Exchange rate pass-through into import prices revisited: what drives it?

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Abstract

A large sample of developed and emerging economies is utilized to investigate import exchange rate pass-through. Panel models reveal that various economic aspects of the destination country can explain about one third of the total variation in pass-through elasticities and the remaining variation comes largely in the form of unobserved country-specific effects. Inflation, exchange rate volatility, openness and relative wealth play a clear role as drivers of emerging markets' pass-through whereas the output gap and protectionism appear influential more generally. Nonlinearity regarding large versus small changes in the exchange rate is quite pervasive. Our evidence challenges the widely-held view that pass-through has been universally falling in developed markets and that it is higher for emerging markets. The economic drivers are shown to play a role as out-of-sample predictors of pass-through. The findings confirm pricing-to-market theories and have implications for the optimal conduct of monetary policy.

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1 Introduction

The extent to which import prices reflect currency fluctuations, a phenomenon called exchange rate pass-through (ERPT), lies at the heart of various academic and policy debates including the international transmission of monetary shocks, the optimal conduct of domestic monetary policy and the resolution of global trade imbalances.[1] The so-called import price ERPT elasticity can plausibly range between 0% and 100% depending on exporters' pricing strategies. When export prices are set up as a markup over marginal costs, foreign firms' willingness to offset currency fluctuations by markup adjustments — a strategy known as local currency pricing (LCP) — results in incomplete ERPT. If this prevails, the importing economy is "insulated" from terms-of-trade shocks and, in turn, from any expenditure switching effects originating from currency fluctuations. On the other hand, if exporters do not adjust margins when the exchange rate fluctuates — a strategy known as producer currency pricing (PCP) — the pass-through is complete in line with the Law of One Price.[2]

In a world of inflation targeting, the impact of exchange rate fluctuations on import prices is relevant to governments, as well as to producers and consumers. Under complete ERPT, domestic currency depreciations increase import prices which can translate into domestic consumer price inflation. However, much of the recent empirical literature suggests that import price ERPT is not complete. The lower the degree of import price ERPT the smaller the interest rate adjustment required to maintain the inflation target; thus monetary policy becomes more effective. Hence, a deeper understanding of the ERPT mechanisms is key to Central Banks for

[1] This paper focuses on the narrowest definition of pass-through to the prices of goods observed "at the dock", *i.e.* when they first arrive in the destination country, as opposed to wider definitions such as the pass-through to the price of the same imported goods at retail (store counter) or to the general price level (CPI). Additional mechanisms are in place in the latter two definitions (over and above the pricing policy of the exporter) such as the costs of transportation from the exporting country to the destination country, the costs of distribution and retail (including real wages and rents) that apply between the dock in the country of import and the store counter, the degree of competition among local producers, and central bank reaction functions.

[2] The Law of One Price states that, under costless arbitrage, identical goods sold in different markets must have the same common-currency price which, in turn, implies that import pass-through must be complete.

policy-making. Import pass-through also matters for optimal exchange rate regime choice. The fear of floating typically associated with developing economies is partly linked to apprehension about complete (or high) import ERPT and its consequences for the trade balance.

Using the early 1970s currency realignments as laboratory, Kreinin (1977) documented various degrees of ERPT; a relatively small pass-through to US import prices at 50 percent and larger ones for Germany, Japan and Italy at 60, 70 and 100 percent, respectively. Moreover, the currency crises (*i.e.* depreciations) experienced in the 1990s, surprisingly, did not entail high inflation rates implying that ERPT was incomplete. This apparent resilience of import prices to fluctuations in the exchange rate has been the subject of a vast theoretical and empirical literature. Recently, the focus of interest shifted from the question of whether pass-through is complete or incomplete to whether pass-through is *endogenous* to the importing economy. In particular, a crucial issue is whether the pass-through is itself influenced by domestic monetary policy and, more generally, whether the pass-through is a "micro" or "macro" phenomenon.

In a seminal paper, Dornbusch (1987) provides a theoretical model that explains incomplete pass-through with microeconomic factors such as the degree of market concentration and product homogeneity/substitutability and the relative market shares of domestic and foreign firms. Further fuelling the debate, Campa and Goldberg (2005) relate the level of ERPT to the product composition of imports, and conclude that the variation in ERPT is a micro phenomenon. In contrast, Marazzi et al. (2005) provide unfavorable evidence that a shift in the geographical composition of US imports was able to explain the declining pass-through documented for this country. Other studies challenge the main conclusion of Campa and Goldberg (2005) by documenting that the country-variation in ERPT is a macro phenomenon. For instance, Taylor (2000) suggests that the degree of ERPT hinges on a country's relative monetary policy, and attributes the US pass-through decline to lower inflation and exchange rate variability. Choudhri and Hakura (2006) show that the CPI pass-through is positively and significantly related, first, to the average inflation rate, and second, to the variance of inflation and the exchange rate.

Ca'Zorzi et al. (2007) show a positive nexus between cross-section inflation variation and CPI pass-through variation among emerging markets. Broadening the analysis to both import and export price ERPT elasticities, Bussière and Peltonen (2008) find strong links with macro factors such as the exchange rate regime and volatility of domestic inflation whereas micro factors proxied by the degree of import dependence and the trade flow product composition are found to play a more modest role.

The present study contributes to the pass-through literature in several directions. First, it sheds further light on the ongoing "micro" versus "macro" debate. To do so, it considers a wider set of potential drivers including *protectionism* materialized in import tariffs and *nonlinearity* in the form of a sign effect (i.e. asymmetry between appreciations and depreciations) and a size effect (i.e. asymmetry between large and small exchange rate changes). Both aspects, protectionism and nonlinearity, are to-date not very common features in empirical pass-through studies.[3] The large exchange rate fluctuations and increase in protectionism observed in the wake of the recent global financial crisis provide a noteworthy motivation. At a methodological level, a departure from the majority of existing studies that analyze the nexus between ERPT and macro/micro aspects of the importing economy is that we exploit both the country- and time-variation in pass-through rates; *e.g.* Choudhri and Hakura (2006) and Bussière and Peltonen (2008) focus their efforts on explaining the cross-section variation whereas Campa and Goldberg (2005) allow for time-variation in a limited split-sample manner. A full pooling across countries and quarterly periods allows us to control for unobserved (latent) country-specific or time-specific factors that may otherwise introduced biases in parameter estimates. An out-

[3] The empirical literature that has investigated nonlinearity in ERPT is still quite scant. Most existing studies are based on a single or a few countries: Herzberg et al. (2003) on the UK, Marazzi et al. (2005) and Pollard and Coughlin (2004) on the US, Khundrakpam (2007) on India, and Bussière (2007) on the G7 economies. Overall the findings are rather conflicting. Using 1978-2000 data, Pollard and Coughlin (2004) document sign asymmetry (*i.e.* appreciations versus depreciations) in about half of 30 industries but the direction is quite mixed; on the whole, the size effect dominates. Using 1975-2001 data, Herzberg et al. (2003) do not refute the hypothesis that the import ERPT mechanism is linear. Bussière (2007) investigates the pass-through to both import and export prices and concludes that nonlinearities/asymmetries cannot be ignored.

of-sample forecasting analysis of the relative role of the various macro/micro drivers is also attempted; to our knowledge, no other paper has done so. Second, we complement the literature by exploiting a relatively large sample of 19 "developed" markets (DMs) and 18 "emerging" markets (EMs) over the period 1980Q1-2009Q3 which includes the recent aggressive monetary intervention by some advanced countries. Thus we can assess possible differences across the two groups of countries regarding the importance of the drivers. Despite the growing importance of EMs in international trade, very few studies have as yet considered a wide cross-section of both EMs and DMs (see Goldfajn and Werlang, 2000; Frankel et al., 2005; Choudhri and Hakura, 2006; Bussière and Peltonen, 2008).[4] Finally, the analysis is based not only on nominal effective exchange rates but also on *trade-weighted* or *effective* foreign export prices which should add accuracy to ERPT estimates. Previous studies proxy foreign export prices by consumer prices, producer prices, or some other cost measures of the exporting country; all these proxies reflect mainly the evolution of prices for consumption or production, but not prices for exports. For instance, Anderton's (2003) export price is a weighted average of the producer prices of 7 major euro area import suppliers and Campa and Goldberg's (2005) is a trading-partner cost index.

Our findings suggest that pass-through in the short-run (defined as one quarter) is closer between emerging and developed economies than hitherto believed; this result is robust across different data spans such as the overall period 1980Q1-2009Q3, a balanced sample 1997Q1-2009Q3 and a subsample 1980Q1-2007Q4 that excludes the recent global financial crisis. The direct policy implication is that the "fear of floating" of EMs may have been overstated as these countries appear less affected by currency changes than commonly thought. Moreover, our findings challenge previous studies which argue that pass-through rates have been universally falling among DMs. The in-sample panel analysis suggests that about 1/3 of the total country/time

[4] Choudhri and Hakura (2006) investigate CPI pass-through and focus on the role of the inflation environment. Goldfajn and Werlang (2000) exclusively study the link between accumulated inflation over periods t to $t+j$ and depreciation over $t-1$ to $t+j-1$. Frankel et al. (2005) use highly disaggregated data. Bussière and Peltonen (2008) assess the nexus between country-variation in pass-through rates and the average inflation and NEER volatility, openness and the trade share of high-tech goods.

variation in pass-through rates can be explained by macro and micro aspects of the importing economy. Inflation and exchange rate volatility stand out in terms of economic significance, relative to other drivers, especially for EMs. This finding confirms the endogeneity of the ERPT to monetary policy although it mainly comes through when the recent financial crisis period (characterized by aggressive monetary policy) is excluded. Beyond that, the results are quite robust to the recent crisis. Proxies for "micro" factors such as relative consumer's wealth and import dependence have a significant influence on pass-through, in line with theory, although only for EMs. The most pervasive drivers across EMs and DMs are: size asymmetries, the country-specific stage of the business cycle and import tariffs. Thus our novel evidence brings to the forefront the important theoretical nexus between pass-through and trade protectionism which has been largely neglected. The total variation in pass-through rates that remains unexplained, at about 67%, is mostly due to "hidden" factors of country-specific type as opposed to time-specific (or global) ones. Our out-of-sample forecasting analysis confirms that there is an element of predictability in short-run import pass-through via both macro and micro factors.

The rest of the paper unfolds as follows. Section 2 outlines the main variables and the methodology. Section 3 presents the in-sample and out-of-sample analysis of the predictive content of macro/micro drivers for import pass-through. A final section concludes.

2 Data and Methodology

2.1 Import Price, Export Price and Exchange Rate

The analysis begins by building individual import ERPT models for each of 18 EMs and 19 DMs in our sample.[5] The variables involved are the exchange rate, the local-currency (domestic)

[5] We follow the country listing by *The Economist* because of its large emphasis on the real economy; *e.g.* it is also employed by Michigan State University to produce its Market Potential Index (see http://globalEDGE.msu.edu/resourceDesk/mpi/). For our sample, the lists by *The Economist* and the IMF's World Economic Outlook Report (October 2008) coincide. However, the classification of some of the countries is controversial: Hong Kong, Singapore and Israel are classified as DMs by MSCI Barra and FTSE but as EMs

import price and the foreign-currency export price. The former is a nominal effective exchange rate (NEER) index of foreign currencies per unit of the domestic currency. For each of the 37 countries, the import price proxy (a measure of the domestic price of goods and services "at the dock") is matched with an *effective* foreign export price proxy (a measure of the foreign price of goods and services coming into the country). The latter is constructed from individual foreign export prices and bilateral trade figures.[6] The observations are quarterly for a maximum period 1980Q1 to 2009Q3. In what follows $t = 1, ..., T$ denote quarters, and $i = 1, ..., N$ importing countries, $p_{i,t}$ is the import price, $p^*_{i,t}$ is the *effective* export price and $s_{i,t}$ is 1/NEER with NEER defined as above (all variables in logs).

