paper, sack kraft, creped or crinkled, in rolls or sheets | 0.96 |
| 520515 | Cotton yarn,>/=85%,single,uncombd,<125 dtex,nt put up f retail sale | 1.04 |
| 520841 | Plain weave cotton fabric,>/=85%, not more than 100 g/m2, yarn dyed | 1.00 |
| 521131 | Plain weave cotton fab,<85% mixed with m-m fib,more than 200 g/m2,dyed | 1.01 |
| 550690 | Synthetic staple fibres, carded or combed, nes | 1.00 |
| 620191 | Mens/boys anoraks & similar articles,of wool/fine animal hair,not knittd | 1.03 |
| 620799 | Mens/boys bathrobes,dressg gowns,etc of oth textile materials,not knit | 1.03 |
| 620990 | Babies garments & clothg accessories of oth textile materials,not knittd | 1.02 |
| 731823 | Rivets, iron or steel | 1.01 |
| 820340 | Pipe-cutters, bolt croppers, perforating punches and similar tools | 0.95 |
| 843352 | Threshing machinery nes | 1.01 |
| 843360 | Machines for cleaning, sorting or grading eggs, fruit or other produce | 1.03 |
| 844329 | Letterpress printing machinery nes exc flexographic printing | 0.99 |
| 900211 | Objective lenses f cameras,projectors/photographic enlargers/reducers | 0.97 |
| 930400 | Arms nes, excluding those of heading No 93.07 | 1.04 |

*Source: Authors' calculations.*

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