The dynamics of international trade invoicing

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Abstract

International trade transactions can be invoiced in the producer currency, in the destination currency, or in some third vehicle currency. This paper shows how an exporter's invoicing choice is affected by her market share, industry structure, the role of imported inputs, the hedging of macroeconomic shocks, and exchange rate regimes. We address a shortcoming in the existing literature by invoicing choices as the outcome of a bargaining game between exporting producers and their customers abroad. Using a new dataset of 45 million individual Canadian import transactions, we examine the roles of the various invoicing determinants, documenting the importance of each of these factors in the invoicing decisions of specific industry exporters, distinguishing between U.S. exporters and those from other countries.

JEL Classification: F3, F4

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1. Introduction

The currency in which exporters set the price of their goods – the so-called "invoicing" currency – has long been recognized as a central aspect of international economics. Specifically, the invoicing choice determines who among the exporter or the customer is exposed to exchange rate risk, and whether the allocation of demand between goods produced in different countries switches following exchange rate fluctuations. Several theoretical contributions have stressed the role of macroeconomic variables, such as exchange rate volatility, and industry-structure aspects, such as the price-sensitivity of demand and the structure of competition, for the invoicing currency selection decisions,[2] which can include the destination market currency, the exporter's currency, or some "vehicle" currency that is neither the exporter's nor the customer's.[3]

This paper makes theoretical as well as empirical contributions to our understanding of invoice currency selection, addressing two limitations that affect the existing literature. First, the usual models assume that invoicing is decided solely by the exporter. The only role of the customer is to provide the exporter with downward-sloping demand in the exporter's price, which he takes into account in his invoicing decision. Friberg and Wilander (2008) point that this setup is counterfactual: using a survey of Swedish exporters, they document that the invoicing currency is set through a negotiation between the exporter and the consumer.

The second limitation is that the empirical literature relies on aggregate data, potentially hiding contrasting patterns across exporters that might be apparent at a more disaggregated level in the data.[4] For instance, firms in an industry where demand is very sensitive to prices have an incentive to choose an invoicing currency that is the same as their competitors, where firms whose products are more differentiated are less subject to this "coalescing" effect (Goldberg and Tille 2008). The invoicing choice could then be very different between different firms in a given country. The existence of such heterogeneity in invoicing data would improve our ability to test different theories relative to what observable in the aggregate data.

We address the first limitation by developing a model where the currency invoicing selection is set through a bargaining game between the exporter and the customer. We consider a Nash bargaining setting where the invoicing splits the surplus of the sale from the exporter to the

[2] A non-exhaustive list of recent contributions includes Bacchetta and van Wincoop (2005), Devereux, Engel, and Storgaard (2004), Friberg (1998), Novy (2006), Goldberg and Tille (2008).

[3] Goldberg and Tille (2008).

[4] Gopinath, Itskhoki and Rigobon (forthcoming).

customer, with the split reflecting their negotiating power. Two main results emerge. First, a unilateral invoicing choice by the exporter, as considered in the literature, is likely to entail a use of the destination currency that is suboptimally low from the point of view of the consumer. Intuitively, the exporter has an incentive to use its own currency to limit the impact of exchange rate movements on his unit revenue, whereas the customer gets a higher utility from having the price set in her own currency. We show that the equilibrium invoicing is tilted towards the customer's currency, even though the exporter reacts to his higher exposure to exchange rate movements by setting a higher price compared to the case where he chooses invoicing unilaterally.

Second, our model implies that the use of the customer's currency is more pronounced for large sales. We assume that the exporter deals with two customers, with one having a higher demand. In the bargaining with a given customer, the alternative option of the exporter is to only sell to the other customer. Failing to reach an agreement with a large customer implies that the exporter's revenue is relatively low, and the marginal utility of the revenue relatively high. The exporter's alternative option is thus worse when bargaining with a large customer, and the bargained outcome is tilted towards the customer's preference for using her own currency.

The second limitation of the literature is addressed by using a new highly disaggregated dataset for Canadian imports. Our data cover each Canadian import transaction between February 2002 and February 2009, with each transaction containing data on the disaggregated industry, the invoicing currency, and the country of origin of the import. We begin by documenting the patterns of invoicing. While the U.S. dollar is extensively used, other currencies still account from 72.9 percent of imports by count (68.4 percent by value) from countries other than the United States. Invoicing patterns are remarkably steady throughout our sample, even though some shifts occur, such as a decreased use of the British pound. We also show that the Canadian dollar is used more extensively for large shipments than smaller ones, in line with the implications from the model.

We next turn to a formal econometric exercise and regress the invoicing choice on variables that reflect industry-structure (i.e. whether demand is price-sensitive), the exchange rate regime of the country of origin, the share of imports from that country into total imports for the particular industry, the size of shipments, exchange rate volatility and dummy variables that capture the ability of various currencies to hedge shocks to demand and marginal costs.

Throughout our analysis we distinguish between overall imports and imports from non-U.S. countries, with this distinction affording an opportunity to focus on the latter as U.S. exporters overwhelmingly use the U.S. dollar.

Our analysis shows four main points. First, exporters in industries where demand is more price-sensitive tend to use the Canadian dollar relatively more than exporters in other industries. Second, exporters in countries with a peg to the dollar tend to use their currency, whereas exporters in countries with a peg to the euro use that currency. Third, exporters in a country which has a dominant share of imports in a particular industry use their own currency, as they face only a limited competition from exporters from other countries. Fourth, the Canadian dollar plays a larger role for large shipments. Hedging and coalescing motives, as well as customer bargaining power results, are supported in the empirical analysis.

The rest of this paper is structured as follows. Section 2 presents the impact of structural parameters, such as the extent of domestic competition or the price-elasticity of demand, in a standard invoicing model. It is aimed as analyzing invoicing shares both at the level of firms and at the level of the entire industry. The determination of invoicing in a novel model with bargaining between exporters and customers is analyzed in Section 3. Section 4 presents our new invoicing data, as well as the measures used in the econometric analysis. The econometric results are analyzed in Section 5, and Section 6 concludes.

2. Invoicing equilibrium with multiple currencies

This section presents a simple model illustrating how various forces affect the invoicing choice of individual firms, as well as the invoicing shares of aggregate sales to a destination market. The setup is based on the one of Goldberg and Tille (2008). For brevity we focus on the main elements of the approach, with more detailed exposition provided in the appendix.

2.1. A simple model of invoicing

Consider an exporter, located in country *e*, which produces a brand *z* for sale in the destination country *d*. The exporter posts a price in a currency *k* before knowing the realization of various shocks affecting the home or destination market economies. The export goods are produced using a technology with decreasing returns to scale:

$$Y_{e,d}(z) = (\alpha)^{-1}\left[H_{e,d}(z)\right]^{\alpha} \qquad 0 < \alpha \leq 1 \tag{1}$$

where $Y_{e,d}(z)$ is the output of *z* and $H_{e,d}(z)$ is an input with a unit cost W_e. The firm faces the following demand for its products:

$$Y_d(z) = \left[P_{e,d}(z)/P_d\right]^{-\lambda} C_d = \left[(S_{e,k}P^k_{e,d}(z))/(S_{e,d}P_d)\right]^{-\lambda} C_d \tag{2}$$

where C_d is the total demand for brands of the relevant sector, P_d is the price index, expressed in currency *d*, across all brands sold in the destination country *d*, and λ>1 is the elasticity of substitution between the various brands. $P^k_{e,d}(z)$ is the price, in currency *k*, set by the exporter. $S_{e,k}$ is the exchange rate defined in terms of units of currency *e* per unit of currency *k*, so that an increase corresponds to a depreciation of currency *e*.[5]

Conditional on the invoicing currency *k* the exporter chooses its price $P^k_{e,d}(z)$ to maximize the expected value of its profits, subject to (1) and (2). The value of expected profits at this optimal price can be expressed as a quadratic approximation around the allocation where there are no shocks and prices are identical in all possible invoice currencies. Denoting log deviations around this allocation by lower case letters, the expected per unit profits are:

$$\begin{aligned}\pi^k_{e,d}(z) = &\frac{\lambda}{\alpha+\lambda(1-\alpha)}\left\{\frac{1}{2}E[s_{e,k}-q^k_{e,d}]^2 + E[s_{e,k}-q^k_{e,d}]c_d\right\} \\ &+\frac{\lambda-1}{\alpha+\lambda(1-\alpha)}\frac{1}{\alpha}\left\{-\frac{1}{2}E[\lambda q^k_{e,d}]^2 + E\lambda q^k_{e,d}(\alpha w_e + c_d)\right\}\end{aligned} \tag{3}$$

where $q^k_{e,d} = s_{e,k} - s_{e,d} - p_d$ is the relative price of brand *z* in the destination country expressed vis-a-vis competing brands.

The exporter chooses the invoicing currency basket *k* to maximize (3). We denote the weight of each currency *i* in this basket by $\beta^i_{e,d}$. Our assumption that invoicing takes the form of a basket, instead of complete invoicing in one currency, facilitates the analysis. These weights are positive and sum to one across all currencies. We denote the share invoiced in currency *i* across the overall sales of all sellers in the market by η^i_d. The sensitivity of the price index in the destination country, p_d, to exchange rate movements reflects these aggregated shares. The

[5] Goldberg and Tille also consider the presence of transaction costs in foreign exchange markets that can differ across currency pairs. We abstract from this aspect for brevity.

relative price of a particular brand reflects the extent to which the invoicing pattern of the specific exporter differs from the average one in that industry: $q_{e,d}^{k} = \sum_{i} (\beta_{e,d}^{i} - \eta_{d}^{i}) s_{e,i}$.

For simplicity, we consider a case where exporters in two countries, 1 and 2, sell to a destination market *d* where local firms are also present. The invoicing choice by an exporter in country 1 is:

(4) $$\beta_{1,d}^{d} = \Omega \eta_{d}^{d} + (1-\Omega)\rho(m_{1,d}, s_{1,d})$$

(5) $$\beta_{1,d}^{2} = \Omega \eta_{d}^{2} + (1-\Omega)\rho(m_{1,d}, s_{1,2})$$

(6) $$\beta_{1,d}^{1} = 1 - \beta_{1,d}^{2} - \beta_{1,d}^{d}$$

where $m_{1,d}$ captures the exogenous drivers of marginal costs, namely movements in factor prices and fluctuations in destination market aggregate demand: $m_{1,d} = w_1 + (1-\alpha)/\alpha \cdot c_d$. The terms $\rho(m_{1,d}, s_{1,d})$ and $\rho(m_{1,d}, s_{1,2})$ reflect the co-movements between m_{1d} and the exchange rates $s_{1,d}$ and $s_{1,2}$, with a positive value of $\rho(m_{1,d}, s_{1,d})$ indicating that marginal costs tend to be high when currency *i* is weak relative to currency *d*.[6] The weight of the correlations in the exporter's invoice currency selection depend on industry characteristics that are reflected in the coefficient $\Omega = \lambda(1-\alpha)/[\alpha + \lambda(1-\alpha)] \in [0,1]$. This term is large when brands are close substitutes and decreasing returns to scale are pronounced.

(4)-(6) show that producers consider selecting invoicing currencies that offer good hedging properties by appreciating when marginal costs are high, or currencies that are used by the firm's competitors. The latter aspect reflects a "coalescing" motive through which firms want to limit the deviation between their own price and that of their competitors, a motive that is more relevant when different brands are stronger substitutes and when fluctuations in demand affect marginal costs (i.e. Ω is large). Similar relations as (4)-(6) hold for the invoicing choices of an exporter in country 2.

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[6] Specifically, the ρ's are the coefficient of a regression of m_{1d} on the two exchange rates:

$$\rho(m_{1,d}, s_{1,d}) = V^{-1}\left[E(s_{1,2})^2 E(s_{1,d} m_{1,d}) - E(s_{1,2} s_{1,d}) E(s_{1,2} m_{1,d})\right]$$
$$\rho(m_{1,d}, s_{1,2}) = V^{-1}\left[E(s_{1,d})^2 E(s_{1,2} m_{1,d}) - E(s_{1,2} s_{1,d}) E(s_{1,d} m_{1,d})\right]$$
$$\text{where}: V = E(s_{1,2})^2 E(s_{1,d})^2 - \left[E(s_{1,2} s_{1,d})\right]^2$$

The shares of various currencies in overall market sales reflect both the invoicing decisions of various firms and the market shares of different countries. We denote the market share of country *i* by $\omega_{i,d}$, and assume that firms located in the destination country fully invoice in their own currency. The shares of overall sales invoiced in the three currencies are then:

$$\begin{aligned} \eta_d^1 &= \beta_{1,d}^1 \omega_{1,d} + \beta_{2,d}^1 \omega_{2,d} \quad ; \quad \eta_d^2 = \beta_{1,d}^2 \omega_{1,d} + \beta_{2,d}^2 \omega_{2,d} \\ \eta_d^d &= 1 - (1 - \beta_{1,d}^d)\omega_{1,d} - (1 - \beta_{2,d}^d)\omega_{2,d} \end{aligned} \tag{7}$$

We denote the share of overall imports invoiced in currency *i* by ϕ_d^i. These shares are written as:

$$\begin{aligned} \phi_d^1 &= \eta_d^1 / (\omega_{1,d} + \omega_{2,d}) \quad ; \quad \phi_d^2 = \eta_d^2 / (\omega_{1,d} + \omega_{2,d}) \\ \phi_d^d &= (\beta_{1,d}^d \omega_{1,d} + \beta_{2,d}^d \omega_{2,d}) / (\omega_{1,d} + \omega_{2,d}) \end{aligned} \tag{8}$$

The general solution of the model is derived by combining (4)-(6) and (7). The detailed results are presented in the appendix and discussed in greater detail in Goldberg and Tille (2008). In order to motivate the empirical application of Section 4, below we focus on some major aspects of the solution by assessing the sensitivity of invoicing to the various parameters.