2.2 Time-Series and Panel Modeling of ERPT Drivers

Our baseline empirical framework is the linear dynamic *error correction* model:

$$\Delta p_{i,t} = a_i + \beta_i \Delta s_{i,t} + \gamma_i \Delta p^*_{i,t} + \phi_i \Delta p_{i,t-1} + \delta_i (p_{i,t-1} - \bar{p}^{ERPT}_{i,t-1}) + \epsilon_{i,t}, \qquad (1)$$

which captures the adjustment mechanism of import prices to deviations from the long-run equilibrium relation between the import price, exchange rate and export price, $\bar{p}^{ERPT}_{i,t-1} \equiv A_i + B_i s_{i,t-1} + C_i p^*_{i,t-1}$. The error correction term $\delta_i(p_{i,t-1} - \bar{p}^{ERPT}_{i,t-1})$ can be rewritten as $\theta_{i,1} p_{i,t-1} + \theta_{i,2} s_{i,t-1} + \theta_{i,3} p^*_{i,t-1}$; thus the model can be estimated country-by-country by OLS to obtain unbiased and consistent measures of $A_i = -a_i/\theta_{i,1}$, $B_i = -\theta_{i,2}/\theta_{i,1}$ and $C_i = -\theta_{i,3}/\theta_{i,1}$. In this

by the IMF and J.P.Morgan; South Korea is listed as DM by the FTSE but as EM by the MSCI and IMF.

[6]Individual country import and export prices are proxied by customs unit value indices. For each importing country $i = 1, ..., 37$, the trade-weighted export price proxy is constructed as $p^*_{i,t} = \sum_{j=1}^{J(i)} w^j_{i,t} p^{j*}_t$ where $j = 1, ..., J(i)$ are its trading partners. For each exporting economy there is a unique total export unit value index available, p^{j*}_t. We weight the latter by the share of the destination country's total imports that comes from each foreign country, $w^j_{i,t} = M^j_{i,t} / \sum_{j=1}^{J(i)} M^j_{i,t}$. Thus $p^*_{i,t}$ proxies the "rest-of-the-world" foreign export price faced by country i. We gathered $\{ p^{j*}_t \}_{j=1}^{K}$ for as large a set of countries K as possible and bilateral trade figures from the IMF *Direction of Trade Statistics* (see Appendix A in the working paper version of this article; Brun-Aguerre et al., 2011); since those K countries may not account for the total exports received by a given economy, we complement the missing trade with three aggregate export unit value indices from the IMF representing developing, emerging and oil exporting economies, respectively.

framework (adopted, for instance, by Campa et al., 2008, and Frankel et al., 2005), the short-run and long-run elasticities are given, respectively, by β_i and $-\frac{\theta_{i,2}}{\theta_{i,1}}$. For instance, a value $\beta_i = 0.4$ implies that a 1% depreciation of the importing country's currency (*i.e.* $\Delta s_{i,t} > 0$) would make import prices 0.4% more expensive in the short-run. This is a relatively parsimonious error correction model (ECM) as it includes no lags of the export price and exchange rate changes, although it can capture inertia (persistence) in import price changes by incorporating the lagged dependent variable as regressor. The *first stage* of the analysis consists of estimating (1) over the total unbalanced sample spanning the maximum period 1980Q1-2009Q3 ($T = 119$ quarters) and over a balanced subsample 1997Q1-2009Q3 ($T = 51$ quarters) in order to obtain a baseline set of elasticities $\hat{\beta}_i$ that we can confront with those from previous studies. The simplest way to exploit the panel structure of the sample while allowing for full heterogeneity (*i.e.* all parameters in (1) are country-specific) is to estimate individual country-by-country equations and then average the ERPT elasticities across countries; this panel approach is called Mean Group (MG) estimation (see Pesaran and Smith, 1995).

The *second stage* combines time-series and panel models to examine the relative role of various economic factors as potential pass-through drivers. We start with a rolling-window estimation of (1) country by country in order to obtain sequences of short-run ERPT elasticities. These are pooled across countries and regressed on the one-quarter-lagged pooled drivers while controlling for unobserved or "hidden" factors.[7] For concreteness, let $\beta_{i,t}$ denote the short-run ERPT elasticity measure for importing country i on quarter t, and $Z^1_{i,t}, ..., Z^k_{i,t}$ a set of k observable stationary covariates. We estimate the 2-way (country/time) fixed effects model:

$$\beta_{i,t} = \alpha_i + [\gamma_t] + \lambda_1 Z^1_{i,t-1} + ... + \lambda_k Z^k_{i,t-1} + [\delta Z_{t-1}] + \varepsilon_{i,t}, \quad t = 1, ..., T_1; i = 1, ..., N \qquad (2)$$

and variations of it with random effects instead to control for unobserved factors. Another panel

[7] This two-stage (rolling window) approach has the advantage of allowing all the parameters in (1) to vary over time versus an alternative single-stage approach where one interacts each of the drivers with $\Delta s_{i,t}$ in equation (1) and estimates it in panel form. A drawback of our approach is its potential sensitivity to the rolling window length; this issue is dealt with in a robustness check.

model considered is a more parsimonious 1-way formulation that accommodates unobserved effects of country-specific type (α_i) only and adds an observable global factor Z_{t-1} as regressor. Below we describe each of the covariates and the expected sign of its coefficient according to theory; they represent different aspects of the importing country's economy most of which are "macro" but some of which can be linked with "micro" issues.

FX rate volatility. The theoretical literature dictates a nexus between import pass-through and FX rate volatility but its direction is not clearcut. Higher FX volatility is typically associated with lower ERPT (*i.e.* negative link) in a highly competitive environment because exporters are prepared to let their markup fluctuate seeking to hold or increase market share (Froot and Klemperer, 1989). On the contrary, if exporters seek predominantly to stabilize their profit margins they will tend to maintain fixed the prices in their own currency, *i.e.* higher ERPT, and so the expected effect is positive (Devereux and Engel, 2002). As noted by Gaulier et al. (2008), this ambiguous nexus reflects a trade-off in the exporter's main strategy, namely, to stabilize export volumes or marginal profits. A related argument is whether the volatility shock is perceived as long-lasting or short-lived by exporters; in the latter case, they are more likely to adjust down their profit margins rather than incur the costs associated with frequent price changing (Froot and Klemperer, 1989). Our quarterly FX rate volatility measure is computed as the square root of the cumulated squared logarithmic daily FX returns $\sqrt{\sum_{j=1}^{D}[\log(\frac{NEER_j}{NEER_{j-1}})]^2}$ where D is the number of days in a quarter; this is known as realized volatility (RV). We employ a one-year moving average of RV in order to smooth out noise.

Inflation. Importing countries where the monetary authority is not credible at fighting inflation typically suffer high level/volatility of inflation and, in turn, high ERPT to domestic prices (see Taylor, 2000; Choudhri and Hakura, 2006). By investigating whether inflation drives *import* pass-through we are indirectly examining the nexus between monetary policy and the exporters' pricing (i.e. LCP versus PCP). Our driver is a one-year moving average of the importing country's quarterly inflation defined as $\log(\frac{CPI_{i,t}}{CPI_{i,t-1}})$.

Output gap. A measure of the country-specific business cycle is the output gap, namely, the deviation of actual from "potential" real GDP. Choudhry and Hakura (2006) put forward a theoretical pass-through model where a monetary policy Taylor-feedback rule is assumed that includes the output gap as input. A positive gap implies that the economy is running above potential and so domestic demand is expanding; in this context, lower ERPT may be observed if exporting firms try to "fill the gap" (*i.e.* sale expansion) by absorbing FX fluctuations in their profit margins. Thus importing economies with growing output gaps could represent an opportunistic incentive for foreign firms to ease the ERPT. Our driver is computed as the logarithmic difference between real GDP and Hodrick-Prescott real GDP trend, $\log(\frac{GDP_{i,t}}{GDP^*_{i,t}})$.

Wealth. A piece of popular wisdom is that rich countries have greater pricing power and, in turn, experience lower import pass-through than poor countries *ceteris paribus*; this represents an instance of price discrimination (or pricing-to-market) behavior. Countries where people earn more money may be seen by foreign firms as more likely sources of market share. To examine this "micro" issue, wealth in relative terms is defined as the logarithmic ratio of the importing country's real GDP per capita to the world's real GDP p.c. The latter is proxied by $GPC_t^{world} \equiv \sum_{i=1}^{N} GPC_{i,t}$ where $N = 37$ is the total cross-section in our sample.

Import dependence. Dornbusch's (1987) model of price discrimination links the pass-through elasticity with the relative market share of foreign firms and local producers, among other micro factors. One approximation to this "size" (market structure) notion is the degree of import openness or import dependence given by $\frac{M_{i,t}}{GDP_{i,t}}$ where $M_{i,t}$ is the total value of imported goods received by country i and GDP is nominal output, both in current U.S. dollars. Dornbusch's argument implies greater pass-through in small, highly import-dependent economies. A related import dependence measure worth considering is $\frac{M_{i,t}}{GDP_{i,t}-X_{i,t}}$ where the total value of exported goods by country i is subtracted from total output. This covariate may be more representative of Dornbush's argument because it proxies the share of foreign exporters to the local market i relative to the share of domestic producers whose output is destined locally also.

Protectionism. An import tariff is a tax that increases the costs to importing firms (*i.e.* a micro issue) and thus can be cast as a "limits-to-arbitrage" trade barrier. Higher protectionism is theoretically linked with incomplete pass-through which represents a particular violation of the Law of One Price (LOOP). Exporting firms may be more willing to absorb currency fluctuations into their margins in trying to compensate the importer for high tariffs. In order to explore this issue, we utilize an import tariff index constructed by Gwartney et al. (2010) from WTO *World Tariff Profiles* sources; a level of 10 indicates absent tariffs and the index moves toward 0 as the tariffs increase. A positive coefficient is interpreted as consistent with the theory, namely, as the barriers to arbitrage increase the extent of pass-through decreases.[8]

Nonlinearities. The direction and magnitude of exchange rate changes may impart asymmetry in the ERPT process. Two possible regimes of import pass-through behavior correspond, respectively, to depreciations and appreciations of the importer's currency. If foreign firms have reached full capacity it will be difficult for them to respond over the short-run to the upward export demand pressure that may accompany a fall in domestic import prices and hence, they may opt instead for not passing appreciations. Lower pass-through for appreciations than depreciations ($\beta^{app} < \beta^{dep}$) is consistent with both foreign firms' capacity constraints and downward price stickiness. On the contrary, as argued by Marston (1990), foreign firms may increase import pass-through during appreciations and reduce it during depreciations in order to quote competitive prices seeking to gain market share ($\beta^{app} > \beta^{dep}$); the same prediction arises if exporters strategically switch from foreign (*i.e.* imported) inputs for production to domestically produced ones when the FX rate changes unfavorably (Webber, 2000). In order to model this nonlinearity, that we refer to as *sign asymmetry,* the following indicator function is defined:

$$I_{i,t}^{sign} \equiv \begin{cases} 1 & \text{if} \quad \Delta s_{it} > 0 \text{ (depr.)} \\ 0 & \text{if} \quad \Delta s_{it} \leq 0 \text{ (appr.)} \end{cases}$$

and $Z_{i,t-1}^{1} \equiv |\Delta s_{i,t-1}|$ and $Z_{i,t-1}^{2} \equiv I_{i,t}^{sign}|\Delta s_{i,t-1}|$ are covariates in (2), that is, $\beta_{i,t} = \alpha_i + [\gamma_t] +$

[8] The tariff data is annual so we adopt a simple step-function interpolation method.

$\lambda_1|\Delta s_{i,t-1}| + \lambda_2 I_{i,t}^{sign}|\Delta s_{i,t-1}| + ... + \varepsilon_{i,t}$ which implies $\beta_i^{dep} = \lambda_1 + \lambda_2$ and $\beta^{app} = \lambda_1$.

Menu costs are like a fixed cost and hence, may induce a nonlinear effect whereby the extent of import pass-through differs for small and large exchange rate changes; this is called *size asymmetry*. Since it may not be worthwhile to reinvoice following small FX rate changes, the direction of this asymmetry depends on the type of invoicing. If the exporter is invoicing in his own currency then its proceeds are kept intact and all of the small FX rate change is borne by the importer. On the contrary, under local-currency invoicing small FX rate changes are fully reflected in the exporter's markup. This asymmetry is modeled via the indicator function:

$$I_{i,t}^{size} \equiv \begin{cases} 1 & \text{if} \quad \Delta s_{it} < \tau_{app}^{-} \text{ or } \Delta s_{it} > \tau_{dep}^{+} \text{ (large)} \\ 0 & \text{if} \quad \tau_{app}^{-} \leq \Delta s_{it} \leq \tau_{dep}^{+} \text{ (small)} \end{cases}$$

where $\tau_{app}^{-} < 0 < \tau_{dep}^{+}$ are two threshold parameters that define, respectively, the cutoff point for large appreciations and large depreciations; any FX rate increase above τ_{dep}^{+} is regarded as a large depreciation and any FX rate decrease below τ_{app}^{-} is considered a large appreciation.

The two asymmetries can be combined in (2) as $\beta_{i,t} = \alpha_i + [\gamma_t] + \lambda_1|\Delta s_{i,t-1}| + \lambda_2 I_{i,t}^{sign} I_{i,t}^{size}|\Delta s_{i,t}| + \lambda_3(1 - I_{i,t}^{sign}) I_{i,t}^{size}|\Delta s_{i,t}| + \lambda_4 I_{i,t}^{sign}(1 - I_{i,t}^{size})|\Delta s_{i,t}| + ... + \varepsilon_{i,t}$. Thus the differential pass-through between depreciations and appreciations, for small FX rate changes, is given by λ_4; the depreciation-versus-appreciation differential effect for large FX rate changes is given by $\lambda_2 - \lambda_3$; the differential pass-through between large and small FX rate changes, for appreciations, is measured by λ_3; and the large-versus-small differential effect for depreciations is given by $\lambda_2 - \lambda_4$. For instance, the significance of the size effect associated with depreciations can be tested through a Wald statistic for the null hypothesis $H_0 : \lambda_2 - \lambda_4 = 0$, and so forth.

Global economic sentiment. Overall booming economic activity increases the demand for commodities which, in turn, puts upward pressure on production costs and may raise pass-through. An opposite argument is that during periods of overall economic expansion sales increase and exporters may be more able to "afford" fluctuations in markups so the ERPT may actually fall. We employ as world driver Z_{t-1} in (2) the logarithmic Global Manufacturing

Purchasing Managers Index (PMI) jointly compiled by J.P.Morgan and *Markit Economics*. This is a GDP-weighted index of individual PMIs for the largest 29 developed and emerging economies covering about 80% of world GDP. A reading above 50 signals improving economic conditions. The PMI contains actual data elements and a forward-looking confidence element thus making it quite valuable as leading indicator in Wall Street. It is recognized as such by the Fed too as borne out by its mention in the FOMC minutes.[9]

3 Empirical Analysis

3.1 Import Pass-Through Elasticities

The time-series properties of the three main variables, p_{it}, p^*_{it} and s_{it}, resemble those of non mean-reverting processes.[10] Time-series plots of the import price, export price and FX rate (all in logarithms) for each country produce informal evidence of cointegration, *i.e.* the variables do not diverge much from each other in the long run in line with the LOOP for traded goods.[11]

More formally, we deploy several cointegration tests: i) the time-series bounds Wald test developed in the context of equation (1) by Pesaran, Shin and Smith (2001) to test the null hypothesis of no long-run comovement ($H_0 : \theta_{i,1} = \theta_{i,2} = \theta_{i,3} = 0$), ii) Johansen's (1998) time-series sequential trace-type cointegration test based on a trivariate VECM specification, and iii) Pedroni (2004), Kao (1999), and Maddala and Wu (1999) panel cointegration tests that jointly

[9] Appendix B1 and B2 in Brun-Aguerre et al. (2011) illustrate, respectively, country and regional differences in the above drivers (excluding the global PMI) on average over the entire 30-year sample period. The graphs confirm stylized facts such as the relatively high inflation levels and FX rate volatility of Latin American countries plus Turkey, the relatively low inflation of Asian EMs particularly Singapore and Thailand, the relatively low income levels of EMs, the small import dependence of the US among advanced economies and of Latin America among other emerging market regions, the relatively high import tariff rates of EMs, specially, the Latin American region, and the hyperinflationary episodes suffered by Brazil, Argentina, Mexico and Venezuela.

[10] For each series we gathered conclusive evidence by testing: i) the null hypothesis of unit root behavior against the alternative of stationarity using the Augmented Dickey-Fuller statistic, ii) the stationarity null against the unit root alternative using the Kwiatkowski et al. (1999) statistic. Results available upon request.

[11] See Figures 1a (EMs) and 1b (DMs) and related discussion in Brun-Aguerre et al. (2011).

exploit the cross-section and time-series dimension of the data. The results are set out in Table 1a (unbalanced sample) and Table 1b (balanced sample). For each country, shaded areas are used to signify evidence supportive of cointegration from at least one of the two time-series tests; the evidence is on the whole quite favorable despite the fact that no allowance is made for structural breaks which has been suggested in the recent literature as one of the main reasons for the failure to find evidence of cointegration (see De Bandt *et al.*, 2008).

[Insert Tables 1a and 1b around here]

The panel cointegration tests provide clearly supportive evidence that p_{it}, p^*_{it} and s_{it} are linked over the long-run and hence, the linear ECM equation (1) is a reasonable baseline framework for the analysis.[12] Nevertheless, for completeness we estimated two other specifications employed in the literature: a first-differences model that ignores the long-run equilibrium (*e.g.* as in Campa and Goldberg, 2005), $\Delta p_{i,t} = c_i + \sum_{k=0}^{4} \beta_{k,i} \Delta s_{i,t-k} + \sum_{k=0}^{4} \gamma_{k,i} \Delta p^*_{i,t-k} + e_{i,t}$, and a less parsimonious ECM than (1) with up to 4 lags for $\Delta s_{i,t}$ and $\Delta p^*_{i,t}$ but excluding $\Delta p_{i,t-1}$ (*e.g.* as in De Bandt et al., 2008). Although the pass-through elasticity estimates from the three models are not dramatically different, the in-sample $\bar{R}^2$, AIC and SBC goodness of fit measures of the latter two specifications (reported in Table 2, columns A and B, respectively) as well as the out-of-sample RMSE and MAE forecast criteria (reported in Appendix A) tend to be inferior than those corresponding to model (1) reported in column C. Hence, the latter model is the focus of the ensuing discussion in this section and the subsequent empirical analysis.

The vast majority of ERPT elasticities, both short-run and long-run, lie between 0 and 1.[13]

[12] In the case of Johansen's trace test, we only report results for the H_0 that there are zero cointegrating relations. For all the countries where this H_0 is rejected, the subsequent test statistic for the H_0 that there is at most one cointegrating relation was either insignificant or weakly rejected at the 10% level. Pedroni's and Kao's panel tests are residual-based in the same spirit of the Engle-Granger two-step approach for time series. Among various panel test statistics proposed by Pedroni, the one reported allows for heterogeneity under the alternative hypothesis. Maddala-Wu's Fisher-type test can be interpreted as a pooled Johansen test.

[13] Although it is widely accepted that plausible pass-through elasticities should lie in (0,1), theoretically it is also possible to justify pass-through coefficients greater than 1 in terms of an amplification effect (see Knetter, 1993). The presence of luxury goods in the import bundle can lead to negative pass-through (Krugman, 1987).

The zero short-run ERPT hypothesis is rejected quite often; *e.g.* for the unbalanced sample (Table 2a, column C) in 15 out of 18 EMs and virtually in all DMs. Complete pass-through is also rejected in the short-run for the vast majority of EMs (14 cases) and DMs (14 cases). Overall the evidence thus indicates partial or incomplete short-run import ERPT. In the long run it is somewhat more difficult to reject the hypothesis of complete pass-through, as one would expect, but 8 EMs and 6 DMs are still found to have less than 100% pass-through.

The short and long run ERPT elasticities for the US appear at the low-end of the spectrum for DMs in line with previous studies (*e.g.* Bussière and Peltonen, 2008; Frankel et al., 2005; Campa and Goldberg, 2005). Although based on a different empirical model from ours, Bussière and Peltonen (2008) report insignificant short-run and long-run US elasticities at 7% and 9%, respectively. This means that exporters to the US market are more prepared to offset exchange rate fluctuations through markup adjustments instead of passing them. The US import market has relative large pricing power possibly as a reflection of its size *inter alios*. For the UK, our short term elasticity at 40% is close to that reported in Campa and Goldberg (2005) at 36%, and in Bussière and Peltonen (2008) at 27%. Our estimates indicate that some advanced markets experience a very high import ERPT which has also been shown in previous studies under different empirical models and time spans. For Japan, the reported elasticities at 69% (short-run) and 77% (long-run) compare well with those documented in Bussière and Peltonen (2008), Ihrig et al. (2006) and Campa and Goldberg (2005), all above 60%. Likewise, the reported pass-through elasticities for Spain and The Netherlands are, like those in Campa and Goldberg (2005), insignificantly different from 1 in the long run.

[Insert Tables 2a and 2b around here]

Among the EMs, South Africa stands out with relatively large short- and long-run ERPT elasticities; this aspect is revealed also in time-series graphs (see Brun-Aguerre et al., 2011; Figure 1b) where the ups/downs in the NEER are tracked by similar movements in the domestic import price whereas the foreign export price remains virtually unchanged. As in Bussière and Peltonen (2008), Brazil, Israel, Thailand and Venezuela exhibit relatively high pass-through, well above 50%, both in the short- and long-run. Despite being a relatively small economy, the Czech Republic exhibits low short-run ERPT at about 40% which is nearly identical to the estimate in Campa and Goldberg (2005) at 39%. The large pass-through found for Poland is in line, but somewhat higher, than that found in Campa and Goldberg (2005) at 56%.