2.2. Market shares

The sensitivity of invoicing to the market share of exporting countries, $\omega_{1,d}$ and $\omega_{2,d}$, is solved as:

$$\begin{vmatrix} d\beta_{1,d}^2 \\ d\beta_{1,d}^d \\ d\beta_{2,d}^1 \\ d\beta_{2,d}^d \end{vmatrix} = \frac{\Omega}{1 - \Omega(\omega_{1,d} + \omega_{2,d})} \begin{vmatrix} \beta_{1,d}^2 & \beta_{2,d}^2 \\ -(1 - \beta_{1,d}^d) & -(1 - \beta_{2,d}^d) \\ \beta_{1,d}^1 & \beta_{2,d}^1 \\ -(1 - \beta_{1,d}^d) & -(1 - \beta_{2,d}^d) \end{vmatrix} \begin{vmatrix} d\omega_{1,d} \\ d\omega_{2,d} \end{vmatrix}$$

A higher market share of country 1 shifts invoicing from currency *d* towards the exporters' currencies. The shifts are identical across all exporters: $d\beta_{1,d}^1 = d\beta_{2,d}^1$, $d\beta_{1,d}^2 = d\beta_{2,d}^2$ and $d\beta_{1,d}^d = d\beta_{2,d}^d$. The magnitude of the shifts reflects the initial invoicing shares of exporters in country 1. Specifically, the use of currency *d* declines more when that currency represents a small share of the initial invoicing basket. Similarly, the use of currency 1 increases more when it already represents a large share of invoicing basket of exporters in country 1. The effects are also larger when the coalescing motive is strong and imports account for a large share of the market. The impact in terms of the shares of the various currencies in total sales (7) is similar:

$$\begin{vmatrix} d\eta_d^1 \\ d\eta_d^2 \\ d\eta_d^d \end{vmatrix} = \frac{1}{1-\Omega(\omega_{1,d}+\omega_{2,d})} \begin{vmatrix} \beta_{1,d}^1 & \beta_{2,d}^1 \\ \beta_{1,d}^2 & \beta_{2,d}^2 \\ -(1-\beta_{1,d}^d) & -(1-\beta_{2,d}^d) \end{vmatrix} \begin{vmatrix} d\omega_{1,d} \\ d\omega_{2,d} \end{vmatrix}$$

Turning to the impact on the currencies shares to imports (8), we obtain:

$$\begin{vmatrix} d\phi_d^1 \\ d\phi_d^2 \\ d\phi_d^d \end{vmatrix} = \frac{\Omega}{1-\Omega(\omega_{1,d}+\omega_{2,d})} \begin{vmatrix} \beta_{1,d}^1 & \beta_{2,d}^1 \\ \beta_{1,d}^2 & \beta_{2,d}^2 \\ -(1-\beta_{1,d}^d) & -(1-\beta_{2,d}^d) \end{vmatrix} \begin{vmatrix} d\omega_{1,d} \\ d\omega_{2,d} \end{vmatrix}$$
$$+ \frac{1}{(\omega_{1,d}+\omega_{2,d})^2} \begin{vmatrix} \omega_{2,d}(\beta_{1,d}^1-\beta_{2,d}^1) & -\omega_{1,d}(\beta_{1,d}^1-\beta_{2,d}^1) \\ \omega_{2,d}(\beta_{1,d}^2-\beta_{2,d}^2) & -\omega_{1,d}(\beta_{1,d}^2-\beta_{2,d}^2) \\ \omega_{2,d}(\beta_{1,d}^d-\beta_{2,d}^d) & -\omega_{1,d}(\beta_{1,d}^d-\beta_{2,d}^d) \end{vmatrix} \begin{vmatrix} d\omega_{1,d} \\ d\omega_{2,d} \end{vmatrix}$$

Two effects are at work. First, the changes in the η's are transmitted to the ϕ's. Second, a higher market share of country 1 also implies that country 1 accounts for a higher share of imports. If the initial invoicing patterns differ between country 1 and 2, the more prominent role of country 1 tilts the invoicing pattern of imports towards its initial invoicing pattern. To sum up, we get the following implications:

Implication 1: A higher market share for an exporting country reduces the use of the destination currency by all exporters and increases the use of all exporters' currencies. The magnitudes of the shifts reflect the initial use of the various currencies by the country with the increased market share.

Implication 2: The effects in implication 1 are larger in sectors with a strong coalescing motive and a large share of imports.

Implication 3: In addition to the effects in implication 1, the invoicing of overall imports is tilted towards currencies which play a larger role in the invoicing by the country with a larger market share, compared to other exporting countries.

For instance, these implications mean that when U.S. goods account for a large share of a country's market, other exporters selling to that market tilt their invoicing towards the U.S. dollar. This is especially the case in sectors with a strong coalescing motive.[7]

[7] This aspect is discussed by Bacchetta and van Wincoop (2005).

2.3. Imported inputs

The invoicing shares (4)-(6) reflect the exogenous hedging considerations in the ρ terms. We focus on the impact on (4)-(6), with the impact on the shares of the various currencies in overall sales (7) and imports (8) simply reflecting the market shares of the various countries.

To gain further insights, we make additional assumptions. First, demand in the destination market is driven by a local factor, such as monetary shocks, denoted by x_d: $c_d = \upsilon x_d$. Second, exporters' marginal costs reflect local factors and exchange rates:

$$w_1 = \chi\tilde{x}_1 + \varphi_1 s_{1,2} + \xi_1 s_{1,d} \quad ; \quad w_2 = \chi\tilde{x}_2 + \varphi_2 s_{1,2} + \xi_2 s_{1,d}$$

where:

$$\tilde{x}_1 = (1-\delta_1)x_1 + \delta_1 x_d \quad ; \quad \tilde{x}_2 = (1-\delta_2)x_2 + \delta_2 x_d$$

The parameter δ reflects the extent to which an exporting country stabilizes its exchange rate vis-à-vis the destination country. $\tilde{x}_i$ is then the domestic factor in country *i*, including the exchange rate regime. If the central bank does not target the exchange rate ($\delta_1 = 0$), this factor is purely driven by domestic consideration. If the central bank however stabilizes the exchange rate regime vis-à-vis the destination country ($\delta_1 > 0$), country *i* monetary stance, and wages, are affected by the exchange rate.

Our specification allows for a direct impact of the exchange rate on the marginal cost to be direct, reflecting the use of imported inputs invoiced in foreign currencies. For instance $\varphi_1 > 0$ implies that country 1 imports some inputs from country 2 that are invoiced in currency 2. $\xi_1 > 0$ similarly implies that it imports inputs from the destination country invoiced in the destination currency. Third, we assume that bilateral exchange rates reflect the difference between bilateral factors:

$$\begin{aligned} s_{1,2} &= \tilde{x}_1 - \tilde{x}_2 = (1-\delta_1)x_1 - (1-\delta_2)x_2 + (\delta_1 - \delta_2)x_d \\ s_{1,d} &= \tilde{x}_1 - x_d = (1-\delta_1)(x_1 - x_d) \\ s_{2,d} &= \tilde{x}_2 - x_d = (1-\delta_2)(x_2 - x_d) \end{aligned}$$

Finally we assume that the factors x_1, x_2 and x_d are uncorrelated, and the variances are: $E(x_1)^2 = \pi_1 E(x_d)^2$ and $E(x_2)^2 = \pi_2 E(x_d)^2$.

Under this assumptions, a higher sensitivity of marginal costs in country 1 to the exchange rate between currencies 1 and 2 ($d\varphi_1 > 0$) shifts invoicing away from currency 1 and towards

currency 2, with no impact on the invoicing in the destination currency. Similarly, a higher sensitivity of marginal costs in country 1 to the exchange rate between currencies 1 and *d* ($d\xi_1 > 0$) shifts invoicing away from currency 1 and towards currency *d*, with no impact on the invoicing in currency 2:

$$\begin{vmatrix} d\beta_{1,d}^{2} \\ d\beta_{1,d}^{d} \\ d\beta_{2,d}^{1} \\ d\beta_{2,d}^{d} \end{vmatrix} = D_1 \begin{vmatrix} 1-\Omega\omega_{2,d} \\ 0 \\ -\Omega\omega_{1,d} \\ 0 \end{vmatrix} d\varphi_1 \quad ; \quad \begin{vmatrix} d\beta_{1,d}^{2} \\ d\beta_{1,d}^{d} \\ d\beta_{2,d}^{1} \\ d\beta_{2,d}^{d} \end{vmatrix} = D_1 \begin{vmatrix} 0 \\ 1-\Omega\omega_{2,d} \\ -\Omega\omega_{1,d} \\ \Omega\omega_{1,d} \end{vmatrix} d\xi_1$$

where: $D_1 = (1-\Omega)/(1-\Omega(\omega_{1,d}+\omega_{2,d}))$. The following implication sums the results:

> Implication 4: When costs in an exporting country 1 are more exposed to the exchange rate with another country 2, the invoicing of all exporters shifts away from the currency of country 1 towards the currency of country 2.

An illustration would be the case of an Asian country whose exports to Canada use imported inputs invoiced in U.S. dollar. This raises that country's use of the U.S. dollar as an invoicing currency, which in turn raises the incentive of other exporters to use the dollar.

2.4. Macroeconomic volatility

For simplicity, we abstract from the direct linkages between marginal costs and exchange rates for the rest of the analysis ($\varphi_1 = \varphi_2 = \xi_1 = \xi_2 = 0$). We assess the impact of the volatility of the various factors, π_1 and π_2, by assuming that policy does not limit exchange rate volatility for simplicity ($\delta_1 = \delta_2 = 0$).

A higher volatility of an exporting country's factor shifts the invoicing of all exporters away from its currency and towards the destination country and other exporters' currencies:

$$\begin{vmatrix} d\beta_{1,d}^{2} \\ d\beta_{1,d}^{d} \\ d\beta_{2,d}^{1} \\ d\beta_{2,d}^{d} \end{vmatrix} = D_2 \begin{vmatrix} \pi_2 \\ (\pi_2)^2 \\ -\pi_2(1+\pi_2) \\ (\pi_2)^2 \end{vmatrix} d\pi_1 + D_2 \begin{vmatrix} -\pi_1(1+\pi_1) \\ (\pi_1)^2 \\ \pi_1 \\ (\pi_1)^2 \end{vmatrix} d\pi_2$$

where: $D_2 = D_1[\chi + (1-\alpha)\upsilon/\alpha](\pi_1 + \pi_2 + \pi_1\pi_2)^{-2}$. A higher volatility of the destination country's factor, holding the volatility of the other factors constant, shifts the invoicing of all

exporters away from the destination currency towards exporters' currencies, especially towards the currency of the country with the least volatile factor:

$$\begin{vmatrix} d\beta_{1,d}^{2} \\ d\beta_{1,d}^{d} \\ d\beta_{2,d}^{1} \\ d\beta_{2,d}^{d} \end{vmatrix} = D_2 \pi_1 \pi_2 \begin{vmatrix} \pi_1 \\ -(\pi_1 + \pi_2) \\ \pi_2 \\ -(\pi_1 + \pi_2) \end{vmatrix} \frac{dE(x_d)^2}{E(x_d)^2}$$

The role of macroeconomic volatility, which was stressed by Devereux, Engel and Storgaard (2004) is summarized in the following implication:

Implication 5: More volatile macroeconomic factors in a country, invoicing shifts the invoicing away from its currency towards the other currencies, especially towards the currencies of countries with more stable fundamentals.

For instance, emerging markets economies where fundamentals are more volatile than in industrialized countries, can be expected to make a relatively small use of their own currencies in invoicing.

2.5. Exchange rate stabilization

The extent to which policy makers in an exporting country smooth the movements of their exchange rate against the destination market is captured by the coefficients δ. For simplicity, we set the exporters factors to be equally volatile: $\pi_1 = \pi_2 = \pi$.

Under these assumptions, when a country puts a higher emphasis on stabilizing its exchange rate, it shifts invoicing by all exporters away from the destination currency towards its own currency. There is no impact on the invoicing share of other exporters' currencies. The effects are larger when the exchange rate is already stable:

$$\begin{vmatrix} d\beta_{1,d}^{2} \\ d\beta_{1,d}^{d} \\ d\beta_{2,d}^{1} \\ d\beta_{2,d}^{d} \end{vmatrix} = D_1 \frac{\chi + (1-\alpha)\upsilon/\alpha}{2+\pi} \left[\frac{1}{(1-\delta_1)^2} \begin{vmatrix} 0 \\ -1 \\ 1 \\ -1 \end{vmatrix} d\delta_1 + \frac{1}{(1-\delta_2)^2} \begin{vmatrix} 1 \\ -1 \\ 0 \\ -1 \end{vmatrix} d\delta_2 \right]$$

Our result is summarized in the following implication:

Implication 6: A reduction of exchange rate volatility by an exporting country vis-à-vis the destination raises the share of its currency in invoicing at the expense of the destination currency.

3. A bargaining view of invoicing

While the model in the previous section allows us to consider the impact of various factors on invoicing, it remains limited in one important dimension. Specifically, consumers play no role in the invoicing decision. They simply provide firms with a demand along which firms choose an allocation, and invoicing is set entirely by the firm. While such an assumption is standard in the literature, it is not consistent with recent evidence that invoicing is set through a bargaining between firms and customers, as shown by Friberg and Wilander (2008).

This section extends our setting to allow for invoicing to be set in a bargaining between consumers and firms. While more empirically appealing, this alternative setup substantially raises the degree of complexity of the analysis. We therefore focus on the problem of an individual exporter, and abstract from the aggregate invoicing shares at the industry level discussed in the previous section.

3.1. Consumer surplus

Consider an exporter in country *e* who sells a brand *z* to customers in country *d*. Customers are indexed by *i* and they differ by size. Specifically, the demand from customer *i* is:

$$C_d^i(z) = \left[(S_{e,k(i)} P_{e,d}^{k(i)}(z))/(S_{e,d} P_d)\right]^{\lambda} C_d^i \tag{9}$$

We allow for the invoicing currency $k(i)$ to differ across customers. Specifically, the invoicing shares in the destination currency *d* and the vehicle currency *v* for customer *i* are denoted by $\beta_{e,d}^{d,i}$ and $\beta_{e,d}^{v,i}$. Similarly the preset component of the price $P_{e,d}^{k(i)}(z)$ can differ across customers. Customers only differ through the size of their consumption in the steady state, denoted by $\overline{C}_d^i$. The utility that consumer *i* gets from its consumption of brand *z* takes a standard CRRA form:

$$C_d^i(z) = (1-\rho_d)^{-1} E[C_d^i(z)/\overline{C}_d^i]^{1-\rho_d} \quad ; \quad \rho_d \geq 1 \tag{10}$$

The inclusion of $\overline{C}^i$ in (10) ensures that the size of the consumer does not affect its utility. Our specification of a utility defined at the level of each brand, instead of over a complete basket of brands, simplifies the analysis by shutting down spillovers across the demands for different brands.

The utility (10) is obtained only if the exporter and the customer reach an agreement in their bargaining over invoicing. Should they fail to do so, the alternative utility for the customer is equivalent to a consumption equal to a fraction $\tau_d^i \leq 1$ of $\overline{C}_d^i$. The surplus that the customer gains from a successful bargaining is then:

$$SC_{e,d}^{k(i)} = (1-\rho_d)^{-1} E[C_d^i(z)/\overline{C}_d^i]^{1-\rho_d} - (1-\rho_d)^{-1}(\tau_d^i)^{1-\rho_d} \tag{11}$$

3.2. Producer surplus

The exporter uses a technology with decreasing returns to scale:

$$C_d^i(z) = (\alpha)^{-1}(\overline{C}_d^i)^{1-\alpha}\left[H_{e,d}^i(z)\right]^{\alpha} \quad ; \quad 0 < \alpha \leq 1 \tag{12}$$

For simplicity, we assume that there are different production lines for different customers, so that the demand by a customer does not affect the marginal costs of producing for other customers. The technology is also scaled by the level of steady state demand, which ensures that steady state marginal costs and prices are equalized across customers. The profits that the exporter gets from selling to customer *i* are denoted by $\Pi_{e,d}^{k(j)}(z)$. We assume that the exporter's utility of its profits to all customers takes a CRRA form:

$$Q_e^J(z) = (1-\rho_e)^{-1} E\left[\sum_{j\in J}\Pi_{e,d}^{k(j)}(z)\right]^{1-\rho_e} \quad ; \quad \rho_e \geq 1 \tag{13}$$

where *J* is the set of customers to whom the exporter sells.

If the firm fails to reach an agreement with customer *i* she will only sell to the other customers in the set *J*.[8] The surplus of the exporter from a successful bargaining is then:

$$SF_{e,d}^{k(i)} = (1-\rho_e)^{-1} E\left[\Pi_{e,d}^{k(j)}(z) + \sum_{j\neq i}\Pi_{e,d}^{k(j)}(z)\right]^{1-\rho_e} - (1-\rho_e)^{-1} E\left[\sum_{j\neq i}\Pi_{e,d}^{k(j)}(z)\right]^{1-\rho_e} \tag{14}$$

The impact of profits on the exporter's marginal utility is an important difference from usual models in which the discount factor is not influenced by the pricing and invoicing decisions. In particular, it implies that the exporter's marginal utility of income is higher when negotiating with a larger customer, making her more willing to accommodate the customer's preferences.

[8] In equilibrium the firm sells to all customers. We can therefore evaluate the firm's outside option in its bargaining with a specific customer as the utility from sales to all other customers.