At the aggregate level, we conduct tests of pass-through based on panel MG estimates, separately for EMs and DMs. Quite clearly, the hypothesis $H_0 : ERPT = 0$ is strongly rejected in the short- and long-run for both types of countries. Another common thread is that the 'complete pass-through' null ($H_0 : ERPT = 1$) is rejected only in the short-run. The balanced-panel MG estimates (Table 2b, column C) suggest that the short-run ERPT is lower than the long-run ERPT for DMs and EMs. There are a few country exceptions to this finding possibly reflecting exporters' short-term overreaction to currency fluctuations.[14] Moreover, the average extent of the ERPT in the short-run (a quarterly period) is broadly similar for EMs and DMs at 67% and 57%, respectively. This result is robust across different time periods: the unbalanced sample 1980Q1-2009Q3 (Table 2a), the balanced sample 1997Q1-2009Q3 (Table 2b) and an unbalanced sample 1980Q1-2007Q3 that excludes the recent crisis period (see Appendix B).[15] Our evidence in this regard puts a question mark on the conventional wisdom that EMs have been historically subject to "large" pass-through. For instance, Goldfajn and Werlang (2000) document substantially lower CPI pass-through for OECD (or developed countries) than for emerging markets on average over the period 1980-1998. Calvo and Reinhart (2000) also establish empirically that the pass-through to consumer price inflation tends to be much greater for EMs than DMs. Our findings over a relatively recent sample ending in 2009Q3 support the

[14]Campa and Goldberg (2005; Table A1, p.690) report several such cases in food, energy and raw materials.

[15]We choose the end of 2007 roughly as the "start" of the recent aggresive monetary policy cycle in response to the credit crunch. The US Federal Reserve decreased its main policy rate by 25bp in October 2007, and repeated the same action both in November and December. In January 2008, the Federal Reserve reduced its policy rate by 100 bp, opening the way to further cuts.

evidence from two other studies that also challenge the conventional wisdom: Ca'Zorzi et al. (2007) for an unbalanced panel of 12 EMs, all but one comprised in our larger sample, over the maximum period 1975Q1 to 2004Q1, and Bussière and Peltonen (2008) for a unbalanced panel of 28 EMs over the maximum period 1990Q1 to 2006Q2.[16] The finding that short-run pass-through in EMs is not high, *i.e.* comparable to that in DMs, suggests greater pricing power than commonly thought and, in turn, that their "fear of floating" may have been exaggerated.

The rest of our analysis focuses on the short-run pass-through because of its policy implications. The relative standing of countries and regions regarding the short-run ERPT elasticity estimates from equation (1) is presented graphically in Figure 1. With reference to the balanced sample estimates, one can notice the relatively low pass-through in North America (mainly driven by the US) and non-eurozone Europe among developed regions. The pass-through in the main three emerging regions, Asia, Central/Eastern Europe and Latin America, is on the whole comparable to that for the developed markets.[17]

[Insert Figure 1 around here]

3.2 Drivers of Country- and Time-Variation in ERPT Elasticities

We now address two questions: Is the pass-through driven by observable macro/micro factors of the importing economy? And are there contrasts in this regard between EMs and DMs? For this purpose we conduct, first, an in-sample panel modeling analysis that jointly exploits the country- and time-variation in pass-through rates. Second, country by country the baseline

[16] In a recent paper by Coulibaly and Kempf (2010) based on a relatively large sample of 27 EMs ending in 2009Q1 it is shown that the *de jure* adoption of inflation targeting by EMs (mainly in the late 1990s) has helped to reduce their import pass-through.

[17] Developed regions: Eurozone (Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Spain), non-eurozone Europe (Denmark, Norway, Sweden, UK), North America (Canada, US), others (Australia, Japan and New Zealand). Emerging regions: Asia (China, Hong Kong, Singapore, S. Korea, Thailand and Pakistan), Central/Eastern Europe (Czech Republic, Hungary, Poland) plus Turkey and Israel, Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Venezuela), Africa (South Africa).

linear ECM specification is generalized to accommodate time variation in the pass-through elasticity according to each of the observable drivers. On this basis, a forward-looking forecasting exercise for import prices is conducted to answer the same questions out-of-sample.

3.2.1 In-Sample Panel Modeling Analysis of Pass-Through Drivers

We begin with a rolling-window estimation of the linear ECM equation (1) to obtain sequences of ERPT elasticities per country (Stage 1). The resulting time series $\{\hat{\beta}_{i,t}\}_{t=1}^{T_1}$ are then pooled across countries and regressed on the one-quarter-lagged observable drivers (Stage 2) using a panel approach that allows us to control for unobserved country-specific and time-specific factors.[18] There is a natural trade-off between the length of the first-stage rolling windows, T_0, required to obtain reliable enough pass-through elasticities, and the time span available for the second-stage panel models, T_1. We adopt as rolling-window length $T_0 = 99$ quarters and thus the panel regressions are based on $T_1 = 21$ quarters (the 6-year period 2004Q3-2009Q3) implying a maximum of $T_1 \times N = 21 \times 37 = 777$ observations for parameter estimation.[19]

The short-run ERPT elasticity estimates 2004Q3-2009Q3 thus obtained are plotted in Figure 2 for 6 EMs (Figure 2a) and 6 DMs (Figure 2b). The countries have been chosen to represent different regions: Latin America (Colombia), Europe (Hungary, Turkey), Asia (Hong Kong, Pakistan), Africa (South Africa), eurozone (France, Germany), non-eurozone Europe (UK), North America (US) and others (Australia, Japan). The overall pass-through dynamics reveals mixed patterns: a downward trend (*e.g.* France, Germany, US), an upward trend (*e.g.* Colombia, Hungary, South Africa) and a relatively stable pattern up to the recent global financial crisis (*e.g.* Australia, Japan). The latter is felt towards the middle of 2008 with sharp

[18] Our main motivation for considering one-period *lagged* (as opposed to contemporaneous) covariates is twofold. One is to rule out simultaneity bias in the panel regressions. Another is that we can thus shed light not only on the in-sample explanatory power of the drivers but also on their out-of-sample predictive role.

[19] A robustness check was conducted by repeating the exercise on the basis of a smaller rolling-window length of 89 quarters; thus the panel regressions are run over 31 quarters. The main conclusions in this section were virtually unchanged and the tables are omitted for brevity. Detailed results available are upon request.

jumps in pass-through for some countries (*e.g.* Colombia, Hong Kong, Japan and Pakistan) and sharp falls for others (*e.g.* Australia, Turkey, UK). Our rolling estimates appear on the whole plausible. On the one hand, the gradual decline in import pass-through for the US agrees with the evidence from previous studies such as Marazzi et al. (2005), Ihrig et al. (2006), and Bussière and Peltonen (2008). The latter study relates such decline to a combination of two factors: a rise in the share of emerging exporters in the US market, and an increase in the exchange rate elasticity of export prices (or "pricing-to-market") observed for several emerging exporters. The mixed patterns uncovered are at odds with the view that import ERPT has been overall declining due to improved macroeconomic conditions (*e.g.* Taylor, 2000; Goldfajn and Werlang, 2000) but are in line with the evidence in Bussière and Peltonen (2008) and Campa and Goldberg (2005) which also stress that the decline in pass-through is far from universal. Various "macro" and "micro" drivers are plotted in Figure 2 alongside the ERPT elasticities.

[Insert Figure 2 around here]

The graphs provide *prima facie* evidence that the time evolution of ERPT elasticities is linked, positively or negatively, with the dynamics of various economic factors. In the case of Japan, for example, the ERPT evolution resembles that of the FX rate volatility (correlation = 94.12%; p-value = 0.00); likewise, for Australia the ERPT is positively related to inflation (correlation = 58%; p-value = 0.00).[20] However, there is large country heterogeneity; several other (unreported) graphs did produce unclear evidence of a nexus or the sign of the correlation was not as expected. Thus the panel models discussed next should be useful because they provide "weighted average" estimates of the nexus by exploiting not only the time-series information but also the cross-section variation while controlling for latent factors.

[20]The reported unconditional (Pearson) correlation is contemporaneous. The correlation between ERPT at quarter t and each economic driver at $t-1$ is somewhat different but the sign is preserved; *e.g.* it falls to 20% for Australia (inflation) and to 85% for Japan (FX rate volatility) whereas it increases to 82% for Colombia (FX rate volatility) and to -48% for Hong Kong (output gap).

The (un-weighted) averaged pairwise correlations between the drivers reported in Table 3 rule out multicollinearity in the panel regressions; the top matrix refers to the entire sample and the bottom matrix to the most recent 6-year period that the regressions are based on.[21] They also confirm a positive link between the country-specific output gap and the Global PMI, and a negative link both between the output gap and tariffs, and between wealth (GDP per capita) and tariffs. These average statistics conceal a large degree of country heterogeneity, *e.g.* the correlation between the output gap and Global PMI ranges from a maximum of 49.92% (US) to a minimum of -36.26% (China), followed by -17.95% (Norway) and -17.11% (Czech Rep.).

[Insert Table 3 around here]

With these results in place, we now measure how much of the total (country/time) variation in ERPT can be accredited to economic aspects of the destination country.[22] Estimation results using fixed effects (FE) and random effects (RE) models are set out in Table 4.[23] Those labelled "2-way" accommodate both *unobserved* country-specific and time-specific factors whereas the "1-way" models include latent country-type effects only. The left-hand-side estimates are for the

[21] By far the largest absolute correlation is between the FX rate volatility and the Global PMI at -73.22%. Nevertheless, the panel regressions are estimated with and without this global business-cycle factor.

[22] We also considered a pure cross-section approach by averaging country by country each of the drivers over time and using these averages as regressors to explain the point ERPT estimates shown in Figure 1. Inferences gleaned from White heteroskedasticity-robust tests in the regression with all six drivers (FX rate volatility, inflation, output gap, wealth, import dependence and protectionism) suggested no significant relationship. The explanatory power is low but comparable with the R^2 reported in Bussière and Peltonen (2008) and Campa and Goldberg (2005), *e.g.* 13.8% for the all-drivers regression. Only one driver emerged as significant at the 5% level in the bivariate regressions, import dependence proxied by $\frac{M_{i,t}}{GDP_{i,t}-X_{i,t}}$ with an R^2 of 11.01% and a positive coefficient of 0.081 in line with Dornbusch's (1987) size argument. However, this pure cross-section approach has two drawbacks. One is that the time-series averaging neglects the ability of the macro factors to explain the dynamics of ERPT. Thus the cross-section regressions do not allow us to explore the presence of sign and size asymmetries with respect to the time-evolution of the FX rate nor global business cycle effects. Second, unlike the panel framework, the pure cross-section analysis does not permit us to control for the presence of unobserved factors (possibly correlated with the regressors) which may introduce biases in parameter estimates.

[23] Three countries have to be excluded because we do not have import dependence data. For Belgium, imports and exports data is missing from 1997Q1. For Pakistan and Venezuela, we were unable to find nominal GDP data. Hence, the panel estimation results are based on 34 countries and 21 quarters (714 observations).

entire estimation period ending in 2009Q3 and the right-hand-side ones are for a period ending in 2007Q4; the latter represents a robustness check on whether the overall-period results are driven by the recent crisis. As seen in some graphs in Figure 2 (*e.g.* South Africa) the theoretically expected relation between the ERPT elasticity and the drivers is somewhat distorted during the crisis period, particularly for the macro factors closely associated with monetary policy.