The profits (13) by both the pricing, $P_{e,d}^{k(i)}(z)$, and the invoicing, $\beta_{e,d}^{d,i}$ and $\beta_{e,d}^{v,i}$. We consider that these are set in two stages. First, the invoicing is set through a bargaining between the exporter and the consumer. Second, the exporter sets the price taking the invoicing and the demand (9) as given. The first step is forward-looking and takes the conditional pricing choice of the second step into account.

Our assumption that invoicing is set through a bargaining process, but prices are not, can appear odd, as one could set both to be chosen through a bargaining. Our modeling choice is motivated by a focus on the invoicing decision. In addition, our setup nests the model of the previous section as a specific case. In particular, the price in the steady state is the same and reflects a markup over marginal cost. This would not be the case if the price was bargained over.

3.3. Pricing

The exporter sets $P_{e,d}^{k(i)}(z)$ to maximize (13). This leads to a standard expression where the expected discounted marginal revenue is markup over the expected discounted marginal cost. The price is then affected by the ex-post co-movements between the various variables of the model, a feature akin to a risk premium. An additional complication over our earlier model is that the discount factor used in setting the price is itself a function of the profits. Assuming that fluctuations in consumption are the same for all consumers ($c_d^i = c_d$), the preset price can be written as a quadratic expansion around the steady state:

$$\frac{\alpha+\lambda(1-\alpha)}{\alpha} p_{e,d}^{k(i)}(z) = \frac{1}{2} E\left[mc_{e,d}^{k(i)}\right]^2 - \frac{1}{2} E\left[mr_{e,d}^{k(i)}\right]^2 + E\left[disc_{e,d}^{k(i)}(mr_{e,d}^{k(i)} - mc_{e,d}^{k(i)})\right] \tag{15}$$

where $mr_{e,d}^{k(i)}$ reflects the drivers of the marginal return, $mc_{e,d}^{k(i)}$, reflects the drivers of marginal costs, and $disc_{e,d}^{k(i)}$ is the discount factor that is inversely relative to denoting the linear component of profits, $\pi_{e,d}$:

$$\begin{aligned}
mr_{e,d}^{k(i)} &= -(\lambda-1)[\beta_{e,d}^{d,i} s_{e,d} + \beta_{e,d}^{v,i} s_{e,v}] + \lambda[s_{e,d} + p_d] + c_d \\
mc_{e,d}^{k(i)} &= w_e + \frac{\lambda}{\alpha}[s_{e,d} + p_d] + \frac{1}{\alpha} c_d - \frac{\lambda}{\alpha}[\beta_{e,d}^{d,i} s_{e,d} + \beta_{e,d}^{v,i} s_{e,v}] \\
disc_{e,d}^{k(i)} &= -\rho_e \left[\frac{1}{\alpha+\lambda(1-\alpha)} \left[\lambda[s_{e,d} + p_d] + c_d\right] - \frac{\alpha(\lambda-1)}{\alpha+\lambda(1-\alpha)} w_e \right] \\
&= -\rho_e \pi_{e,d}
\end{aligned}$$

(15) shows that altering the invoicing shares impacts the exposure of the exporter to fluctuations in exchange rates and marginal costs, and leads her to alter the level at which she sets the prices. The utility of the exporter (13) can also be expressed as a quadratic approximation around the steady sate.

3.4. Invoicing

In the first step of the solution, the exporter and the customer set the invoicing shares to maximize the following measure of joint surplus that combines (11) and (14):

(16) $$N_{e,d}^{k(i)} = \left[SF_{e,d}^{k(i)}\right]^{\delta}\left[SC_{e,d}^{k(i)}\right]^{1-\delta}$$

For brevity we focus on the optimization with respect to the invoicing share of the destination currency, $\beta_{e,d}^{d,i}$. The analysis for the share of the vehicle currency, $\beta_{e,d}^{v,i}$, follows similar steps. We can show the derivative of (16) with respect to the invoicing share take the following form:

(17) $$\frac{\partial N_{e,d}^{k(i)}}{\partial \beta_{e,d}^{d,i}} = \Psi_d^i \left\{ G_{e,d}^{d,i} + D_d^i \frac{\partial SC_{e,d}^{k(i)}}{\partial \beta_{e,d}^{d,i}} \right\}$$

where Ψ_d^i is a positive coefficient and D_d^i is an increasing function of the size of customer *i*:

$$D_d^i = \frac{1-\delta}{\delta}\frac{1-\rho_d}{1-(\tau_d^i)^{1-\rho_d}}\frac{\alpha+\lambda(1-\alpha)}{\lambda(\lambda-1)}H(\bar{c}_d^i) \quad ; \quad H(\bar{c}_d^i) = \frac{1}{1-\rho_e}\frac{1}{\bar{c}_d^i}\left[1-(1-\bar{c}_d^i)^{1-\rho_e}\right]$$

The function *H* is positive and increase with the size of customer *i*, measured by the steady state ratio $\bar{c}_d^i$ of her consumption to the overall consumption. The terms $G_{e,d}^{d,i}$ in (17) reflects the derivates of the exporter's surplus (14) with respect to the invoicing share. Both this terms and the derivative of the customer surplus (11) are decreasing linear functions of the share of the customer's currency in the invoicing basket, $\beta_{e,d}^{d,i}$.

The optimal invoicing share is obtained by setting (17) and the corresponding condition with respect to the share of the vehicle currency to zero. The invoicing shares are then:

(18) $$\beta_{e,d}^{d,i} = \gamma^s \eta_d^d + \gamma^w \rho(w_e, s_{e,d}) + \gamma^c \rho(c_d, s_{e,d})$$

(19) $$\beta_{e,d}^{v,i} = \gamma^s \eta_d^d + \gamma^w \rho(w_e, s_{e,v}) + \gamma^c \rho(c_d, s_{e,v})$$

where the ρ terms are regressions coefficients defined in the same way as in (4)-(5), and the γ's are coefficients.

If the exporter holds the entire bargaining power (δ = 1), she sets the invoicing shares unilaterally. $D_d^i = 0$ in (17) and the invoicing shares (18)-(19) are identical to the model of the previous section. Under this allocation, the derivative of the customer's surplus (11) with respect to the invoicing share of the customer's currency is:

$$\left.\frac{\partial SC_{e,d}^{k(i)}}{\partial \beta_{e,d}^{d,i}}\right|_{\text{unilat}} = \lambda^2 \frac{(\rho_d - 1)\alpha - (\rho_e - 1)}{\alpha + \lambda(1-\alpha)}[\eta_d^d E(s_{e,d})^2 + \eta_d^v E(s_{e,d}s_{e,v})] + \lambda \frac{(\rho_d - 1)\alpha - (\rho_e - 1)}{\alpha + \lambda(1-\alpha)} Ec_d s_{e,d} + \lambda\alpha \frac{(\rho_e - 1)(\lambda - 1) - (\rho_d - 1)\lambda}{\alpha + \lambda(1-\alpha)} Ew_e s_{e,d} \quad (20)$$

The customer's surplus is affected by two factors. First, it is reduced when the exporter sets a higher price (15), and aspect captured by the $\rho_e - 1$ terms in (20). Increasing the invoicing share of the destination currency boosts the exporter's exposure to exchange rate volatility, inducing her to charge a high price. In addition, a lower demand ($c_d < 0$) reduces the exporters' profits and increases her discount factor. If the exporter's currency appreciates when demand is low ($Ec_d s_{e,d} > 0$), raising the invoicing share of the destination currency adversely affects her as she faces a low revenue in her currency when demand is low. This induces her to set a higher price. Finally, high wages ($w_e > 0$) lower profits and increase the discount factor. If the exporter's currency depreciates when wages are high ($Ew_e s_{e,d} > 0$), raising the invoicing share of the destination currency generates a favorable hedge as the exporter receives more in terms of her own currency when wages are high. This induces her to reduce her price.

Second, the customer's surplus is lowered when demand is volatile, either because the relative price of the brand is volatile or because aggregate demand fluctuates. This dimension is captured by the $\rho_d - 1$ terms in (20). Increasing the invoicing share of the customer's currency above the unilateral allocation reduces the volatility of the exporter's brand relative price, which benefits the customer. In addition, the sensitivity of the customer's surplus to the invoicing share is lower when the customer's currency is already used substantially in the unilateral invoicing. This is the case if for instance this currency offers a good hedge against fluctuations in wages ($Ew_e s_{e,d} > 0$). Increasing the use of the destination currency then yields only a moderate gain for the customer. Finally, a higher use of the destination currency limits the impact of fluctuations in demand, c_d, on the customer's surplus, if the exporter's currency depreciates when demand is

high ($Ec_d s_{e,d} > 0$). Intuitively, invoicing in the exporter's currency then lowers the relative price of her good when demand is already high, thereby magnifying demand volatility.

The customer's surplus then balances the impact on the preset price with that on demand volatility. The second aspect dominates if the customer is sufficiently more risk averse than the exporter, i.e. $(\rho_d - 1)\alpha > (\rho_e - 1)$. (20) also shows that a use of the customer's currency in invoicing above its share in the unilateral outcome is not necessarily in the customer's interest. Consider the impact of exchange rate volatility. Raising the share of the customer's currency has a direct benefit by reducing her exposure to exchange rate movements. This exposure is however shifted onto the exporter, who responds by raising her preset price (15). The indirect effect through the price is stronger the more risk averse the exporter (the higher ρ_e). The bargaining allocation can thus shift the invoicing towards the exporter's currency. Intuitively, this is because the exporter only takes account of the impact of a lower $P_{e,d}^{k(i)}(z)$ on her own profits, and not on the customer's utility.

If the model parameters are such that (20) is positive, the bargaining allocation leads to a larger use of the customer's currency than under the unilateral allocation. At that point, the derivative of the exporter's surplus with respect to the invoicing share is negative, while the derivative of the customer's surplus is positive.

An interesting implication of the model pertains to the impact of the exporter's bargaining power, δ. As D_d^i is a decreasing function of δ, a reduction in the exporter's power shifts invoicing towards the customer's currency. This shift can occur primarily at high values of δ, implying that a bargaining allocation dominated by the exporter can lead to a substantially different result than a unilateral allocation.[9] Our results can be summarized by the following implications:

Implication 7: The optimal invoicing under bargaining is likely to call for a larger use of the destination currency than under a unilateral choice by the exporter.

Implication 8: Most of the shift in implication 7 can occur when the exporter retains a dominant role in the bargaining process.

[9] A numerical exercise (available on request) focusing on the impact of exchange rate volatility shows that the invoicing share of the customer's currency goes from 38 percent when $\delta = 1$ to 44 percent when δ goes to zero. Most of the impact is achieved by lowering δ to 0.9, where the invoicing share amounts to 42 percent.

3.5. Invoicing and consumer size

The role of the consumer size is derived by setting (17) to zero, and differentiating the resulting expression with respect to the invoicing share and the size of demand. This implies:

$$(21) \qquad D_d^i \frac{\partial SC_{e,d}^{k(i)}}{\partial \beta_{e,d}^{d,i}} \frac{H'(\bar{c}_d^i)}{H(\bar{c}_d^i)} d\bar{c}_d^i = \left[1 + \lambda \frac{1-\alpha}{\alpha} + \lambda D_d^i \left[\frac{\lambda + \alpha(\lambda - 1)}{\alpha} + \lambda(\rho_d - 1)\right]\right] E(s_{e,d})^2 \, d\beta_{e,d}^{d,i}$$

Focus on the case where the derivative of the customer's surplus with respect to the invoicing share is positive at the unilateral allocation. As discussed above, this implies that the derivative at the allocation under bargaining is also positive, and both sides of (21) are positive. The share of the customer's currency in the invoicing basket is then larger for bigger customers.

Intuitively, the marginal value of profits for the firm is higher when it fails to reach an agreement with a large customer than when it fails to do so with a smaller one. When bargaining with a large customer, the firm is thus more amenable to moving the use of the local currency beyond the level that it would unilaterally choose.

The central element of our result is not just the fact that failing to reach an agreement with a large customer entails substantial foregone profits, but that the marginal value of these profits is larger. If the firm is risk-neutral ($\rho_e = 0$) then the function H in (21) is equal to one, implying that customer size has no impact on the outcome of the bargaining process.

The impact of customer's size on the invoicing decision depends on the value of the derivative of the customer's surplus with respect to the invoicing share. If the bargaining allocation is substantially tilted towards the customer's preferences, because of a limited bargaining power of the exporter for instance, the derivative of the customer's surplus is small. The left hand side of (21) is then small and customer's size has little impact. Intuitively, being a large customer offers little additional benefit when the customer already has a substantial role in the bargaining process. By contrast, only large customers can tilt the invoicing allocation in their favor when their direct bargaining weight is limited. Our analysis can be summarized in the following implication:

Implication 9: Under a bargaining determination of invoicing, the use of the destination currency is more pronounced for larger customers.

Implication 10: Customer size has more impact on the invoicing decision when the bargaining allocation is close to the unilateral one.

3.6. Discussion

Our model shows that moving the choice of invoicing from a unilateral decision by a firm to a bargaining process substantially alters the results. First, it leads to a larger use of the destination currency as the marginal impact on the consumer's welfare is positive at the invoicing level unilaterally chosen by the firm (as long as (20) is positive). Second, this shift can be pronounced even when bargaining is dominated by the exporter. Third, the use of destination currency is larger for large sales, as the marginal value of profits is high for such sales. Fourth, the impact of customer's size is larger when customers have little direct influence on the bargaining process.

Our bargaining model also offers a channel through which firms in large countries are less likely to invoice in the currency of their consumers. In the model, we considered that the firm only sells to foreign consumers for brevity. The model could be extended to include domestic sales by the firm in its country. A firm with a large domestic market would have a lower marginal utility of profits than a firm with a small market, and thus be less amenable to shift its invoicing towards the destination currency. In addition, the firm could to have a larger bargaining power δ, which further reduces its willingness to accommodate the needs of foreign consumers.

While we have not assessed the impact of the various drivers considered in section 2 in our alternative model, the results are likely to be qualitatively similar.

Section 4. The Currency Invoicing of Canadian Imports

To explore the role of the various forces influencing invoicing we use a novel database containing 45 million individual import transactions for Canada, covering all imports during 2002 to 2009. We use this data to generate detailed observations on invoicing and to test the strength of hedging motives, of coalescing around a common invoicing currency in an industry, and of a bargaining relationship between importers and exporters.

4.1 The Invoicing Data

The Canada Border Services Agency (CBSA) records of every import transaction into Canada. Each transactions is accompanied by a customs invoice with detailed information on the context's exporting country of origin, currency of settlement, industry code (up to HS10), quantity, and value of transaction.[10] Our dataset is obtained from Statistics Canada (StatsCan) in conjunction with CBSA, contained the full roster of 44.5 million import transactions and spanning the period from February 2002 through February 2009. After observing some incomplete sampling in Feb and March 2002 we drop the months of data and then apply other filters to the database: transactions are dropped if there is missing information for invoicing currency, industry code, country of origin, or value. We drop Canadian imports from Canada as the country of origin, since these Canadian imports are most likely prior Canadian exports being returned to producers or are goods imported for the purpose of repairs. Additionally, in our econometric work (described below) we introduce variables that are country and time-specific. For tractability, we limit the group of exporting countries to the 47 that account for a combination of most import transactions by count (covering 95.9 percent) and by value (covering 97.1 percent).