[Insert Table 4 around here]

First, we carry out a full pooling so that the panel model coefficients represent *average* measures of the nexus between import ERPT and economic covariates across all economies. Second, we introduce a country-type dummy which equals 1 or 0 depending on whether the country is classified as EM or DM. This country dummy is interacted which each of the macroeconomic drivers to enable comparisons across the two groups. Inferences are based on White-period covariances that are designed to accommodate arbitrary heteroskedasticity and within cross-section serial correlation. The GLS covariance matrix in the random effects formulation is based on the quadratic unbiased Swamy-Arora estimator which uses residuals from the within (fixed effect) and between (means) regressions. The thresholds (τ^{-}_{app},τ^{+}_{dep}) are not set at *ad hoc* levels but instead estimated alongside all other model parameters; their estimates at $(-5.3\%, 3.9\%)$ roughly correspond, respectively, to the 8th percentile of the empirical distribution of appreciations and the 73th percentile for depreciations.[24] Thus any quarterly FX rate fall below 5.3% and rise above 3.9% are deemed, respectively, a "large" appreciation and depreciation.

The coefficient estimates of the random and fixed effects models in Table 4 are quite close

[24]The observed quarterly FX rate changes (pooled across countries over the entire sample period) are, first, subdivided into appreciations and depreciations, denoted $\{\Delta s_{i,t}\}^{-}$ and $\{\Delta s_{i,t}\}^{+}$, respectively. We then conduct a bidimensional grid search in $S = (\{\Delta s_{i,t}\}^{-}_{0.05-0.5} \times \{\Delta s_{i,t}\}^{+}_{0.5-0.95})$, that is, the candidates for τ^{-}_{app} are the observations between the 5th and 50th percentiles of $\{\Delta s_{i,t}\}^{-}$ and the candidates for τ^{+}_{dep} are those between the 50th-95th percentiles of $\{\Delta s_{i,t}\}^{+}$. Following the Least Squares principle, the threshold estimates minimize the residual sum of squares, formally $(\hat{\tau}^{-}_{app}, \hat{\tau}^{+}_{dep}) = \arg\min_{S} RSS$. A further possible refinement (not attempted) which would be computationally more expensive consists of allowing the thresholds to be country-specific.

but Hausman tests favour the latter.[25] The explanatory power of the fixed effect models is quite high, although a large amount of it can be ascribed to country dummies.[26] The adjusted-R^2 of panel models with a single overall intercept instead (*i.e.* excluding country and time dummies) indicate that as a whole the micro/macro covariates explain about 1/3 of the total ERPT variation; $\bar{R}^2$ is 30.09% (entire sample) and 32.07% (non-crisis sample) and the corresponding F-tests remain strongly significant at the 1% level. The variance decomposition of the composite error term $\nu_{it} \equiv e_i + u_t + \epsilon_{it}$ in the random effects models (with/without the Global PMI factor) indicates that about 98% of the total error variance is accounted by the country-specific error component e_i. Indirectly, this suggests that "hidden" time (or global) effects represented by u_t play a relatively minor role in explaining ERPT variation. This is also borne out by the fact that the estimates from the 2-way fixed or random specifications and the corresponding 1-way specifications with/without the Global PMI factor are quite close. Hence, about 2/3 of the overall country- and time-variation in ERPT remains unexplained by the economic drivers, and can be mostly accredited to "hidden" country-specific factors.

Figure 3 plots the country fixed effects (top exhibit). For DMs, the most notable downward effects are revealed for New Zealand followed by France, Finland and the US (all three at about the same level -0.80) suggesting that these countries have the strongest pricing power as import destination markets *ceteris paribus* whereas Italy (-0.33), The Netherlands (-0.31) and Denmark (-0.30) lie at the other extreme. The implication is that for similar levels of the measurable factors (FX rate volatility, inflation, import dependence, tariffs and so forth) the import ERPT elasticity of, say, the US is 0.80 units below average and that of Italy is 0.33

[25] The Hausman test to compare the 1-way FE and RE models rejects at the 5% level both when the Global PMI factor is included (statistic 22.097; p-value=0.024) and when it is excluded (statistic 22.228; p-value=0.014) suggesting possible correlation between the unobserved country-specific effects and macro/micro factors.

[26] The reported $\bar{R}^2$ and F statistics for the fixed effects models are based on the difference between the RSS from the estimated model, and the RSS from a single-constant-only specification, not from a fixed-effect-only specification. Therefore these statistics are typically large because they reflect the explanatory power of the entire specification, including the estimated fixed effects.

units above average. Among the EMs, Singapore exhibits the largest pricing power followed by Chile, Argentina and Hong Kong. Other EMs such as Brazil and South Africa lie at the other extreme with very weak pricing power relative to average due to factors over and beyond the economic covariates here considered. Possible "hidden" country-specific factors (*i.e.* not accounted for in the ERPT regressions) that may lie behind the estimated country fixed effects are idiosyncrasies in the product/geographical composition of the import bundle.

[Insert Figure 3 around here]

The bottom exhibit of Figure 3 graphs the Global PMI and the estimated time-specific fixed effects. The correlation between the two time series at 47.90% (p-value=0.028) is significant at the 5% suggesting that the estimated time effects partly reflect the overall business cycle.

Several economic factors play a significant role as drivers of ERPT elasticities. Both inflation and the FX rate volatility have a significantly positive coefficient confirming that the extent of import pass-through is endogenous to a country's monetary policy; it is noteworthy (but not surprising) that the effect of these two covariates is most apparent after the exclusion of the recent global financial crisis period characterized by aggressive monetary policy. Another significant macro factor is the output gap, albeit negatively signed; the effect is smaller in magnitude than that of inflation and FX rate volatility. Robustly across specifications, the size asymmetry emerges as relevant (particularly, when the recent crisis period is included) and dominates the sign asymmetry in line with the evidence in Pollard and Coughlin (2004) for the US. Thus far it seems fair to conclude that "macro" factors, particularly those closely linked to monetary policy, have in-sample predictive power on short term pass-through. However, the estimation results also give a role to "micro" aspects of the importing economy. Relative wealth, import dependence and tariffs have significant and plausibly signed coefficients suggesting, respectively, that exporters price-discriminate by subjecting poorer countries to larger pass-through, that more import-dependent economies are subject to greater pass-through[27] and

[27]The reported results are for imports over GDP net of exports. The coefficient of the imports over GDP ratio

that the higher the import tariffs the lower the pass-through *ceteris paribus.* These results are qualitatively robust to the inclusion/exclusion of the recent financial crisis period.

So far we have discussed the broad picture. However, some differences are observed between EMs and DMs. The hypothesized monetary variables, inflation and FX rate volatility, appear mostly influential for EMs. Likewise, the slope estimates for PMI suggest that the ERPT evolution has a cyclical component albeit only for importing DMs. Sign asymmetries are only apparent for DMs and the direction depends on the size of the exchange rate change: small depreciations are more likely to be passed on to the importer than small appreciations whereas large appreciations trigger greater import pass-through than large depreciations. Two covariates proxying "micro" issues, relative wealth and import dependence, play a major role for EMs.

Turning now to the commonalities across EMs and DMs. Three factors are revealed as significant drivers of import pass-through: output gap, tariffs and the size asymmetry. The coefficient on the output gap, however, is positive for EMs but negative for DMs. This contrast could relate to the degree of competition for market share among exporting firms.[28] Competition is high for DMs, and can increase further during periods of expansion (positive output gap); thus foreign firms could be tempted to price-to-market in order to maintain/gain market share. Competition is smaller for EMs and hence, expansion phases may instead provide an incentive for foreign companies to increase profits. The coefficient on tariffs is positive for both EMs and DMs — the higher the import tariffs the lower the level of pass-through — but in terms of magnitude its effect on pass-through is more strongly felt for importing DMs. The size

was also found positive across specifications, as expected, but insignificantly so or only marginally significant at the 10% level as in the related literature. We obtained positive and strongly significant coefficients for another openness proxy, the *self-sufficiency* index, defined as the share of total domestic demand that is satisfied by imports, $\frac{M_{i,t}}{GDP_{i,t}+M_{i,t}-X_{i,t}}$. This measure is, however, less representative of Dornbusch's "importers/local producers" factor because the denominator also includes imports. However, a low level of self-sufficiency (*i.e.* high index value) may be taken by foreign firms as an indication of low price elasticity of import demand and hence, they may opportunistically exercise greater import pass-through which rationalizes a positive coefficient.

[28] According to the Global Competitiveness Indicator published by the World Economic Forum (www.weforum.org/issues/global-competitiveness) most of our DMs rank among the most competitive markets.

asymmetry (for depreciations) is statistically significant for both DMs and EMs but the direction offers yet another contrast: a negative coefficient for DMs and a positive coefficient for EMs. This difference could relate again to the degree of market competition for exports. As noted above, competition is high for DMs and hence, if the importer's currency depreciates, exporters maybe more inclined to offset price increases by reducing margins. In importing EMs, the competition is typically less strong and thus adverse depreciations may be more fully passed to the importer. Although pricing and invoicing are not identical decisions (see Bacchetta and van Wincoop, 2005), the contrasting direction of the size asymmetry for DMs and EMs could also relate to different invoicing practices by exporting firms in the two markets.

3.2.2 Out-of-Sample Forecasting Analysis of Pass-Through Drivers

This section finally investigates the out-of-sample forecast improvement afforded by the pass-through drivers. To this aim, model (1) is generalized to allow for time-variation in the import ERPT elasticity ($\beta_{i,t}$) according to the following time-series specification:

$$\Delta p_{i,t} = a_i + \beta_{i,t}\Delta s_{i,t} + \gamma_i \Delta p^*_{i,t} + \phi_i \Delta p_{i,t-1} + \delta_i(p_{i,t-1} - \bar{p}^{ERPT}_{i,t-1}) + \epsilon_{i,t}, \tag{3}$$

where $\beta_{i,t} = \beta_i + \lambda_i Z_{i,t-1}$ and $Z_{i,t-1}$ represents a "macro" or "micro" driver. The forecasting exercise is conducted on the basis of individual time-series models in order to allow for country-heterogeneity in all the model coefficients. Each of the drivers is examined separately to save degrees of freedom and also to enable comparisons of their relative predictive power. A rolling window approach is adopted to generate one-quarter-ahead *conditional* forecasts of the import price over the 2004Q4-2009Q3 period; the length of the rolling estimation window is 99 quarters.[29] In order to mitigate the bias introduced by Jensen's inequality, the log im-

[29] The first and last estimation windows correspond, respectively, to the period 1980Q1-2004Q3 and 1984Q4-2009Q2. The sample size of the rolling estimation window is fixed at 99 quarters *maximum*; the effective sample size can be slightly smaller due to the moving-averaging and first-differencing involved in some of the economic covariates. In some cases, the sample size is notably smaller as dictated by data unavailability. For instance, in the models that focus on the FX rate volatility (based on daily data) as driver, $Z_{i,t-1}$, the initial estimation

port price forecasts are transformed into level forecasts using the bias-corrected transformation $\hat{p}_{it} = \exp(\log \hat{p}_{it} + \frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma}^2$ is the residual variance of the model at hand. The average forecast losses are reported in Table 5 according to the root mean squared error (RMSE) and mean absolute error (MAE). The table presents, in those cases where a forecast gain relative to the linear benchmark is observed, the percentage forecast error reduction.