Table 1 presents a decomposition of Canadian import transactions into broad product categories, and by associated exporting region. This decomposition is based on a *count* of import transactions, without regard to the value of each invoiced transaction. Table 2 provides a more conventional decomposition of imports, weighting these by value of transactions. While Canadian imports are widely dispersed across by exporting countries, the United States is the largest partner of Canada by a wide margin, accounting for 59 percent of all import transactions by count, and 57 percent by value. The next largest import sources for Canada are the eurozone (12 percent of import counts, 9 percent of import value) and Asia (both East and SouthEast Asia, and China).

The right most column of each of these tables shows the industry composition of Canadian imports. Clearly, industry concentration is lower than the concentration in terms of country of origin of these imports. Viewed from the lens of number of import transactions, imports of machinery and equipment account for 35 percent of the sample, followed by transport sector imports at 20 percent. Viewed transaction value, however, the relative size of these two

[10] The Customs Coding form can be referenced at http://www.cbsa-asfc.gc.ca/publications/forms-formulaires/b3-3.pdf

broad sectors is flipped (transport higher than machinery and equipment) and imports of mineral products have more visible economic significance.

Tables 1 and 2 also show that the presence of particular countries or regions in Canadian imports varies by the type of import. The United States share in Canadian Imports, divided according to sixteen broad industry group, ranges from a low of 40 percent (footwear/headgear by count; or 5 percent by value) to a high of 84 percent for mineral products, by count (77 percent for plastics/rubber by value). The eurozone countries are most prevalent in Canadian imports of chemicals, leather/furs/hides, and foodstuffs, although these latter products represent a low value of total imports. While East and South East Asia and China account for lower total shares in Canadian imports, the products supplied by these countries are highly concentrated in specific sectors, such as footwear/headgear and leather/furs/hides.

4.2 Broad observations on currency invoicing of imports

What broad patterns appear in the invoicing of Canadian imports? As a first depiction of this data, Figure 1 (upper and lower panels) presents the evolution of the share of US dollar (US$), Canadian dollars (CAD), euro's (EUR), and other currencies in invoicing Canadian imports. The data is presented in two formats. The upper panel of Figure 1 provides invoicing shares based on import transaction counts; the lower panel of Figure 1 shows currency shares in invoicing when transactions are import-value weighted. These figures provide some striking observations. In aggregate, we observe a dominant role for the US dollar, accounting over 85 percent of Canadian import invoices over the period between 2002 and 2009. This role has been quite stable over time. The CAD, euros, and other currencies each appear on less than 5 percent of Canadian import invoices. Interestingly, quite a different pattern appears in the lower panel. In the value-weighted invoicing data, the CAD share rises to between 20 and 25 percent of imports, reducing somewhat the economic prevalence of invoicing in US dollars (which nonetheless is still dominant) and reducing the prevalence of other currencies. There has been a small tendency toward an increase in CAD invoicing valuations.

Another way to slice the data is using the related metric and language of our theoretical exposition, casting invoicing choice according to producer currency pricing, local currency pricing, or vehicle currency pricing among exporters to Canada. Figure 2 shows the shares across exporting countries of own-currency use in exporting (PCP), versus CAD use (LCP),

versus third country or vehicle currency use (VCP). There are four panels in Figure 3, allowing us to distinguish between transaction counts and valuations, as well as between overall imports and imports from countries other than the United States. This focus is useful since the United States is an outlier both in terms of magnitude of trade with Canada and also in terms of the high PCP share in this trade. These figures are quite revealing.

In terms of transaction courts, local currency pricing is the least prevalent pricing practice across Canadian invoices (unweighted by value), regardless of whether transactions include the United States. For the full spectrum of transaction counts, PCP is the most prevalent form of pricing, reflecting both the U.S. exporter use of dollars, as well as invoicing in euros from the eurozone exporters, yen from Japanese exporters, and pound sterling from United Kingdom exporters. When U.S. transactions are excluded from the sample, VCP dominates transaction counts presumably due to the extensive international role of the U.S. dollar.[11]

A somewhat different invoicing profile appears in the value-weighted computations. PCP shrinks, with local currency pricing more prevalent. This interesting observation arises because in the Canadian data large value import transactions tend to use LCP more frequently than low value imports. PCP is seldom used on import transactions weighted by value when non-U.S. exporters are isolated. High-value exports most often use a vehicle currency for invoicing (the dollar) or LCP (the CAD).

Figure 3 shows the prevalence of PCP in the exports of the United States, eurozone, United Kingdom, Japan, China, and all other countries. The U.S. is an outlier in terms of strong PCP. For other countries shown, the degree of PCP is still substantial and more variable over time. PCP is a feature of fewer transactions across all other major exporters. However, in some cases the value of PCP trade has eroded less substantially.

Differences in invoice shares across count and value measures arise due to invoicing outcomes differing along the dimension of transaction size. Specifically, our tests over imports disaggregated at the HS2 or HS4 level repeatedly show statistically higher use of LCP in higher value import transactions. To illustrate the magnitude of such differences Table 3 presents the prevalence of LCP in import transaction in the upper 5^{th} percentile of transaction (by size) in each broad category of Canadian imports. Higher value import transactions, which the

[11] Figures 1 and 2 provide PCP, shares exporter own currency used in invoicing shares for the United States, Eurozone, Japan, United Kingdom, China and all other countries. Appendix is Figure 1 by count, Appendix Figure 2 is by value.

transaction size column suggests are generally substantially larger transactions and not just higher quality goods purchased, are consistently invoiced with substantially higher LCP shares. This pattern is robust to inclusion or exclusion of Canadian trade with the United States. [12] In 2002, PCP characterized about 40 percent of Canadian import invoices from the Eurozone and the United Kingdom, with this proportion falling to closer to 30 percent by 2009.

5. Econometric Analysis

We now turn to a formal assessment of the patterns in the data. Our econometric tests are devised to explore the determinants of LCP, PCP, and VCP for the full sample of Canadian imports described above. For each transaction, each left hand side regression variable – which represents a single import invoice -- takes a value of zero or 1: for example, in the LCP regression the dependent variable is one if an invoice is in CAD, and zero otherwise. The regression form is LOGIT, separately run for LCP, PCP, and VCP. Moreover, separate specifications are generated using data that span the full (cleaned) spectrum of import transactions (leaving a sample of approximately 42 million observations) or using data which excludes the United States counterparty transactions (leaving a sample of approximately 17 million import transactions). All regression specifications of the LCP, PCP, and VCP choice by transaction include time fixed effects and clustering of residuals by date (monthly).

5.1. Variables introduced in regressions

The regression variables introduced in our specifications are described below:

- $walras_t^i$ and ref_t^i: Constructed from the Rauch Index, and following the discussion in Goldberg and Tille (2008), these measures are high for higher elasticity of substitution goods. Recall that the Rauch index takes three values: differentiated, reference priced, and exchange traded or Walrasian goods. Organized exchange traded goods are those that are most highly substitutable with similar categories of foreign produced goods, and the differentiated products least substitutable, with the latter group including the bulk of manufactured products. The dummy variables $walras_t^i$ and ref_t^i take the respective values of 1 if goods are walrasian or reference priced (respectively), and zero otherwise so that

[12] Appendix Table 3 presents the shares of LCP, PCP, and VCP in each of these broad industries for transaction samples that include or exclude Canadian imports from the United States.

differentiated goods are the reference category.[13] With the walrasian and reference priced goods expected to place a lower weight on hedging and exchange rate volatility variables.

- $dollarpeg_t^e$ and $europeg_t^e$: constructed to be exporter specific at each date *t*, these dummy variables indicate whether the exporter is maintaining a dollar peg or is pegged to the euro. The peg classifications come from Reinhart and Rogoff's "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" These classifications go through the end of 2007, so we used the final values for our 2008 observations. The strict peg measure only includes an exact peg. The loose peg measure also includes observations within a 2 percent band. For the baseline regressions presented, only the strict pegs are included.
- $M_t^{i,e}$: constructed by exporter, by quarter, and by HS2 category, this variable reflects the share of each country's imports into Canada, as generated from the complete CBSA dataset. We use it to assess whether exporters from countries with a large market share in a particular industry in Canada are more inclined to use their own currency. The variable ranges from 0 to 1.
- $top5ind^n$ and $top5total^n$: constructed to proxy orders of large Canadian importers, these dummy variables take the value of 1 if the value of the invoice corresponding to being in the 95th or higher percentile for a particular HS4 code ($top5ind^n$) or for our *total* data sample ($top5total^n$), or is otherwise zero. For most regression results we focus only on the industry constructs.
- $ERvolatility_t^e$: This variable captures the degree of bilateral variability between the exporter's exchange rate and the Canadian dollar. In order to control for differences in levels of exchange rates, the construct is defined as the coefficient of variation of the Foreign/CAD exchange rate over a rolling lagged five-year period. The period-average exchange rate data come from the IMF's International Financial Statistics database.
- $Dollarshare_{t-1}^i$: This variable is a construct of the HS4 industry share of U.S. dollars in invoicing trade (by value). It is lagged one quarter in regressions.

[13] While the index is originally constructed for SITC codes, we used an SITC-HS concordance to match the variables. Rauch provided a "conservative" and a "liberal" classification, of which we use the conservative index.

- $HUS\$_t^e$, $Heuro_t^e$ and $HCAD_t^e$: As in Goldberg and Tille (2008), this hedging variable takes a value of 1 if the US dollar or CAD or euro are respectively are significantly better currencies for hedging the volatility of profits of the exporter, and are zero otherwise. Variable construction is described in the appendix.

Some specific observations are appropriate for the construction of the hedging variable. Intuitively, the hedging motive argues that the currency used for invoicing should be the currency which generates unexpected fluctuations in revenue that offset unexpected shocks to marginal costs, stemming from either wages or the strength of demand. If for instance an unexpected high growth in Canadian demand raises the marginal cost, the exporter has an incentive to invoice in a currency that tends to appreciate against his own in such states, thereby boosting his unit revenue. The challenge is to implement such a construct in for our sample of 48 exporters and over the full sample period. In practice, if there is a period of above trend growth in an export destination market, an exporter might value for invoicing via the hedging motive a currency that has tended to appreciate over similar periods of economic growth. We construct rolling correlations of exporter bilateral exchange rates against the proxy for exporter costs over the prior 8 quarters and use the pattern of observed correlations in an exporter's recent past to determine his hedging preference in period *t*. A hedging currency should appreciate (on average) when the export destination market has abnormally high growth, and should have a stronger positive correlation that would be the case if alternative currencies were used for hedging. In our data, the general trend is that the CAD is a good hedge early on in the period and late in the period. USD and EUR get some action in the middle. Across all countries and over the whole estimation period, the three currencies (and none at all) are about equally balanced: USD 22 percent, EUR 21 percent, CAD 26 percent and none 31 percent.

5.2. Econometric assessments of LCP, PCP, and VCP

Our econometric analysis is performed using LOGIT regressions over LCP, PCP, and VCP choices. The analysis is conducted for the full sample of all Canadian imports, for imports from non-U.S. countries, and for imports from the United States. The first pass through the data introduces all variables into each specification without interactions among these variables. Our next passes through the data are specifically aimed at hypothesis testing related to support for the

hedging motive, coalescing motive, exchange rate regimes, and the role of bargaining between customers and producers. The numerical results are given in additional tables, where columns represent distinct regressions and cells report maximum likelihood estimates of coefficients, with levels at which Pr > ChiSq in brackets beneath the estimates. Any coefficient estimates that are statistically significant at the 5 percent level are indicated in bold. The tables also report the number of observations used in the regressions, the number of observations for which the dependent variable is nonzero, and the AIC statistic on the regression fits. As noted, all regressions include time fixed effects and have clustered residuals by (monthly) date.

A broad assessment of the results

Instead of delving into all of the individual regression specification results (Tables 5 to 7), we first review the expected signs on terms introduced into the regressions and discuss which hypotheses are associated with these terms. This mapping of hypotheses to regression inputs is provided in Table 4, which is central for understanding the empirical findings of the paper. The terms are divided into four groups relevant for the hypotheses of drivers of currency invoicing of international trade: these headings including 1) coalescing or herding in a common currency, 2) hedging against profit volatility, 3) bargaining power of importing customers, and 4) direct role of exchange rate arrangements. The signs in the table denote the expected direction of results as predicted by the theoretical model. In terms of the vehicle currency, we take it to be the U.S. dollar for non-US exporters, so that reference priced and walrasian goods (those with higher elasticities of substitution among competing suppliers) would coalesce around the US dollar. Theoretically, the coalescing could occur around another currency.

Table 4 also is important in that it summarizes which of the theoretical hypotheses are confirmed or refuted by the empirical work. A "C" label next to the sign indicates that the estimated coefficients are consistent with the theoretical prediction and significant at the 5 percent level. An "I" label denotes that the estimated results are inconsistent and statistically significant. The absence of labels indicates that the coefficient estimates are not statistically significant.

Coalescing or herding in a common currency: When the dummy indicating highly substitutable goods is interacted with prior dollar shares in industry invoicing, we find support for the theoretical hypotheses. Industries with a large previous use of the dollars are more likely

to keep using dollars. Regressions that exclude the interacted terms find a more consistent pattern of support for $walras_t^i$ and ref_t^i.

Hedging against profit volatility: The hedging variables have mixed success in influencing the invoice currency choice, possibly reflecting the challenges of building these measures. PCP is higher for US exports when hedging motives favor the US dollar, and higher for LCP when hedging motives favor the CAD. The euro as a hedging currency is a less consistent predictor of choices. This mixed evidence on the hedging motive can arise either because the theory is not fully supported, or because the data underlying our tests are limited. It is possible that this indicator variable does not appropriately account for the profit correlations that enter into producer decisions. Exchange rate volatility of a country does not consistently reduce the prevalence of producer currency pricing, or raise the prevalence of PCP or VCP.

Bargaining power of importers. The presumption of our regressions is that larger imports into an industry in Canada are mapped to larger and more powerful importers. Thus, these imports are more likely to be associated with LCP since the importers prefer to have the exchange rate risk borne elsewhere. Indeed, some of the effects of enhanced bargaining power of dominant exporters – where high import share raises the likelihood of PCP – might be diminished when there are likewise large customers on the other side of the transaction. These hypotheses are broadly supported in the regression specifications.

Direct role of exchange rate arrangements. The hypotheses regarding exchange rate regimes and invoicing are broadly supported. Dollar peg countries are consistently found to use vehicle currencies more broadly, presumably the US dollar as the vehicle currency, and reduce the prevalence of LCP and PCP. Europeg countries are likely to use the euro more frequently, with LCP and VCP less prevalent.

Detailed regressions

We now turn to the detailed econometric results. For brevity we focus on the results for non-U.S. exporters, as the overall results are substantially driven by U.S. firms who nearly exclusively use the USD. Table 5 presents the estimates of a baseline regression that does not include any interaction between the various variables. Specifically, we estimate:

$$LCP_t^n \left(\text{or } PCP_t^n \text{ or } VCP_t^n\right) = \alpha_0 + \alpha_1 \cdot walras_t^i + \alpha_2 \cdot ref_t^i + \alpha_3 \cdot dollarpeg_t^e + \alpha_4 \cdot europeg_t^e + \alpha_5 \cdot M_t^{i,e}$$
$$+ \alpha_6 \cdot top5ind^n + \alpha_7 \cdot ERvolatility_t^e + \alpha_8 \cdot HUSD_t^e + \alpha_9 \cdot HEUR_t^e + \alpha_{10} \cdot HCAD_t^e + \mu_t$$

Exporters in industries where demand is sensitive to prices (*ref* or *walras*) tend to use the CAD and a vehicle currency (likely to be the USD) more extensively. This is consistent with a coalescing motive around the destination currency, for instance reflecting Canadian competition, or around the USD which is the standard currency in commodities.