[Insert Table 5 around here]

This exercise broadly confirms that there is predictive content for pass-through in both macro and micro drivers. Import tariffs stand out by bringing relatively large average and cumulative forecast error reductions (reported, respectively, in the last rows of each panel). Likewise, import dependence (as measured by imports over GDP net of exports) and FX rate volatility play a non-negligible role in a forward looking sense. Some correspondences are observed between the out-of-sample and in-sample analyses regarding the EMs versus DMs comparison. For instance, the ability of the FX rate volatility and inflation to predict pass-through is slightly stronger for EMs than DMs; for instance, the mean forecast error (RMSE) reduction afforded by the FX rate volatility is 16.46% for EMs versus 10.86% for DMs, and by inflation at 6.53% (EMs) versus 2.75% (DMs). The two "micro" drivers of import pass-through that were found mostly important for EMs, relative wealth and import dependence, also bring larger out-of-sample forecast error reductions for EMs than for DMs. For instance, the mean RMSE reduction afforded by the import dependence ratio is 15.89% (EMs) versus 7.35% (DMs). Likewise, the predictive power of tariffs appears stronger for DMs than for EMs both in-sample and out-of-sample. Again as with the in-sample analysis, the sign asymmetry is a less fruitful predictor than the size asymmetry: for instance, for EMs, the forecast error reduction (RMSE) associated with the size asymmetry of the FX rate change, at about 6.02%

window size is 39 since the daily series start in 1993Q4 and the last estimation window contains 58 observations. Even more constrained are the models with tariffs as driver since the data is available only from 2000 onwards: the initial and last windows contain, respectively, 18 and 37 quarters. See Appendix A for more details.

is larger than that of the sign asymmetry at about 4.34%. Country heterogeneity is again very prominent but overall the evidence suggests that there is some merit in exploiting economic drivers to characterize the time-variation in ERPT for short term forecasting purposes.

4 Policy Implications and Conclusion

The reaction of import prices to changes in the exchange rate has been the subject of a vast literature which has evolved from industrial organization issues to debates over appropriate exchange rate regimes and monetary policy optimality in general equilibrium models. The main contribution of this paper is to provide a systematic empirical investigation, both in-sample and out-of-sample, of the ability of macro- and microeconomic factors to predict import pass-through. Unlike other studies that shed light on the "macro" versus "micro" phenomenon, we control for the presence of sign and size asymmetries and the importing country-specific and global stage of the business cycle. Moreover, we bring to the forefront the role of protectionism which has been paid scant attention so far in the literature. By exploiting both the cross-section variation and the dynamics of pass-through rates via panel models we can control for unobserved country- or time-specific effects which is not feasible in a cross-section framework. We also depart from most existing studies in exploiting a large sample over the period 1980Q1-2009Q3 for 37 countries, emerging and developed, and in employing an *effective* export price measure which is a trade-weighted average of national export unit value indices.

Our evidence does not support the notion that import pass-through has been universally falling in developed markets nor that it is far greater in emerging markets; thus the pricing power of the latter may have been understated. These findings have implications for debates on exchange rate regime optimality in general equilibrium models. Both macro and micro factors play a role as pass-through drivers. Exchange rate volatility and inflation stand out in terms of the economic magnitude of their impact which highlights the importance of accounting for such endogeneity in the design of monetary policy. Relative wealth and the ratio of total imports to domestic output net of exports appear significantly influential as well. The evidence suggests that the extent of pass-through differs for small and large exchange rate changes. Domestic regulatory policies (tariffs) have relatively large predictive power both in- and out-of-sample, and there is a nexus between the country business-cycle stage and the pass-through rate.

Overall this study has relatively succedeed at explaining the overall country and time variation in pass-through rates with macro- and micro-economic factors of the importing economy. However, about 2/3 of the total variation remains unexplained and it is mostly due to unobserved country-specific factors. Hence, more theoretical breakthroughs may be needed and/or better proxies for existing ones in order to explain the phenomenon of pass-through into prices.

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APPENDIX A
Out-of-sample forecast comparison of empirical pass-through models

	Random Walk		A: First-diff. model		B: ECM 4 lags		C: Parsimonious ECM	
Country	RMSE	MAE	RMSE	MAE	RMSE	MAE	RMSE	MAE
Panel I: Emerging countries (N=18)								
Argentina	5.2199	3.7348	5.0621	3.1514	5.2605	3.6138	**4.9767** (1.69%)	3.4713
Brazil	14.3902	9.7264	11.5455	8.5983	13.1502	9.7098	**10.9126** (5.48%)	**8.0313** (6.59%)
Chile	5.9698	4.0835	5.7977	4.1067	6.1350	4.3754	**3.9503** (31.87%)	**3.0750** (25.12%)
China	6.3519	4.0432	3.6489	2.0784	4.0784	2.3192	4.0562	2.6614
Colombia	4.7318	4.1397	7.5333	5.7676	**7.2669** (3.54%)	**5.0988** (11.60%)	**6.2696** (16.77%)	**3.4453** (40.27%)
Czech Republic	1.7337	1.2839	2.2334	1.8171	2.5635	2.2455	**1.7974** (19.52%)	**1.4010** (22.90%)
Hong Kong	0.8486	0.6551	0.6044	0.4802	**0.5618** (7.05%)	**0.4382** (8.75%)	**0.6011** (0.55%)	**0.4710** (1.92%)
Hungary	4.1647	3.1611	2.9867	1.9477	**2.8257** (5.39%)	**1.8702** (3.98%)	**1.8080** (39.46%)	**1.3915** (28.55%)
Israel	3.7188	2.6174	2.9593	2.0428	**2.9333** (0.88%)	2.2243	3.2451	2.3518
Mexico	2.2356	1.5528	1.4567	0.8091	1.5348	0.8292	1.8078	1.0245
Pakistan	15.3072	10.4805	8.2533	6.1729	8.5504	6.6131	9.4383	7.0079
Poland	4.7657	3.9302	5.2361	3.6091	5.2997	3.9003	**3.8027** (27.37%)	**2.9921** (17.09%)
Singapore	3.6606	2.3057	2.4109	1.6231	2.4900	1.6920	**2.3838** (1.13%)	**1.6187** (0.27%)
South Africa	23.9934	15.9021	10.3720	6.9396	11.8769	7.8740	10.8824	7.5858
South Korea	11.8203	8.0180	5.3478	3.8158	5.8549	3.9513	9.3258	4.8594
Thailand	3.8668	3.1731	3.9929	2.7987	4.6141	3.1631	4.1597	**2.4513** (12.41%)
Turkey	8.2989	5.6952	4.3808	2.9287	**3.9335** (10.21%)	2.9348	**3.8772** (11.49%)	**2.8411** (2.99%)
Venezuela	3.9060	3.0983	5.4124	3.7606	**4.5555** (15.83%)	3.7921	**4.5124** (16.63%)	**3.5892** (4.56%)
Panel II: Developed countries (N=19)								
Australia	4.5078	3.0909	4.2519	2.6677	4.2543	2.6909	**4.1363** (2.72%)	**2.4032** (9.91%)
Belgium	3.8014	3.3302	3.6394	2.6089	3.8773	2.8219	4.1943	3.1124
Canada	3.3067	2.7302	2.5449	1.5402	2.5776	1.6395	2.6290	1.8875
Denmark	2.3564	1.9485	2.2464	1.7311	2.3034	1.8521	2.4782	2.0250
Finland	3.3588	2.2577	3.1770	2.2218	3.7935	2.5295	**3.1443** (1.03%)	**1.9598** (11.79%)
France	2.7883	1.9809	3.2914	2.1100	3.5215	2.2603	3.3569	**2.0540** (2.65%)
Germany	2.9349	2.3465	2.5401	1.9984	**2.5037** (1.43%)	**1.9596** (1.94%)	**2.4368** (4.07%)	**1.8349** (8.18%)
Greece	3.0421	2.1056	2.4066	1.7879	2.5422	1.8796	2.5162	1.8317
Ireland	2.3625	1.6753	2.6128	1.8701	**2.5682** (1.71%)	**1.7514** (6.35%)	**1.9438** (25.60%)	**1.4579** (22.04%)
Italy	4.3353	3.1421	3.8010	2.8081	4.2721	2.9296	4.2626	2.9076
Japan	11.8628	7.3856	5.8580	4.0336	6.1161	**3.9050** (3.19%)	6.1002	**4.0017** (0.79%)
Netherlands	3.4988	2.5667	3.3248	2.5593	**3.2816** (1.30%)	**2.4707** (3.46%)	3.3460	**2.3876** (6.71%)
New Zealand	4.8656	3.6407	4.5573	3.2604	5.0352	3.6613	4.8818	3.6382
Norway	2.2858	1.7532	1.9264	1.4277	**1.8496** (3.98%)	1.5105	**1.5463** (19.73%)	**1.2418** (13.02%)
Spain	3.3758	2.4623	2.8019	2.2073	3.4716	2.5288	2.9889	2.2748
Sweden	2.8285	2.2002	3.1289	2.2842	3.5416	2.4376	**3.1141** (0.47%)	**2.0406** (10.67%)
Switzerland	2.4764	2.0183	2.2554	1.9531	**2.1732** (3.65%)	**1.8927** (3.09%)	2.2831	**1.8910** (3.18%)
United Kingdom	2.7120	2.1275	2.5566	1.7357	2.6195	**1.6764** (3.41%)	2.7292	1.8947
United States	5.9361	3.7326	2.6347	1.6497	2.7144	1.7509	**2.5728** (2.35%)	**1.5774** (4.38%)

Panel A reports results from a model in first-differences as in Campa and Goldberg (2005) with no long-run levels relation, Panel B reports results from a less parsimonious version of equation (1) with four lags for the export price and NEER changes and without the lagged dependent variable as regressor. Panel C corresponds to equation (1). One-quarter-ahead forecasts for the 2004Q4-2009Q3 period (20 quarters) based on a rolling window. Bold shaded indicates that at least one of the two ECMs produces smaller RMSE or MAE than the first-differences model. The figures in parenthesis are the corresponding percentage reduction in RMSE or MAE relative to the model in first-differences.