Exporters from countries with an exchange rate peg to the USD invoice more in that currency (VCP) at the expense of their own. A peg with the euro leads exporters to favor the use of their own currency.

A higher share of Canadian imports reduces the use of the CAD, as exporters are in a stronger position vis-à-vis Canadian customers, and raise the use of the exporter's currency and, more so, the USD. Large orders, which reflect a stronger bargaining position of Canadian customers, are associated with a larger use of the CAD. What matters is whether orders are large relative to the industry in question, and not relative to overall imports.

Exporters from countries with a volatile exchange rate favor the USD over their own currency, a feature consistent with the theoretical finding that invoicing takes place in currencies with more stable fundamentals.

The analysis shows some limited support for the hedging motive. When the USD is a better hedging currency, invoicing is tilted towards it (but also towards the CAD). Similarly the CAD is used more extensively when it provides hedging benefits. By contrast favorable hedging properties of the euro are not associated with a more intensive use.

We now assess whether some of our variables are complementary, testing for the significance of interactions. We start by asking whether the coalescing motives (the *ref* and *walras*) variables interact with the aggregate use of the USD. The results are presented in Table 6 where we estimate:

$$LCP_t^n \left(\text{or } PCP_t^n \text{ or } VCP_t^n\right) = \alpha_0 + \alpha_1 \cdot walras_t^i + \alpha_2 \cdot ref_t^i + \alpha_3 \cdot dollarpeg_t^e + \alpha_4 \cdot europeg_t^e + \alpha_5 \cdot M_t^{i,e}$$
$$+ \alpha_6 \cdot top5ind^n + \alpha_7 \cdot ERvolatility_t^e + \alpha_8 \cdot HUSD_t^e + \alpha_9 \cdot HEUR_t^e + \alpha_{10} \cdot HCAD_t^e + \alpha_{11} \cdot walras_t^i \cdot$$
$$dollarshare_{t-1}^i + \alpha_{12} \cdot ref_t^i \cdot dollarshare_{t-1}^i + \mu_t$$

The results show that exporters in industries with a strong coalescing motive tend to use the CAD or their currency, at the expense of the USD. This does not imply that individual exporters do not use the USD, but instead that they require an aggregate use of that currency to do so, as shown by the interacted variables. The table thus offers supports for the coalescing hypothesis that firms in industries where demand is price-sensitive are more likely to invoice in the currency that has a higher aggregate role. Notice that this particular aspect could not be tested in earlier studies that relied on aggregated data.

We next turn to the hedging motive, and ask whether it is less prevalent in industries with a strong coalescing motive. Specifically, Table 7 shows the results of the following regression:

$$LCP_t^n \left(\text{or } PCP_t^n \text{ or } VCP_t^n\right) = \alpha_0 + \alpha_1 \cdot walras_t^i + \alpha_2 \cdot ref_t^i + \alpha_3 \cdot dollarpeg_t^e + \alpha_4 \cdot europeg_t^e + \alpha_5 \cdot M_t^{i,e} + \alpha_6 \cdot top5ind^n + \alpha_7 \cdot ERvolatility_t^e + \alpha_8 \cdot HUSD_t^e + \alpha_9 \cdot HEUR_t^e + \alpha_{10} \cdot HCAD_t^e + \alpha_{11} \cdot HUSD_t^e \cdot walras_t^i + \alpha_{12} \cdot HUSD_t^e \cdot ref_t^i + \alpha_{13} \cdot HEUR_t^e \cdot walras_t^i + \alpha_{14} \cdot HEUR_t^e \cdot ref_t^i + \alpha_{15} \cdot HCAD_t^e \cdot walras_t^i + \alpha_{16} \cdot HCAD_t^e \cdot ref_t^i + \mu_t$$

Intuitively, we expect firms in industries with strong coalescing motives to have less leeway to pick the currency that would best hedge their own costs, as they have to keep in line with the pattern of invoicing in their own industry.

We find some support for this conjecture: firms for which the euro offers hedging benefits use it relatively less when they have to also take account of substantial coalescing considerations. The signs are reversed for the CAD and USD, as firms with such considerations are most likely to use the currency in question when it offers hedging benefits. This pattern potentially reflect the fact that industries with high coalescing motive coordinate either around the CAD, due to Canadian competition for instance, or the USD. The hedging and coalescing motive could then be complementary, whereas they are opposite in the case of the euro.

Finally, we consider the interaction of variables reflecting the relative bargaining powers of consumers and firms with other variables. This is done in Table 7 where we estimate:

$$LCP_t^n \left(\text{or } PCP_t^n \text{ or } VCP_t^n\right) = \alpha_0 + \alpha_1 \cdot walras_t^i + \alpha_2 \cdot ref_t^i + \alpha_3 \cdot dollarpeg_t^e + \alpha_4 \cdot europeg_t^e + \alpha_5 \cdot M_t^{i,e} + \alpha_6 \cdot top5ind^n + \alpha_7 \cdot ERvolatility_t^e + \alpha_8 \cdot HUSD_t^e + \alpha_9 \cdot HEUR_t^e + \alpha_{10} \cdot HCAD_t^e + \alpha_{11} \cdot top5ind^n \cdot M_t^{i,e} + \mu_t$$

Large shipments are more likely to be invoiced in CAD, whereas exporters make more use of their own currency when they represent a large share of the market. Interacting the two shows that the invoicing tilt towards the CAD for large shipments is more marked when exporters represent a large share of the market. This finding is in line with our theoretical result that customer size matters most when exporters have a higher bargaining power, which can be proxied by their market share.

6. Concluding Remarks (to be further developed)

This paper addresses two limitations that affect the existing literature on international trade invoicing. On the theory side, we address the lack of interplay between customers and exporters in the selection of invoicing currencies. We develop a model where invoicing is set through a bargaining game between the exporter and the customer. Two main results emerge. First, a unilateral invoicing choice by the exporter, as considered in the literature, is likely to lead to a use of the destination currency that is suboptimally low from the point of view of the consumer. Second, our model implies that the use of the customer's currency is more pronounced for large sales, especially when the direct bargaining power of exporters is high.

On the empirical side we test a range of determinants of invoicing by using a new highly disaggregated dataset for 45 million Canadian import transactions. We begin by documenting the patterns of invoicing. While the U.S. dollar is extensively used, other currencies still account from 72.9 percent of imports by count (68.4 percent by value) from countries other than the United States. We find strong support for coalescing or herding a common currency, strong support for the bargaining power of importing customers, strong support for a direct role of exchange rate arrangements, and only mixed support for invoicing decisions influenced by profit hedging considerations. The latter weakness could be a result of the difficulty getting an appropriate indicator of this choice.

References:

Bacchetta, Philippe and van Wincoop, Eric. 2005. “A Theory of the Currency Denomination of International Trade.” *Journal of International Economics*, (December) 67(2), pp. 295-319.

Devereux, Michael, Engel, Charles, and Storgaard, Peter. 2004. “Endogenous Exchange Rate Pass-Through when Nominal Prices are set in Advance.” *Journal of International Economics*, 63(2), pp. 263-291.

Donnenfeld, Shabtai and Haug, Alfred. 2003. "Currency Invoicing in International Trade: An Empirical Investigation." *Review of International Economics*, 11, pp. 332-345.

Friberg, Richard, and Wilander, Fredrik, 2008. “The currency denomination of exports -- A questionnaire study.” *Journal of International Economics*, 75(1), pp. 54-69.

Friberg, Richard. 1998. "In which Currency Should Exporters Set their Prices?" *Journal of International Economics*, 45(1), pp. 59-76.

Goldberg, Linda, and Cédric Tille. 2008. “Vehicle currency use in international trade.” *Journal of International Economics*, 76, pp. 177-192.

Gopinath, Gita, Oleg Itskhoki and Roberto Rigobon. “Currency Choice and Exchange Rate Pass-through", *American Economic Review*, forthcoming.

Novy, Dennis, 2006. Hedge your Costs: Exchange Rate Risk and Endogenous Currency Invoicing, mimeo, University of Cambridge.

Rauch, James. 1999. “Networks versus Markets in International Trade.” *Journal of International Economics*, 48, pp. 7-35.

Reinhart and Rogoff’s "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?"

Table 1. Regional Exporter Presence in Canadian Imports by Broad Industry Group, by Count

Percent Share in Import Transaction Counts							
Broad Industry Category	United States	Eurozone	East and SE Asia	China	Other Americas	All Other Countries	Percent of Total
Animal Products	68.2	5.0	9.9	4.6	3.0	9.3	1.0
Vegetable Products	60.6	7.9	7.5	5.9	3.8	14.3	3.1
Foodstuffs	61.7	11.8	7.8	3.5	1.6	13.5	3.2
Mineral Products	84.0	4.6	1.5	3.2	0.7	6.1	1.5
Chemicals	70.3	11.5	2.8	3.3	0.4	11.6	9.8
Plastics/Rubbers	63.7	11.2	7.8	3.3	0.9	13.2	7.0
Leather/Furs/Hides	44.2	14.3	13.1	9.3	1.9	17.2	1.0
Wood Products	66.3	9.8	8.2	4.7	1.0	9.9	7.2
Textiles	42.8	13.6	14.6	9.2	1.4	18.4	9.3
Footwear/Headgear	39.7	12.9	18.2	15.1	1.9	12.1	1.2
Stone/Glass	52.9	13.3	9.7	6.8	1.7	15.7	4.6
Metals	61.7	11.4	7.3	4.6	0.8	14.2	13.2
Machinery/Electrical	56.3	13.4	8.8	3.5	0.9	17.1	23.2
Transportation	65.4	10.3	5.9	3.2	0.8	14.3	2.8
Miscellaneous	54.5	11.6	10.7	6.5	0.5	16.2	10.9
Service	67.2	8.9	7.1	2.9	0.7	13.1	0.8
Total	58.9	11.8	8.6	5.0	1.0	14.7	

Table 2. Regional Exporter Presence in Canadian Imports by Broad Industry Group, by Value

Percent Share in Import Transaction Value							
Broad Industry Category	United States	Eurozone	East and SE Asia	China	Other Americas	All Other Countries	Percent of Total
Animal Products	62.3	5.5	8.3	7.9	4.2	11.8	0.8
Vegetable Products	69.6	5.5	3.7	2.8	6.2	12.2	1.9
Foodstuffs	58.6	17.7	4.0	1.9	4.9	12.8	3.0
Mineral Products	26.9	4.6	0.3	0.4	1.3	66.5	10.9
Chemicals	59.0	19.3	1.3	2.0	1.2	17.2	7.8
Plastics/Rubbers	76.9	5.1	5.4	6.0	0.4	6.1	4.7
Leather/Furs/Hides	14.4	15.9	5.3	53.2	3.0	8.2	0.4
Wood Products	79.4	7.2	2.3	6.0	1.6	3.5	3.4
Textiles	32.2	6.7	11.4	33.2	0.9	15.6	2.7
Footwear/Headgear	4.9	11.0	11.9	64.8	3.9	3.6	0.5
Stone/Glass	55.5	8.7	2.7	8.0	11.3	13.8	2.2
Metals	64.5	7.6	4.9	9.4	3.7	9.8	6.8
Machinery/Electrical	54.5	7.9	9.0	11.1	0.3	17.2	25.7
Transportation	68.9	9.1	4.2	0.8	0.9	16.0	21.0
Miscellaneous	47.3	9.7	4.6	22.2	0.2	15.9	6.2
Service	59.6	24.0	0.7	0.9	0.1	14.7	2.0
Total	56.6	9.2	5.0	7.5	1.5	20.2	

Table 3. LCP Share and Import Transaction Size

	Including the United States				Excluding the United States			
	Median Transaction Size, CAD		LCP Share by Count		Median Transaction Size, CAD		LCP Share by Count	
Broad Industry Category	Low 95th Percentile	Upper 5th Percentile	Low 95th Percentile	Upper 5th Percentile	Low 95th Percentile	Upper 5th Percentile	Low 95th Percentile	Upper 5th Percentile
Animal Products	7,378	366,215	3.3	8.7	3,861	457,343	5.7	16.2
Vegetable Products	3,508	320,042	3.7	5.2	2,335	221,396	5.7	9.3
Foodstuffs	6,720	329,681	4.4	19.4	2,733	326,451	6.0	24.5
Mineral Products	4,174	1,173,402	2.9	7.1	764	27,059,727	5.2	7.0
Chemicals	2,221	260,242	4.5	13.8	1,462	262,860	6.6	19.3
Plastics/Rubbers	3,287	312,689	3.0	8.9	1,289	187,073	3.3	13.9
Leather/Furs/Hides	816	141,768	3.3	9.3	1,309	284,232	3.4	10.3
Wood Products	1,502	209,611	3.2	12.6	539	150,689	4.1	13.5
Textiles	924	151,503	3.7	8.8	1,030	180,142	4.0	10.7
Footwear/Headgear	520	233,843	4.5	7.8	1,014	375,026	4.7	7.7
Stone/Glass	1,668	188,994	3.5	7.0	1,307	183,740	4.0	8.7
Metals	1,788	243,673	3.2	7.9	925	211,080	3.7	13.2
Machinery/Electrical	4,005	509,480	2.9	8.5	2,861	560,843	3.3	10.9
Transportation	13,655	2,523,291	2.5	10.2	6,071	1,921,510	2.7	13.4
Miscellaneous	2,133	267,970	3.4	10.3	1,937	277,942	3.8	13.2
Service	2,521	557,624	5.4	15.1	1,929	545,826	6.4	20.6

Table 4 Summary of Hypotheses and Empirical Results

The signs indicated denoted the expected direction of results as predicted by the theoretical model. If estimatesare consistent with the prediction and significant at the 5 percent level, the symbol C for consistent is entered. If inconsistent and statistically significant, the symbol I is entered. If no symbols are entered, the results are statistically insignificant. For non-US exporters the VCP is assumed USD. $Heuro^{e}_{t-1}$ and *europeg* raise PCP for euro exporters only.