APPENDIX B

Import pass-through estimates and goodness-of-fit: 1980Q1-2007Q4 (*excl. recent crisis*)

Country	Estimation period	Estimation quarters (T)	Short run ERPT		Long run ERPT		Adj. R^2	AIC	SBC
Panel I: Emerging countries (N=18)									
Argentina	1996Q1-2007Q4	48	0.0108		0.0095		0.0688	-4.6173	-4.3390
Brazil	1996Q3-2007Q4	46	0.9206	***	0.8950	***	0.6589	-2.5329	-2.2490
Chile	1996Q1-2007Q4	48	-0.0629		-0.6196	***	0.1744	-3.8433	-3.5650
China	1995Q1-2007Q4	52	0.2579	***	-0.2750		0.2709	-5.4461	-5.1785
Colombia	1980Q1-2007Q4	112	0.5044	***	1.0101	***	0.0596	-1.8660	-1.6912
Czech Republic	1997Q1-2007Q4	44	0.4895	***	0.0577		0.7046	-6.0636	-5.7740
Hong Kong	1980Q1-2007Q4	112	0.3266	***	1.3112	***	0.6744	-6.7115	-6.5397
Hungary	1994Q1-2007Q4	56	0.6718	***	1.0765	***	0.7510	-5.4043	-5.1489
Israel	1994Q1-2007Q4	56	0.9149	***	1.3099	***	0.8052	-5.5478	-5.2923
Mexico	1988Q1-2007Q4	80	0.8984	***	0.2732	***	0.9176	-5.1354	-4.9239
Pakistan	1980Q1-2007Q4	112	0.2165		1.4328	***	0.0687	-3.1540	-2.9821
Poland	1994Q1-2007Q4	56	0.6234	***	0.9964	***	0.5382	-4.4327	-4.1772
Singapore	1980Q1-2007Q4	112	-0.0221		0.3071	***	0.2062	-5.1009	-4.9291
South Africa	1980Q1-2007Q4	112	1.2576	***	2.2198	***	0.7767	-3.4530	-3.2812
South Korea	1980Q1-2007Q4	112	0.8979	***	0.0995		0.6406	-4.0026	-3.8307
Thailand	1980Q1-2007Q4	112	0.8546	***	2.4767	***	0.3684	-3.4342	-3.2624
Turkey	1997Q1-2007Q4	27	0.9764	***	1.0262	***	0.9317	-4.4744	-4.1848
Venezuela	1996Q2-2007Q4	47	0.6961	***	1.2922	***	0.8504	-4.9502	-4.6692
	Panel MG estimates		*0.5796*	***	*0.8277*	***			
Panel II: Developed countries (N=19)									
Australia	1980Q1-2007Q4	112	0.7450	***	0.6402		0.7869	-5.5022	-5.3303
Belgium	1980Q1-2007Q4	112	0.9676	***	0.6680	***	0.3023	-4.0217	-3.8498
Canada	1980Q1-2007Q4	112	0.6405	***	0.4160		0.3496	-4.6911	-4.5193
Denmark	1980Q1-2007Q4	112	0.8857	***	0.6235	***	0.5097	-5.1332	-4.9613
Finland	1980Q1-2007Q4	112	0.3483	***	0.9861	**	0.3611	-5.1572	-4.9853
France	1980Q1-2007Q4	112	0.4305	**	0.5704	**	0.3320	-5.0240	-4.8521
Germany	1980Q1-2007Q4	112	0.6046	***	0.3893	***	0.4154	-4.9971	-4.8253
Greece	1980Q1-2007Q4	112	0.4757	***	1.0414	***	0.3983	-4.4506	-4.2787
Ireland	1980Q1-2007Q4	112	0.7034	***	0.9484	***	0.4965	-5.1072	-4.9353
Italy	1980Q1-2007Q4	112	0.9132	***	0.4596	**	0.2757	-3.3408	-3.1689
Japan	1980Q1-2007Q4	112	0.6263	***	0.7715	***	0.4904	-3.8799	-3.7080
Netherlands	1980Q1-2007Q4	112	0.8550	***	0.7245	***	0.3865	-4.9127	-4.7408
New Zealand	1980Q1-2007Q4	112	0.0197	**	0.1620		0.1297	-4.0051	-3.8332
Norway	1980Q1-2007Q4	112	0.4731	***	0.8957	**	0.2493	-5.1937	-5.0218
Spain	1980Q1-2007Q4	112	0.7404	***	0.7030		0.2256	-3.5252	-3.3534
Sweden	1980Q1-2007Q4	112	0.5596	***	-2.1599		0.5790	-5.2862	-5.1143
Switzerland	1980Q1-2007Q4	112	0.5798	***	0.3715		0.2898	-4.7470	-4.5751
United Kingdom	1980Q1-2007Q4	112	0.4216	***	0.7605	***	0.5564	-5.6024	-5.4305
United States	1980Q1-2007Q4	112	0.3291	***	0.3461		0.3115	-5.4701	-5.2983
	Panel MG estimates		*0.5957*	***	*0.4904*	***			

The reported estimation results are based on the parsimonious ECM specification (1). *, ** and *** denote rejection of the hypothesis of zero pass-through at the 10%, 5% and 1% level. Bold denotes rejection of the hypothesis of complete pass-through at the 5% level.

Table 1a. Misspecification and cointegration tests: unbalanced sample 1980Q1-2009Q

Country	Misspecification linear ECM eq. (1) Autocorrelation (p-value)	Heteroscedasticity (p-value)	Reset (p-value)	Time-series cointegration PSS F-statistic	Johansen trace statistic	Panel cointegration test type	statistic
Panel I: Emerging countries (N=18)							
Argentina	0.341	0.000 ***	0.044 **	3.723	34.388 *	Pedroni (Group-ADF)	-2.690 ***
Brazil	0.760	0.671	0.147	8.361 ***	31.918	Kao (ADF)	-1.608 *
Chile	0.000 ***	0.100	0.156	7.404 ***	35.904 **	Maddala-Wu (Fisher)	
China	0.199	0.023 **	0.001 ***	0.742	28.679	Ho: None	78.820 ***
Colombia	0.468	0.952	0.001 ***	5.211 **	30.550	Ho: At most 1	38.130
Czech Republic	0.077 *	0.272	0.749	0.871	34.692 *	Ho: At most 2	29.600
Hong Kong	0.331	0.002 ***	0.609	12.032 ***	50.233 ***		
Hungary	0.002 ***	0.003 ***	0.875	4.091	32.349 *		
Israel	0.781	0.000 ***	0.163	1.930	30.214		
Mexico	0.736	0.383	0.077 *	6.403 ***	42.896 ***		
Pakistan	0.076 *	0.526	0.101	5.867 ***	37.380 **		
Poland	0.011 **	0.631	0.032 **	2.749	22.432		
Singapore	0.801	0.000 ***	0.053 *	2.923	20.076		
South Africa	0.567	0.222	0.433	4.294 *	30.997		
South Korea	0.001 ***	0.004 ***	0.014 **	1.860	20.355		
Thailand	0.223	0.155	0.035 **	2.334	25.958		
Turkey	0.000 ***	0.940	0.860	1.440	48.685 ***		
Venezuela	0.797	0.226	0.001 ***	6.567 ***	33.363 *		
Panel II: Developed countries (N=19)							
Australia	0.036 **	0.000 ***	0.235	4.491 *	29.584	Pedroni (Group-ADF)	-2.989 ***
Belgium	0.757	0.392	0.231	1.698	24.250	Kao (ADF)	-5.424 ***
Canada	0.457	0.078 *	0.404	1.752	17.133	Maddala-Wu (Fisher)	
Denmark	0.021 **	0.503	0.036 **	10.416 ***	33.922 *	Ho: None	78.350 ***
Finland	0.542	0.010 **	0.389	2.523	27.066	Ho: At most 1	41.210
France	0.109	0.001 ***	0.015 **	5.478 **	30.018	Ho: At most 2	34.290
Germany	0.033 **	0.895	0.946	5.868 ***	45.582 ***		
Greece	0.624	0.628	0.000 ***	3.116	39.804 **		
Ireland	0.303	0.652	0.517	11.433 ***	32.428 *		
Italy	0.522	0.000 ***	0.001 ***	3.114	22.157		
Japan	0.116	0.044 **	0.073 *	7.888 ***	31.254		
Netherlands	0.011 **	0.697	0.029 **	6.872 ***	30.085		
New Zealand	0.572	0.436	0.000 ***	4.069	24.903		
Norway	0.154	0.043 **	0.778	6.453 ***	22.878		
Spain	0.348	0.351	0.610	12.807 ***	18.827		
Sweden	0.893	0.426	0.971	3.788	31.457		
Switzerland	0.146	0.680	0.626	3.649	43.722 ***		
United Kingdom	0.524	0.002 ***	0.241	5.857 ***	23.144		
United States	0.287	0.283	0.095 *	3.241	29.847		

Autocorrelation is tested using the Breusch-Godfrey Lagrange Multiplier (LM) test using a maximum lag order of 4 quarters. Heteroskedasticity is tested using White's LM statistic. The Pesaran, Shin and Smith (2001; PSS) test rejects the null of no level relationship at the 1%, 5% or 10% level whether the regressors are I(0) or I(1) if the test statistic is larger than, respectively, 5.52, 4.85 or 4.14. Evidence of cointegration at the10%, 5% and 1% level is denoted, respectively, by *, ** and ***. Shaded countries are those for which evidence of cointegration is found with at least one of the two time-series tests.

Table 1b. Misspecification and cointegration tests: balanced sample 1997Q1-2009Q3

Country	Misspecification linear ECM eq. (1) Autocorrelation (p-value)	Heteroscedasticity (p-value)	Reset (p-value)	Time-series cointegration PSS F-statistic	Johansen trace statistic	Panel cointegration test type	statistic
Panel I: Emerging countries (N=18)							
Argentina	0.365	0.000 ***	0.050 *	3.485	34.388 *	Pedroni (Group-ADF)	-2.852 ***
Brazil	0.760	0.671	0.147	8.361 ***	31.918	Kao (ADF)	-3.303 ***
Chile	0.015 **	0.114	0.275	8.501 ***	35.904 **	Maddala-Wu (Fisher)	
China	0.372	0.111	0.005 ***	0.824	27.012	Ho: None	90.600 ***
Colombia	0.232	0.032 **	0.036 **	2.433	50.539 ***	Ho: At most 1	43.500 *
Czech Republic	0.077 *	0.272	0.749	0.871	34.692 *	Ho: At most 2	36.960
Hong Kong	0.144	0.890	0.198	6.352 ***	28.069		
Hungary	0.468	0.002 ***	0.331	2.728	30.801 *		
Israel	0.309	0.847	0.674	3.401	35.642 **		
Mexico	0.555	0.166	0.992	4.006	48.073 ***		
Pakistan	0.143	0.172	0.234	7.612 ***	24.851		
Poland	0.050 **	0.730	0.114	1.955	18.128		
Singapore	0.181	0.921	0.260	4.444 *	28.399		
South Africa	0.751	0.924	0.077 *	4.578 *	23.930		
South Korea	0.012 **	0.155	0.046 **	13.270 ***	37.059 **		
Thailand	0.553	0.327	0.134	1.393	29.751		
Turkey	0.000 ***	0.940	0.860	1.440	48.685 ***		
Venezuela	0.868	0.251	0.001 ***	6.762 ***	33.363 *		
Panel II: Developed countries (N=19)							
Australia	0.050	0.527	0.597	8.622 ***	21.231	Pedroni (Group-ADF)	-2.011 **
Belgium	0.612	0.116	0.278	0.674	25.642	Kao (ADF)	-3.567 ***
Canada	0.526	0.099 *	0.239	2.591	24.455	Maddala-Wu (Fisher)	
Denmark	0.215	0.514	0.124	4.829 *	31.881	Ho: None	80.050 ***
Finland	0.188	0.394	0.618	2.390	35.894 **	Ho: At most 1	42.720
France	0.176	0.779	0.037 **	5.300 **	28.836	Ho: At most 2	35.940
Germany	0.484	0.441	0.525	14.635 ***	21.351		
Greece	0.260	0.022 **	0.110	2.211	25.330		
Ireland	0.659	0.365	0.535	12.605 ***	36.551 **		
Italy	0.031 **	0.147	0.274	2.812	28.320		
Japan	0.682	0.190	0.764	9.348 ***	43.186 ***		
Netherlands	0.495	0.396	0.428	2.654	33.118 *		
New Zealand	0.354	0.095 *	0.697	2.984	29.706		
Norway	0.899	0.808	0.426	4.180 *	23.515		
Spain	0.077 *	0.528	0.048 **	2.977	21.504		
Sweden	0.415	0.694	0.797	0.960	29.953		
Switzerland	0.356	0.565	0.272	1.370	30.699		
United Kingdom	0.602	0.800	0.166	5.114 **	36.460 **		
United States	0.671	0.178	0.630	0.843	32.361 *		

See note to Table 1a.