Hypothesis	Corresponding Variable	Regression Coefficients Non-US Exports to Canada			Regression Coefficients US Exports To Canada		
		LCP	**PCP**	**VCP**	**LCP**	**PCP**	**VCP**
Coalescing or herding in a common currency	Ref^{i}	**- I**	**- C**	**+ C**	**-I**	**+C**	**-C**
	$Walras^{i}$	**- I**	**- C**	**+ C**	**-C**	**+C**	**-C**
	Ref^{i}	**- I**	**- I**	**+ I**	**-I**	**+I**	**-C**
	$Walras^{i}$	**- I**	**- I**	**+ I**	**-I**	**+I**	**-C**
	$Ref^{i} \bullet Dollarshare^{i}_{t-1}$	**- C**	**- C**	**+ C**	**-C**	**+C**	**-C**
	$Walras^{i} \bullet Dollarshare^{i}_{t-1}$	**- C**	**- C**	**+ C**	**-C**	**+C**	**-C**
Hedging against profit volatility	$HCAD^{e}_{t-1}$	**+C**	**-**	**-**	**+**	**-**	**-**
	$Heuro^{e}_{t-1}$	**-I**	**+I**	**-I**	**-C**	**-**	**+**
	$HUS\$^{e}_{t-1}$	**-**	**-C**	**+C**	**-**	**+**	**-**
	$HCAD^{e}_{t-1} \bullet ref^{i}\left(walras^{i}\right)$	**–**	**+**	**+**	**-**	**+**	**+**
	$Heuro^{e}_{t-1} \bullet ref^{i}\left(walras^{i}\right)$	**+(I/C)**	**-(I,C)**	**+I**	**+I**	**+C**	**-C**
	$HUS\$^{e}_{t-1} \bullet ref^{i}\left(walras^{i}\right)$	**+**	**+I**	**-**	**+**	**-**	**+**
	$ERvolatility^{e}_{t-1}$	**+**	**-C**	**+C**	**+*C***	**-*C***	**+*C***
Bargaining power of importing customers	$importshare^{e,i}_{t}$	**+ C**	**+C**	**- C**	**- C**	**+ C**	**- C**
	$top5ind^{i}$	**+ C**	**- C**	**- C**	**+ C**	**- C**	**- C**
	$importshare^{e,i}_{t} \bullet top5ind^{i}$	**+ C**	**- C**	**+C**	**+ C**	**- C**	**- C**
Direct role of exchange rate arrangements	$dollarpeg^{e}_{t}$	**- C**	**- C**	**+ C**			
	$europeg^{e}_{t}$	**- I**	**+ C**	**- C**			

Table 5 Baseline Regression

	All Canadian Import Transactions			All Canadian Imports, excluding US			All Canadian Imports, from US		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
Ref	**0.27**	**-0.09**	**-0.07**	**0.49**	**-0.23**	**0.02**	**0.05**	**0.08**	**-1.15**
	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.04]
Walras	**0.02**	**0.09**	**-0.08**	**0.23**	**-0.18**	**0.07**	**-0.19**	**0.36**	**-2.21**
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.10]
Dollarpeg	**-0.13**	**1.54**	**-1.02**	**-0.12**	**-1.36**	**0.96**			
	[0.02]	[0.07]	[0.06]	[0.01]	[0.04]	[0.02]			
Europeg	**0.10**	**1.49**	**-1.30**	**0.10**	**1.42**	**-1.26**			
	[0.01]	[0.06]	[0.06]	[0.01]	[0.02]	[0.02]			
Importshare	**-0.57**	**6.24**	**-8.33**	**-5.68**	**0.65**	**0.89**	**-0.61**	**0.61**	**-0.53**
	[0.02]	[0.07]	[0.12]	[0.10]	[0.04]	[0.04]	[0.03]	[0.03]	[0.03]
Top5ind	**1.34**	**-1.24**	**0.63**	**1.67**	**-0.32**	**-0.55**	**1.24**	**-1.07**	**-1.84**
	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.05]
ERcoefvar	0.33	**5.37**	**-4.26**	-0.14	**-7.23**	**5.03**	-1.19	-8.40	20.13
	[0.29]	[2.05]	[1.87]	[0.30]	[1.90]	[1.32]	[29.59]	[20.64]	[30.63]
HUSD	0.05	**-0.24**	**0.25**	**0.07**	**-0.23**	**0.18**			
	[0.02]	[0.06]	[0.08]	[0.02]	[0.04]	[0.03]			
HEUR	**0.05**	-0.30	0.25	**0.07**	**-0.16**	**0.11**	-0.05	0.25	-0.07
	[0.02]	[0.20]	[0.21]	[0.02]	[0.06]	[0.05]	[0.37]	[0.26]	[0.39]
HCAD	0.01	-0.17	0.18	**0.06**	-0.01	0.00	0.07	-0.13	0.06
	[0.03]	[0.17]	[0.17]	[0.02]	[0.03]	[0.02]	[0.73]	[0.51]	[0.76]
AIC	12,563,956	27,373,110	24,454,140	5,787,297	13,428,808	15,670,579	6,713,172	7,579,768	1,554,428
Observations	40,642,260	40,642,260	40,642,260	16,538,291	16,538,291	16,538,291	24,103,969	24,103,969	24,103,969
Dependent=1	1,506,593	26,084,860	13,050,807	735,226	2,879,709	12,923,356	771,367	23,205,151	127,451

Note: All regressions include time fixed effects. Regressions follow a Binary Logit Model, with maximum likelihood estimate of coefficients provide and [.] reporting standard errors. Indicated in bold are significant coefficients at the 5 percent probability level.

Table 6 Canadian Imports and Coalescing Motive

	All Canadian Import Transactions			All Canadian Imports, excluding US			All Canadian Imports, from US		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
Ref	**1.31**	**0.21**	**-0.86**	**1.25**	**0.81**	**-1.11**	**1.38**	**-1.35**	**1.31**
	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.07]
Walras	**0.69**	**0.11**	**-0.34**	**0.43**	**1.01**	**-0.98**	**1.07**	**-1.01**	**1.15**
	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.04]	[0.05]	[0.22]
Dollarpeg	**-0.15**	**1.57**	**-1.05**	**-0.11**	**-1.33**	**0.94**			
	[0.02]	[0.07]	[0.06]	[0.01]	[0.04]	[0.02]			
Europeg	**0.09**	**1.48**	**-1.29**	**0.10**	**1.43**	**-1.26**			
	[0.01]	[0.06]	[0.07]	[0.01]	[0.02]	[0.02]			
Importshare	**-0.53**	**6.21**	**-8.27**	**-5.76**	**0.55**	**0.98**	**-0.55**	**0.55**	**-0.47**
	[0.02]	[0.07]	[0.12]	[0.10]	[0.03]	[0.04]	[0.03]	[0.03]	[0.03]
Top5ind	**1.34**	**-1.25**	**0.64**	**1.67**	**-0.32**	**-0.55**	**1.26**	**-1.09**	**-1.86**
	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.05]
ERcoefvar	0.23	**5.85**	**-4.73**	-0.27	**-6.80**	**4.84**	13.43	-7.16	-14.08
	[0.31]	[2.25]	[2.06]	[0.32]	[1.96]	[1.39]			[30.85]
HUSD	0.03	**-0.25**	**0.27**	**0.07**	**-0.23**	**0.18**			
	[0.02]	[0.07]	[0.08]	[0.02]	[0.04]	[0.03]			
HEUR	0.04	-0.35	0.31	**0.07**	**-0.15**	**0.10**	**-0.73**	**0.17**	**1.68**
	[0.02]	[0.20]	[0.21]	[0.02]	[0.07]	[0.05]	[0.09]	[0.07]	[0.39]
HCAD	0.00	-0.26	0.26	**0.05**	-0.01	0.01	-0.48	0.05	**1.33**
	[0.03]	[0.17]	[0.17]	[0.02]	[0.03]	[0.02]			[0.09]
Ref * Dollarshare	**-1.28**	**-0.37**	**0.96**	**-0.95**	**-1.31**	**1.41**	**-1.61**	**1.73**	**-3.12**
	[0.01]	[0.02]	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]	[0.13]
Walras * Dollarshare	**-0.77**	-0.02	**0.30**	**-0.25**	**-1.47**	**1.28**	**-1.40**	**1.52**	**-3.97**
	[0.03]	[0.04]	[0.04]	[0.03]	[0.02]	[0.02]	[0.04]	[0.05]	[0.20]
AIC	12,084,732	26,453,543	23,673,806	5,577,185	12,936,509	15,096,980	6,445,729	7,288,484	1,509,919
Observations	39,244,109	39,244,109	39,244,109	16,013,317	16,013,317	16,013,317	23,230,792	23,230,792	23,230,792
Dependent=1	1,450,312	25,136,185	12,657,612	708,199	2,771,962	12,533,156	742,113	22,364,223	124,456

Note: All regressions include time fixed effects. Regressions follow a Binary Logit Model, with maximum likelihood estimate of coefficients provide and [.]reporting standard errors. Indicated in bold are significant coefficients at the 5 percent probability level.

Table 7 Canadian Imports and Hedging Motive

	All Canadian Import Transactions			All Canadian Imports, excluding US			All Canadian Imports, from US		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
Ref	**0.24**	**-0.13**	-0.03	**0.54**	**-0.17**	0.02	**0.09**	**0.04**	**-1.11**
	[0.02]	[0.03]	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.08]
Walras	**-0.06**	**0.18**	**-0.14**	**0.16**	**-0.14**	**0.09**	**-0.19**	**0.35**	**-1.81**
	[0.02]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.01]	[0.01]	[0.12]
Dollarpeg	**-0.14**	**1.54**	**-1.03**	**-0.12**	**-1.36**	**0.96**			
	[0.02]	[0.07]	[0.06]	[0.01]	[0.04]	[0.02]			
Europeg	**0.10**	**1.49**	**-1.30**	**0.10**	**1.42**	**-1.26**			
	[0.01]	[0.06]	[0.06]	[0.01]	[0.02]	[0.02]			
Importshare	**-0.56**	**6.23**	**-8.32**	**-5.67**	**0.65**	**0.88**	**-0.61**	**0.61**	**-0.53**
	[0.02]	[0.07]	[0.12]	[0.09]	[0.03]	[0.04]	[0.03]	[0.03]	[0.03]
Top5ind	**1.34**	**-1.24**	**0.63**	**1.67**	**-0.32**	**-0.55**	**1.24**	**-1.07**	**-1.84**
	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.05]
ERcoefvar	0.36	**5.36**	**-4.26**	-0.14	**-7.23**	**5.03**	1.39	-8.37	19.99
	[0.29]	[2.05]	[1.87]	[0.30]	[1.90]	[1.32]		[20.62]	[30.65]
HUSD	-0.01	**-0.22**	**0.24**	**0.08**	**-0.22**	**0.18**			
	[0.02]	[0.07]	[0.08]	[0.02]	[0.04]	[0.03]			
HEUR	0.05	-0.31	0.27	**0.08**	**-0.16**	**0.12**	-0.08	0.23	-0.06
	[0.03]	[0.21]	[0.22]	[0.02]	[0.06]	[0.05]		[1.53]	[0.39]
HCAD	0.01	-0.18	0.18	**0.06**	0.00	0.00	0.14	-0.14	0.06
	[0.03]	[0.17]	[0.18]	[0.02]	[0.03]	[0.02]		[0.25]	[0.76]
HUSD * Ref	**0.26**	**-0.12**	**0.08**	-0.04	**-0.08**	0.04			
	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]			
HUSD * Walras	**0.25**	**-0.40**	**0.27**	0.02	**-0.05**	0.01			
	[0.03]	[0.04]	[0.04]	[0.04]	[0.02]	[0.01]			
HEUR * Ref	-0.05	**0.13**	**-0.17**	**-0.09**	0.03	**-0.12**	**-0.05**	**0.05**	-0.09
	[0.03]	[0.04]	[0.04]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.09]
HEUR * Walras	0.01	-0.04	0.01	**0.10**	**-0.08**	**-0.07**	-0.01	0.02	-0.24
	[0.03]	[0.04]	[0.05]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.19]
HCAD * Ref	0.01	0.05	-0.05	**-0.04**	**-0.08**	**0.03**	**-0.05**	**0.04**	-0.03
	[0.03]	[0.04]	[0.04]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.09]
HCAD * Walras	**0.09**	**-0.09**	0.04	**0.10**	-0.03	-0.04	0.01	0.00	**-1.27**
	[0.02]	[0.04]	[0.04]	[0.03]	[0.03]	[0.02]	[0.01]	[0.02]	[0.18]
AIC	12,561,998	27,369,123	24,450,703	5,787,206	13,428,365	15,669,708	6,713,126	7,579,717	1,554,312
Observations	40,642,260	40,642,260	40,642,260	16,538,291	16,538,291	16,538,291	24,103,969	24,103,969	24,103,969
Dependent=1	1,506,593	26,084,860	13,050,807	735,226	2,879,709	12,923,356	771,367	23,205,151	127,451

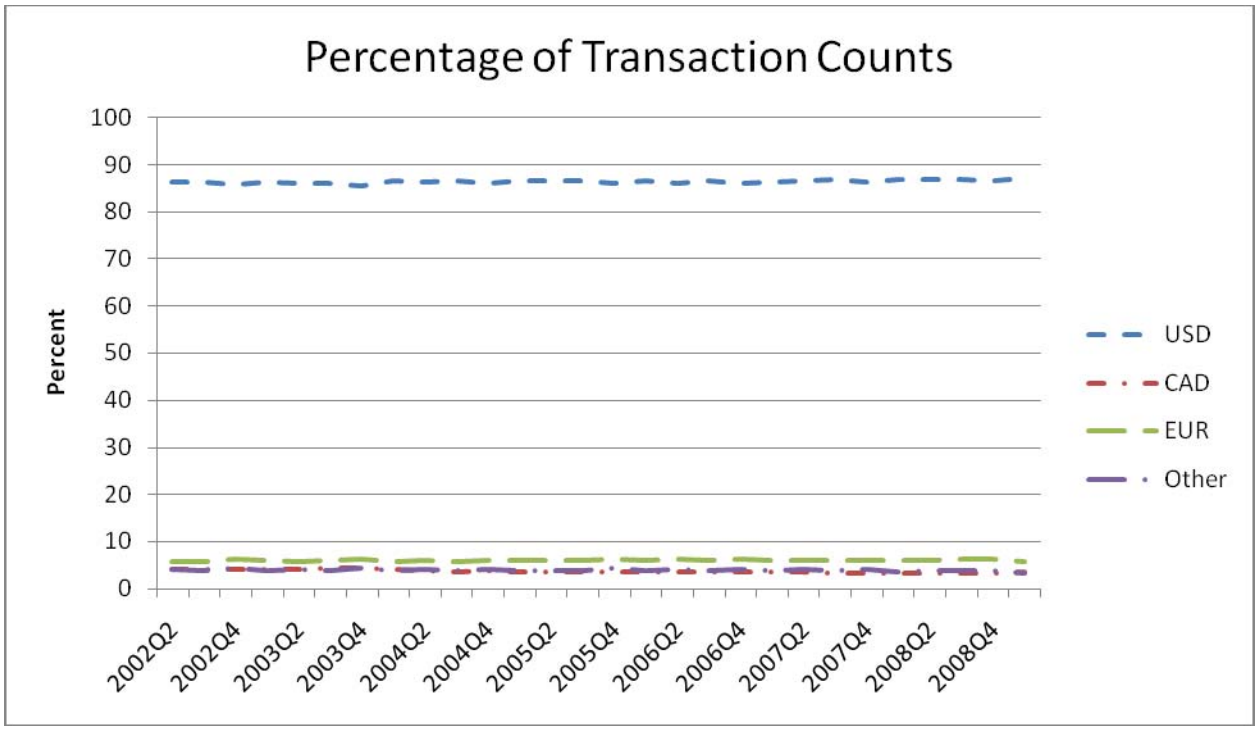
Note: All regressions include time fixed effects. Regressions follow a Binary Logit Model, with maximum likelihood estimate of coefficients and [.] reporting standard errors.

Table 8 Canadian Imports and Hedging and Bargaining Forces

	All Canadian Import Transactions			All Canadian Imports, excluding US			All Canadian Imports, from US		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
Ref	**0.27**	**-0.09**	**-0.07**	**0.50**	**-0.23**	**0.02**	**0.05**	**0.08**	**-1.15**
	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.04]
Walras	**0.01**	**0.08**	**-0.07**	**0.23**	**-0.18**	**0.07**	**-0.19**	**0.35**	**-2.21**
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.10]
Dollarpeg	**-0.14**	**1.51**	**-0.99**	**-0.11**	**-1.36**	**0.96**			
	[0.02]	[0.07]	[0.06]	[0.01]	[0.04]	[0.02]			
Europeg	**0.10**	**1.49**	**-1.31**	**0.10**	**1.42**	**-1.26**			
	[0.01]	[0.06]	[0.06]	[0.01]	[0.02]	[0.02]			
Importshare	**-0.51**	**6.39**	**-8.72**	**-7.61**	**0.91**	**0.53**	**-0.64**	**0.64**	**-0.53**
	[0.02]	[0.07]	[0.12]	[0.13]	[0.03]	[0.04]	[0.03]	[0.03]	[0.03]
Top5ind	**1.47**	**-0.69**	**-0.05**	**1.54**	**-0.17**	**-0.67**	**1.03**	**-0.83**	**-1.15**
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]	[0.11]
ERcoefvar	0.32	**5.33**	**-4.18**	-0.18	**-7.23**	**5.03**	3.26	-8.77	19.27
	[0.30]	[2.05]	[1.87]	[0.29]	[1.90]	[1.32]		[20.64]	[30.64]
HUSD	0.03	**-0.24**	**0.25**	**0.07**	**-0.23**	**0.18**			
	[0.02]	[0.07]	[0.08]	[0.02]	[0.04]	[0.03]			
HEUR	**0.05**	-0.29	0.25	**0.07**	**-0.16**	**0.10**	-0.11	0.24	-0.06
	[0.02]	[0.20]	[0.21]	[0.02]	[0.07]	[0.05]		[0.26]	[0.39]
HCAD	0.01	-0.17	0.17	**0.05**	-0.01	0.00	0.18	-0.15	0.04
	[0.03]	[0.17]	[0.17]	[0.02]	[0.03]	[0.02]		[0.51]	[0.76]
Top5ind * Importshare	**-0.39**	**-1.53**	**3.28**	**3.64**	**-2.55**	**1.94**	**0.35**	**-0.41**	**-1.21**
	[0.01]	[0.03]	[0.04]	[0.11]	[0.07]	[0.05]	[0.03]	[0.03]	[0.19]
AIC	12,561,566	27,337,067	24,344,189	5,783,582	13,424,779	15,666,035	6,712,847	7,579,307	1,554,383
Observations	40,642,260	40,642,260	40,642,260	16,538,291	16,538,291	16,538,291	24,103,969	24,103,969	24,103,969
Dependent=1	1,506,593	26,084,860	13,050,807	735,226	2,879,709	12,923,356	771,367	23,205,151	127,451

Note: All regressions include time fixed effects. Regressions follow a Binary Logit Model, with maximum likelihood estimate of coefficients provide and [.] reporting standard errors. Indicated in bold are significant coefficients at the 5 percent probability level.

Figure 1. Currency Use in Invoicing Canadian Imports



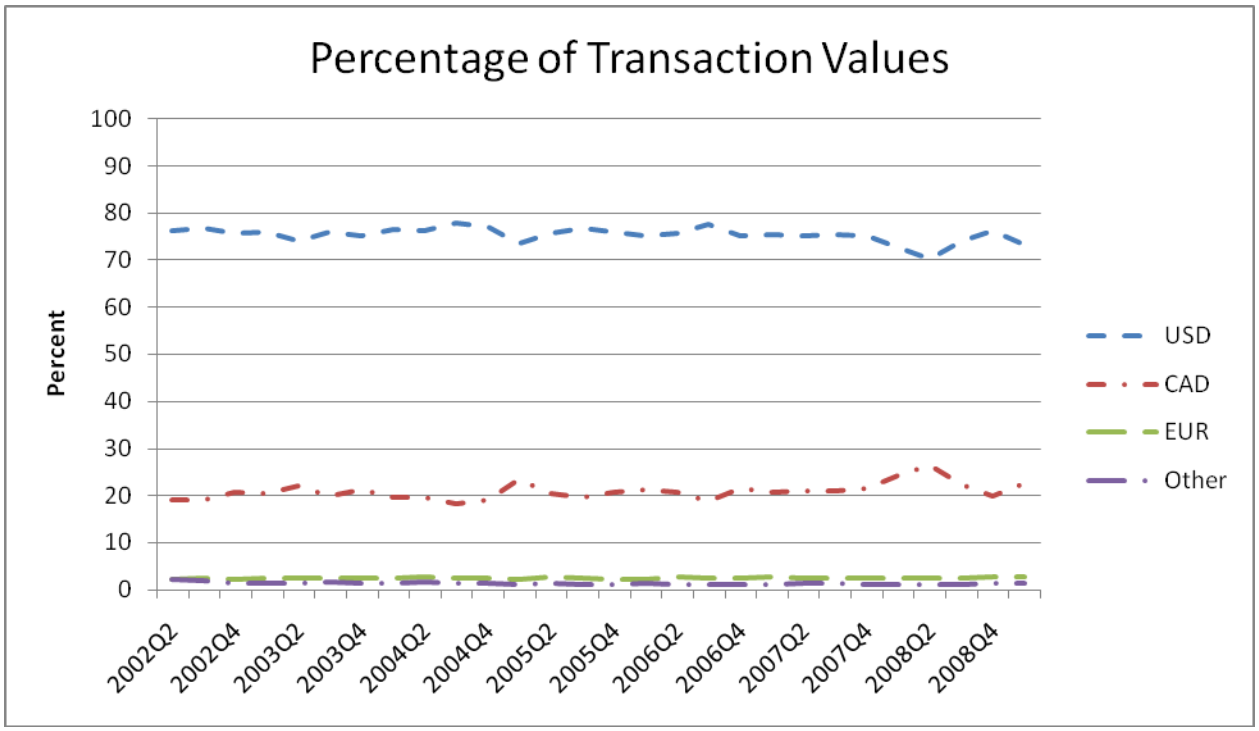
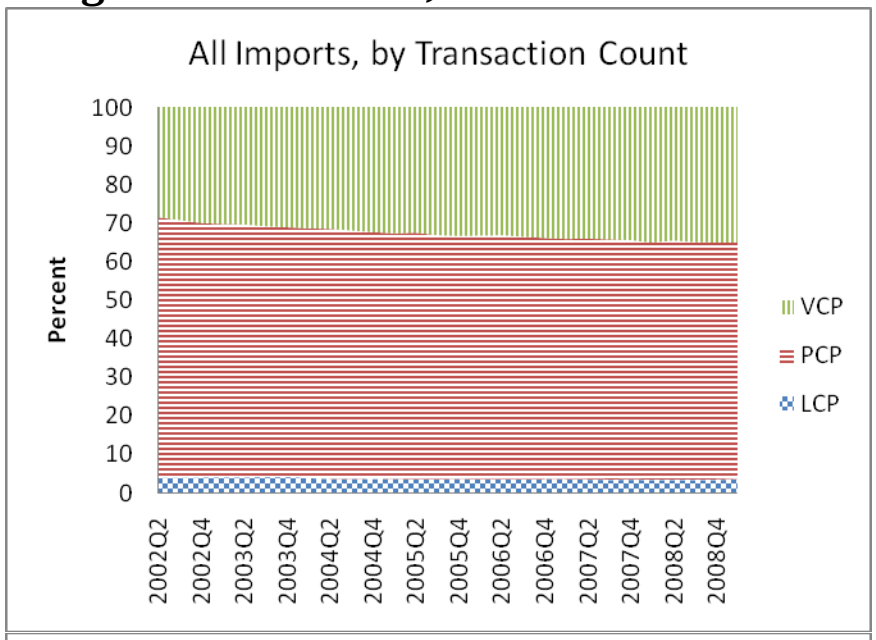
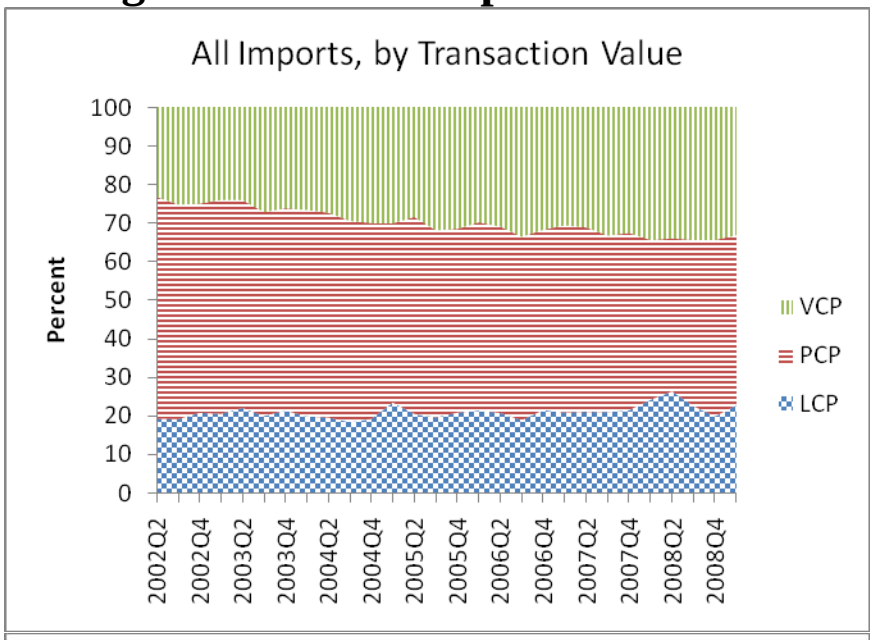
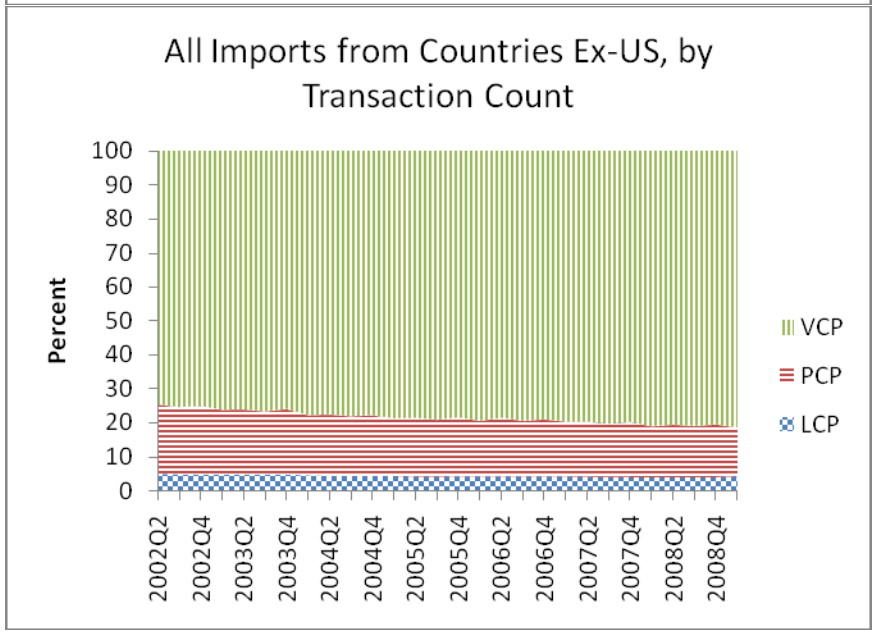


Figure 2. Producer, Local and Vehicle Currency Pricing in Canadian Import Transactions







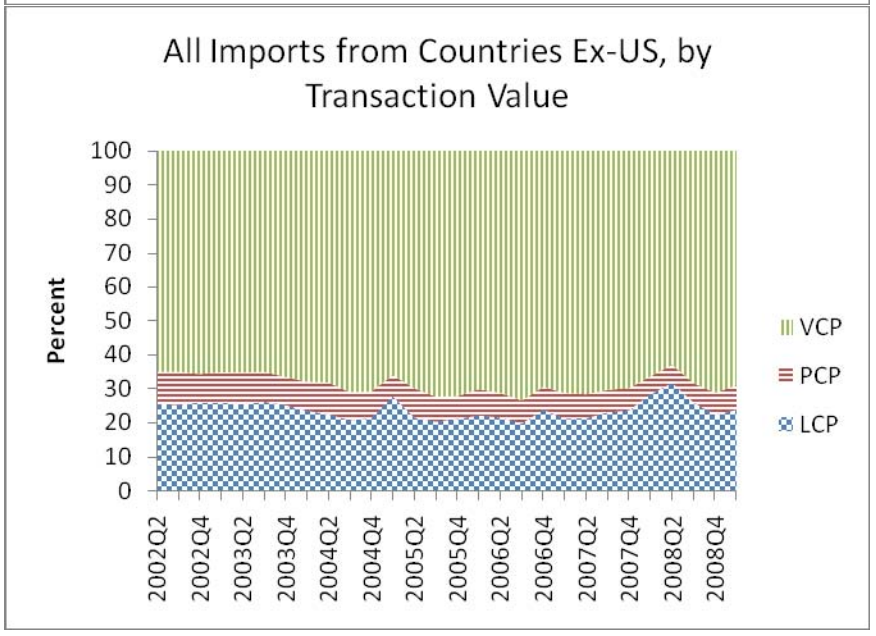
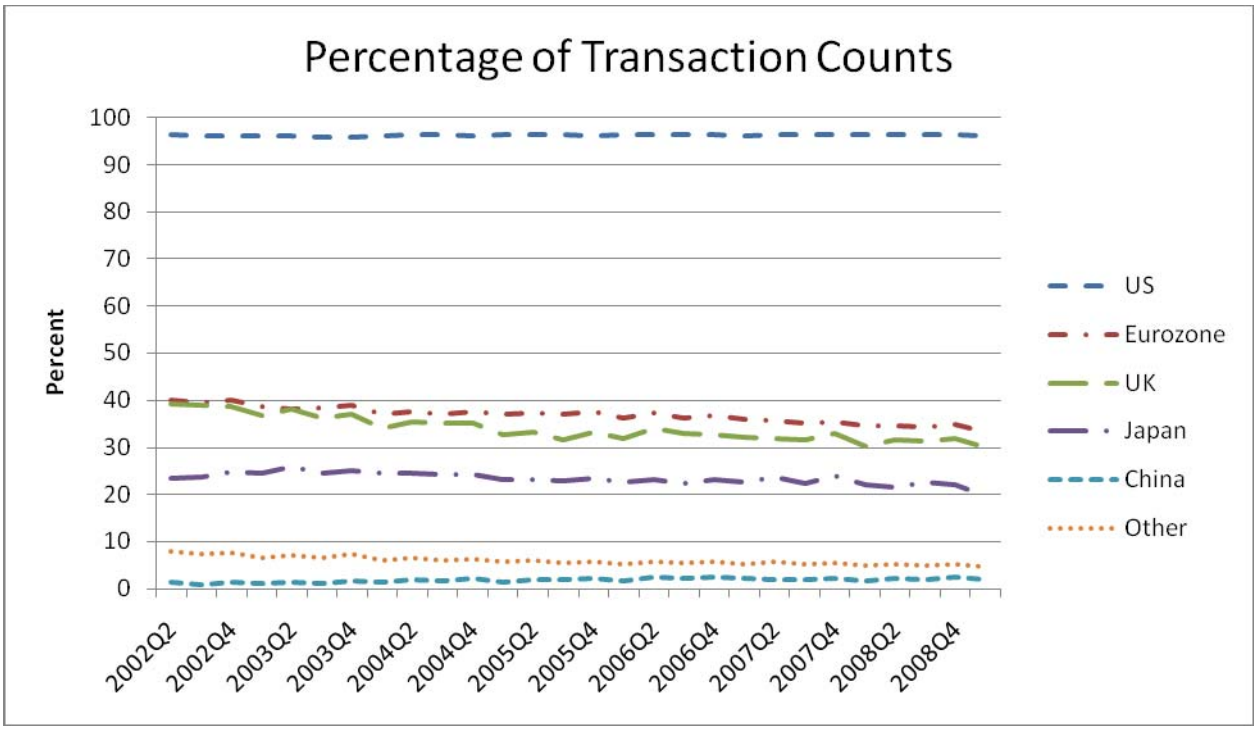
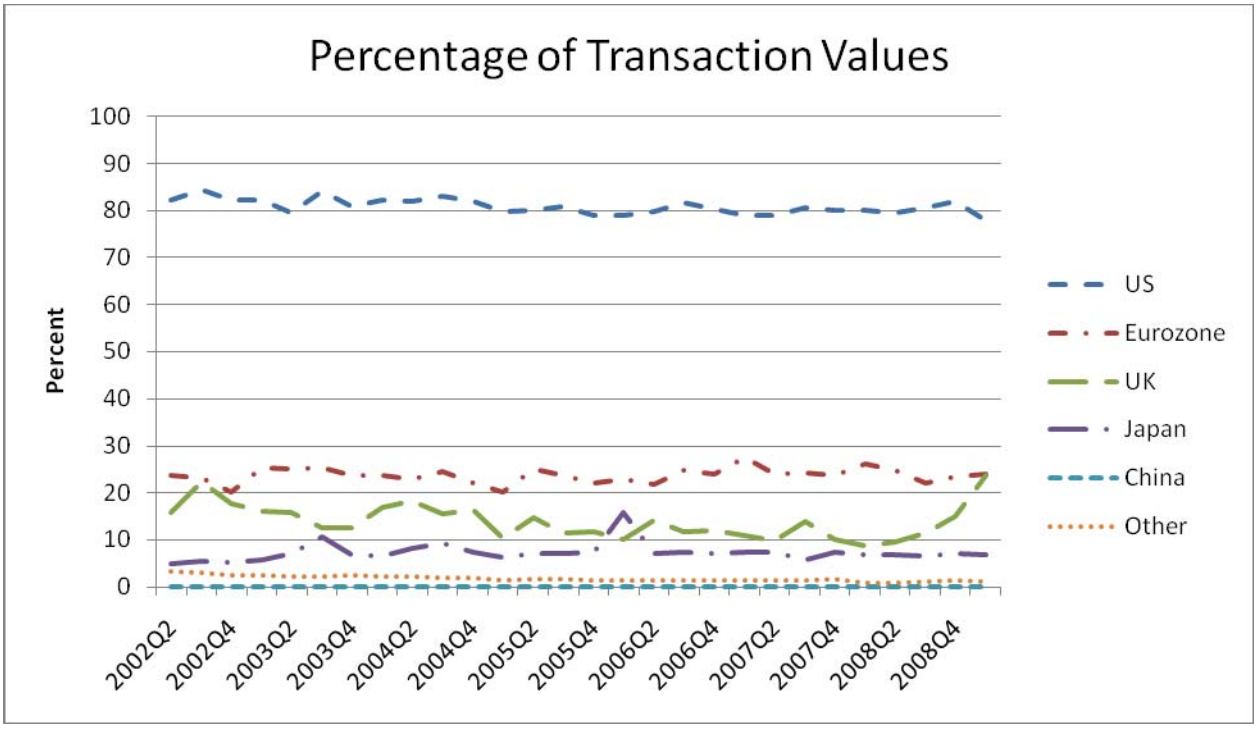
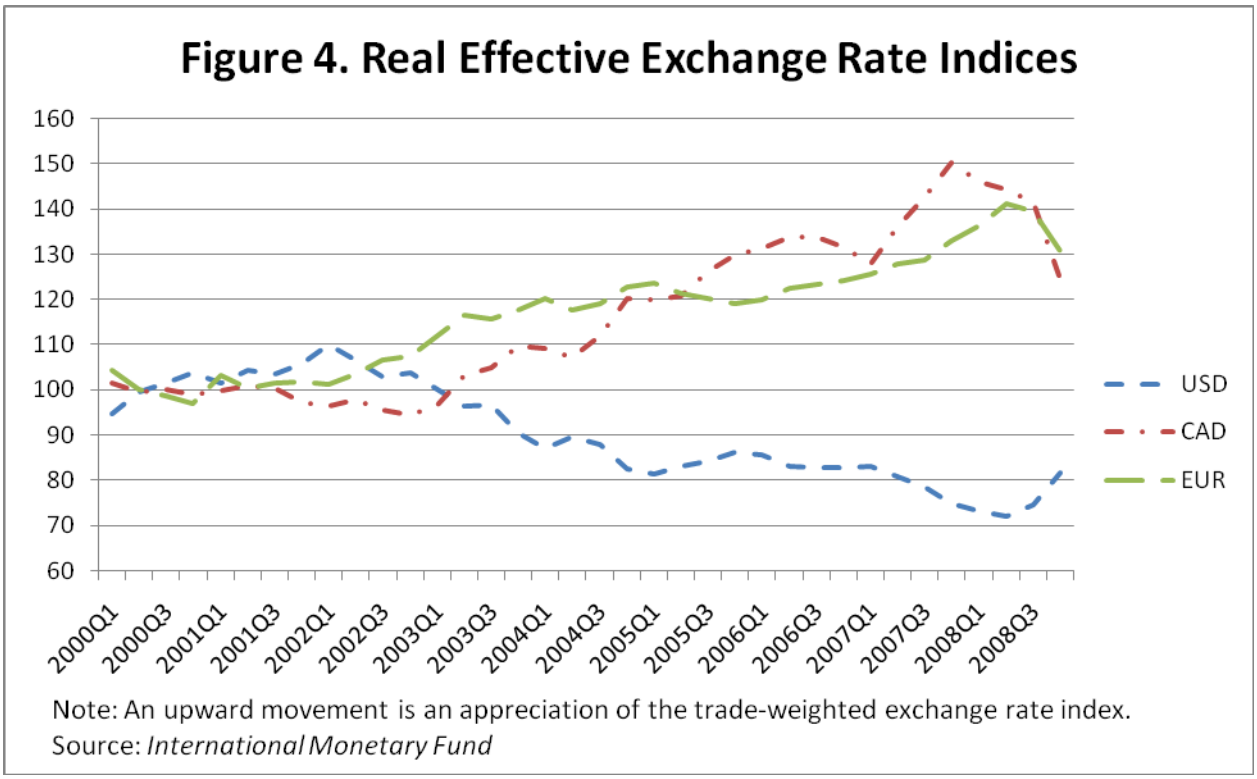


Figure 3. Prevalence of Producer Currency Pricing by Specific Exporters







Appendix

Constructing the hedging variable. As exposited in Goldberg and Tille (2008), the hedging motive for invoice currency selection reflects the covariances between exchange rates and producer marginal costs $\rho(m_{ed}, s_{ed})$ and $\rho(m_{ed}, s_{ev})$. The idea is that the producer should choose an invoicing currency so that revenues are highest when costs are highest, with this positive correlation helping to hedge producer profitability. Producer marginal costs are modeled as $m_{ed} = w_e + (1-\alpha)/\alpha \cdot c_d$ where w_e is the wage or producer price index representing the unit marginal cost of the exporter and $c_{d,e}$ is the sensitivity of marginal costs to changes in demand, representing the shape of the production frontier.[14] We proxy for

[14] For the approximately 50 countries covered as exporters to Canada we have wage data and producer price index data. For the 26 countries across which both wage and PPI data are available, these series tend to be highly correlated in most cases except for France and Japan, and positively but less strongly correlated for parts of Asia. Wage data were nominal and in the home currency from the ILO : http://laborsta.ilo.org/ . PPI data are from the IMFs IFS database.

exporter marginal costs in each country by constructing quarterly values for m_{ed}, where the cost of inputs w_e are the logs nominal producer price indices in exporter's currency, α is set at 0.65, and c_d is the log of real consumption in Canada as the export destination market "*d*". The ppi values are more desirable than pure wages since they internalize the cost of imported inputs that can influence hedging decisions. (Even more desirable would be industry-specific production costs). s_{ek} is in units of currency *e* per unit of currency *k* so an increase is a depreciation of currency *e*.

In our application to the Canadian data, ideally surprises in consumption strength and ppi would be correlated with surprise depreciations of the exporter currency to extract a preferred hedge. We do not have data coverage to run this type of experiment. Instead, we compute each m_{ed} and run a rolling correlation with three bilateral exchange rates, which are vis-à-vis dollars, euros, and CAD, over 8 prior quarters of data. A desirable hedging currency has a positive correlation and a higher correlation than the two alternative currencies. If no currencies have recent positive correlations with the m_{ed}, then all hedge dummies are given a zero value at a particular date. The constructed indicator variables are *H$, HEURO*, and *HCAD* that take the

Appendix Table 1

		Percent of Observations	
Country	Frequency	By Count	By Value
Algeria	2,804	0.01	1.10
Angola	638	0.00	0.97
Australia	189,876	0.44	0.43
Austria	264,842	0.61	0.32
Belgium	283,294	0.65	0.43
Brazil	293,295	0.67	0.74
Chile	70,499	0.16	0.35
China	2,086,341	4.78	7.29
Czech Republic	166,495	0.38	0.07
Denmark	248,269	0.57	0.35
Finland	161,066	0.37	0.26
France	848,044	1.94	2.44
Germany	1,366,460	3.13	2.69
Hong Kong	379,889	0.87	0.16
Hungary	121,353	0.28	0.06
India	638,209	1.46	0.44
Indonesia	305,158	0.70	0.24
Iraq	239	0.00	0.45
Ireland	137,397	0.31	0.53
Israel	211,370	0.48	0.22
Italy	1,039,771	2.38	1.31
Japan	1,119,697	2.57	3.66
Malaysia	290,031	0.66	0.64
Mexico	804,077	1.84	3.67
Netherlands	361,875	0.83	0.51
Nigeria	5,889	0.01	0.65
Norway	90,394	0.21	1.36
Pakistan	133,013	0.30	0.07
Peru	63,036	0.14	0.33
Philippines	229,161	0.53	0.23
Poland	155,627	0.36	0.16
Portugal	133,610	0.31	0.10
Russia	59,141	0.14	0.44
Saudi Arabia	10,028	0.02	0.38
Singapore	159,667	0.37	0.32
South Africa	110,256	0.25	0.18

Appendix Table 1 cont.

		Percent of Observations	
Country	Frequency	By Count	By Value
South Korea	593,440	1.36	1.65
Spain	336,599	0.77	0.36
Sweden	366,043	0.84	0.54
Switzerland	458,790	1.05	0.55
Taiwan	970,169	2.22	0.96
Thailand	467,332	1.07	0.52
Turkey	226,562	0.52	0.18
United Kingdom	1,027,244	2.35	3.34
United States	24,654,574	56.49	54.96
Venezuela	14,926	0.03	0.38
Vietnam	193,860	0.44	0.15
Total	41,850,350	95.89	97.12

Appendix Table 2: Standalone Regression introduction of variables

	All Canadian Imports			Canadian Imports, excluding US		
	LCP	**PCP**	**VCP**	**LCP**	**PCP**	**VCP**
Ref	0.164	0.541	-0.614	0.528	-0.138	-0.047
	[0.003]	[0.003]	[0.003]	[0.005]	[0.004]	[0.004]
Walras	-0.061	0.487	-0.509	0.263	-0.262	0.140
	[0.005]	[0.004]	[0.004]	[0.007]	[0.008]	[0.007]
Dollarpeg	-0.376	3.971	-3.869	-0.346	-1.150	0.886
	[0.004]	[0.022]	[0.018]	[0.012]	[0.021]	[0.009]
Europeg	0.067	1.541	-1.339	0.067	1.537	-1.336
	[0.003]	[0.011]	[0.008]	[0.003]	[0.011]	[0.008]
Importshare	-0.679	7.474	-9.201	-3.963	-3.328	3.649
	[0.005]	[0.029]	[0.031]	[0.060]	[0.038]	[0.039]
Top5ind	1.030	-0.410	0.158	1.012	-0.410	-0.142
	[0.009]	[0.008]	[0.009]	[0.009]	[0.009]	[0.008]
Top5tot	0.411	0.119	-0.335	0.549	-0.360	-0.014
	[0.003]	[0.003]	[0.003]	[0.005]	[0.009]	[0.005]
ERcoefvar	0.657	-2.318	2.329	0.525	-9.470	7.365
	[1.008]	[5.629]	[5.726]	[0.439]	[3.725]	[2.982]
Hedge$	0.328	-2.733	2.667	0.133	-0.370	0.301
	[0.019]	[0.185]	[0.204]	[0.024]	[0.093]	[0.085]
HedgeEuro	-0.029	-0.416	0.464	-0.022	-1.427	1.180
	[0.031]	[0.420]	[0.444]	[0.027]	[0.092]	[0.080]
HedgeCAD	-0.011	-0.317	0.359	0.007	-0.500	0.441
	[0.033]	[0.408]	[0.433]	[0.033]	[0.090]	[0.085]
Dollarshr$_{t-1}$	-1.017	0.269	-0.098	-0.872	-1.058	1.125
	[0.019]	[0.015]	[0.011]	[0.016]	[0.015]	[0.010]

Note: Variable pairs in regressions indicated by shading of rows. All regressions include time fixed effects. Standard errors in brackets. For each set of variables, the table reports the results of 6 distinct regressions.

Appendix Table 3. Prevalence of LCP, PCP and VCP by Broad Industry Category

Broad Industry Category	Invoicing Shares, by Count			Invoicing Shares, by Value		
	Local Currency	Producer Currency	Vehicle Currency	Local Currency	Producer Currency	Vehicle Currency
Animal Products	3.5	72.6	23.9	11.2	63.6	25.2
Vegetable Products	3.8	65.3	30.9	6.7	69.7	23.6
Foodstuffs	5.1	70.9	24.0	33.0	53.5	13.5
Mineral Products	3.1	84.1	12.8	22.3	17.1	60.6
Chemicals	4.9	72.3	22.7	35.8	46.9	17.3
Plastics/Rubbers	3.3	67.8	29.0	13.2	70.9	15.9
Leather/Furs/Hides	3.6	52.2	44.2	10.9	18.8	70.3
Wood Products	3.7	71.2	25.1	24.7	62.9	12.4
Textiles	3.9	49.9	46.2	12.5	31.3	56.1
Footwear/Headgear	4.7	47.3	48.0	7.5	11.4	81.1
Stone/Glass	3.7	58.3	38.0	6.5	56.7	36.8
Metals	3.5	65.6	31.0	11.2	61.7	27.1
Machinery/Electrical	3.2	61.8	35.0	12.5	53.6	34.0
Transportation	2.9	69.3	27.8	33.9	49.7	16.3
Miscellaneous	3.8	59.6	36.6	16.0	46.3	37.7
Service	5.9	66.9	27.2	25.1	53.2	21.7

Appendix Table 3 cont. Prevalence of LCP, PCP and VCP by Broad Industry Category, Excluding US

Broad Industry Category	Invoicing Shares, by Count			Invoicing Shares, by Value		
	Local Currency	Producer Currency	Vehicle Currency	Local Currency	Producer Currency	Vehicle Currency
Animal Products	6.2	18.7	75.0	22.5	10.7	66.8
Vegetable Products	5.9	15.7	78.4	14.6	7.8	77.7
Foodstuffs	6.9	30.8	62.3	51.4	16.1	32.5
Mineral Products	5.3	15.1	79.6	16.9	0.2	82.9
Chemicals	7.2	16.8	76.0	51.7	7.3	41.0
Plastics/Rubbers	3.9	17.4	78.8	23.9	7.5	68.6
Leather/Furs/Hides	3.8	17.1	79.2	11.3	6.6	82.1
Wood Products	4.6	21.1	74.3	23.0	16.6	60.3
Textiles	4.3	15.2	80.4	12.3	4.9	82.8
Footwear/Headgear	4.8	15.6	79.6	6.8	7.9	85.3
Stone/Glass	4.2	15.4	80.4	6.3	11.0	82.7
Metals	4.2	15.4	80.4	16.7	7.0	76.4
Machinery/Electrical	3.7	17.4	79.0	16.3	9.4	74.3
Transportation	3.3	19.2	77.5	41.7	6.8	51.5
Miscellaneous	4.3	16.0	79.8	19.8	8.8	71.4
Service	7.1	13.0	79.9	19.6	27.6	52.8