Table 2a. In-sample goodness-of-fit comparison of empirical pass-through models: unbalanced sample 1980Q1-2009Q3

	Estimation	Estimation	A: First-differences model					B: ECM 4 lags					C: Parsimonious ECM				
Country	period	quarters (T)	Short run ERPT	Long run ERPT	Adj. R^2	AIC	SBC	Short run ERPT	Long run ERPT	Adj. R^2	AIC	SBC	Short run ERPT	Long run ERPT	Adj. R^2	AIC	SBC
Panel I: Emerging countries (N=18)																	
Argentina	1996Q1-2009Q3	55	**0.0881** **	**0.0512** *	0.0830	-3.9562	-3.5510	**0.0818** **	**0.2424** ***	0.1799	-4.0291	-3.5134	**0.0081**	**0.0893** ***	0.0721	-3.9928	-3.7325
Brazil	1996Q3-2009Q3	53	**0.7563** ***	**0.3171**	0.3700	-1.7906	-1.3778	0.9001 ***	0.9688 ***	0.6266	-2.2742	-1.7489	0.8648 ***	0.9014 ***	0.6342	-2.3739	-2.1088
Chile	1996Q1-2009Q3	55	**-0.2045**	**-0.2857**	0.2716	-3.5760	-3.1708	**-0.2794** *	**-0.7931** ***	0.3516	-3.6536	-3.1380	**-0.2431**	**-0.6949** ***	0.3910	-3.8043	-3.5441
China	1995Q1-2009Q3	59	**0.4981** ***	0.7555 ***	0.7317	-5.0664	-4.6756	**0.5404** ***	0.4849	0.7309	-5.0260	-4.5287	**0.5331** ***	**0.1502**	0.6978	-4.9899	-4.7390
Colombia	1980Q1-2009Q3	119	0.6552 ***	0.7002 ***	0.0280	-1.8206	-1.5505	0.6751 **	0.9840 ***	0.0499	-1.8196	-1.4759	**0.5295** ***	1.0150 ***	0.0722	-1.9349	-1.7669
Czech Republic	1997Q1-2009Q3	51	**0.4771** ***	0.6653 ***	0.4717	-5.3533	-4.9326	**0.4510** ***	1.6806	0.4567	-5.2853	-4.7499	**0.3981** ***	0.2707	0.6011	-5.7317	-5.4615
Hong Kong	1980Q1-2009Q3	119	**0.2958** ***	0.7702 ***	0.4508	-6.2069	-5.9429	**0.2807** ***	1.0814 ***	0.6444	-6.6184	-6.2824	**0.3209** ***	1.2309 ***	0.6712	-6.7245	-6.5592
Hungary	1994Q1-2009Q3	63	**0.7460** ***	0.9187 ***	0.7958	-5.5840	-5.1932	**0.7185** ***	1.1895 ***	0.8254	-5.7029	-5.2056	**0.7673** ***	1.0837 ***	0.7680	-5.3625	-5.1223
Israel	1994Q1-2009Q3	63	**0.9138** ***	**0.8469** ***	0.8527	-5.6786	-5.2878	**0.9091** ***	1.2494 ***	0.8589	-5.6837	-5.1864	**0.8692** ***	1.3566 ***	0.7747	-5.3611	-5.1210
Mexico	1988Q1-2009Q3	87	**0.8951** ***	**0.8009** ***	0.9039	-4.9013	-4.5874	**0.8937** ***	**0.6584** ***	0.9121	-4.9621	-4.5626	**0.9191** ***	**0.3587** **	0.9193	-5.1047	-4.9035
Pakistan	1980Q1-2009Q3	119	**0.3295**	0.4250	0.2437	-3.0187	-2.7547	**0.3595** *	**1.4265** ***	0.3008	-3.0741	-2.7381	**0.3445** *	**1.4100** ***	0.2643	-3.0923	-2.9270
Poland	1994Q1-2009Q3	63	**0.6211** ***	0.7802 ***	0.4860	-4.2490	-3.8582	**0.6511** ***	1.0639 ***	0.5332	-4.3078	-3.8105	**0.7118** ***	0.9850 ***	0.5904	-4.4269	-4.1867
Singapore	1980Q1-2009Q3	119	**-0.1659**	**0.2415**	0.3633	-5.0098	-4.7458	**-0.1697**	**0.1201**	0.3785	-5.0108	-4.6748	**-0.0853**	**0.2753** ***	0.3525	-5.0371	-4.8719
South Africa	1980Q1-2009Q3	119	**1.3064** ***	**1.5515** ***	0.7905	-3.3254	-3.0614	**1.3304** ***	**2.4510** ***	0.7893	-3.2965	-2.9605	**1.3359** ***	**2.2873** ***	0.7806	-3.3264	-3.1611
South Korea	1980Q1-2009Q3	119	0.9402 ***	**0.3861** ***	0.7955	-4.2848	-4.0208	0.9581 ***	1.4713 **	0.7948	-4.2584	-3.9224	0.9269 ***	0.1552	0.6209	-3.6999	-3.5347
Thailand	1980Q1-2009Q3	119	0.9200 ***	0.6097 **	0.4247	-3.5072	-3.2432	0.9579 ***	2.2993 **	0.4346	-3.5015	-3.1655	0.8507 ***	2.2914 **	0.3861	-3.4985	-3.3332
Turkey	1997Q1-2009Q3	51	1.0035 ***	0.9652 ***	0.9280	-4.4087	-3.9880	0.9751 ***	0.9804 ***	0.9298	-4.3935	-3.8581	0.9799 ***	**1.0604** ***	0.8943	-4.0681	-3.7979
Venezuela	1996Q2-2009Q3	54	**0.6734** ***	**0.7861** ***	0.8151	-4.7576	-4.3487	**0.6658** ***	**1.2992** ***	0.8451	-4.8961	-4.3756	**0.6800** ***	1.3648 ***	0.8213	-4.8868	-4.6242
	Panel MG estimates		***0.5972*** ***	*0.6270* ***				***0.6055*** ***	*1.0477* ***				***0.5951*** ***	*0.8662* ***			
Panel II: Developed countries (N=19)																	
Australia	1980Q1-2009Q3	119	**0.7124** ***	**0.7230** ***	0.7720	-5.2454	-4.9814	**0.7038** ***	0.9164 ***	0.7799	-5.2576	-4.9216	**0.7222** ***	0.8834 **	0.7754	-5.3162	-5.1510
Belgium	1980Q1-2009Q3	119	1.1040 ***	1.2660 ***	0.2547	-3.9241	-3.6601	1.0195 ***	0.5505 *	0.2796	-3.9351	-3.5991	0.9706 ***	0.7010 ***	0.3202	-4.0185	-3.8533
Canada	1980Q1-2009Q3	119	**0.6861** ***	**0.4878** ***	0.6492	-5.8829	-5.6189	**0.6827** ***	0.5725	0.6458	-5.8502	-5.5142	**0.6512** ***	0.5048 *	0.4117	-4.7110	-4.5457
Denmark	1980Q1-2009Q3	119	0.7389 ***	0.8695 ***	0.3369	-4.8945	-4.6305	**0.6951** ***	**0.3869** **	0.3785	-4.9362	-4.6002	0.8802 ***	**0.5031** ***	0.4886	-5.0641	-4.8988
Finland	1980Q1-2009Q3	119	**0.3650** ***	**0.6338** ***	0.2739	-4.8357	-4.5717	**0.3434** ***	0.1068	0.2755	-4.8148	-4.4788	**0.3351** ***	0.2037	0.3873	-5.0303	-4.8651
France	1980Q1-2009Q3	119	**0.3250**	1.0389 ***	0.2631	-4.8487	-4.5847	**0.2199**	**0.0998**	0.3145	-4.8980	-4.5620	**0.3987** **	0.4071	0.3576	-4.9596	-4.7943
Germany	1980Q1-2009Q3	119	**0.5689** ***	0.7095 ***	0.3953	-4.9395	-4.6755	**0.5935** ***	**0.3496** ***	0.4433	-4.9993	-4.6632	**0.5880** ***	**0.3841** ***	0.4400	-4.9719	-4.8066
Greece	1980Q1-2009Q3	119	**0.5150** ***	0.7667 ***	0.3390	-4.3641	-4.1001	**0.4474** **	1.0035 ***	0.3688	-4.3872	-4.0512	**0.4824** ***	0.9769 ***	0.3780	-4.3960	-4.2307
Ireland	1980Q1-2009Q3	119	**0.6230** ***	0.8614 ***	0.3659	-4.9257	-4.6616	**0.6498** ***	0.8780 ***	0.3937	-4.9475	-4.6114	**0.7161** ***	1.0009 ***	0.4666	-5.0334	-4.8681
Italy	1980Q1-2009Q3	119	**0.4533** **	**0.4152** *	0.1202	-3.5763	-3.3123	**0.4922** **	**0.5871** ***	0.1816	-3.6256	-3.2896	0.8697 ***	**0.5575** ***	0.2979	-3.3726	-3.2073
Japan	1980Q1-2009Q3	119	0.8010 ***	0.8978 ***	0.6164	-3.7617	-3.4976	0.7871 ***	**0.7997** ***	0.6382	-3.7970	-3.4610	**0.6894** ***	**0.7663** ***	0.6324	-3.8611	-3.6958
Netherlands	1980Q1-2009Q3	119	0.7865 ***	0.8928 ***	0.3907	-4.8697	-4.6056	0.8132 ***	**0.6570** ***	0.4301	-4.9134	-4.5774	0.8231 ***	0.7435 ***	0.4496	-4.9110	-4.7457
New Zealand	1980Q1-2009Q3	119	**0.0142** *	**0.0323** **	0.2301	-3.9901	-3.7261	**0.0197** **	0.2904	0.2996	-4.0617	-3.7257	**0.0179** **	**0.0478**	0.1596	-3.9325	-3.7672
Norway	1980Q1-2009Q3	119	**0.4701** ***	**0.6931** ***	0.2613	-5.1370	-4.8729	**0.4575** ***	0.0992	0.2838	-5.1448	-4.8088	**0.4834** ***	0.6948	0.2953	-5.2285	-5.0633
Spain	1980Q1-2009Q3	119	0.9105 ***	1.2845 ***	0.1397	-3.4907	-3.2266	0.8585 ***	0.4655	0.1808	-3.5165	-3.1805	0.7518 ***	0.7630	0.2504	-3.5516	-3.3863
Sweden	1980Q1-2009Q3	119	**0.5876** ***	**0.6015** ***	0.5766	-5.2168	-4.9527	**0.5590** ***	13.8891	0.5787	-5.1987	-4.8627	**0.5757** ***	-1.5459	0.5975	-5.3011	-5.1358
Switzerland	1980Q1-2009Q3	119	**0.5285** ***	0.8948 ***	0.3009	-4.7178	-4.4538	**0.5172** ***	**-0.0849**	0.3247	-4.7294	-4.3933	**0.5717** ***	**0.3356**	0.2838	-4.7204	-4.5552
United Kingdom	1980Q1-2009Q3	119	**0.4398** ***	**0.6262** ***	0.5467	-5.4650	-5.2010	**0.4285** ***	0.8440 **	0.5669	-5.4877	-5.1517	**0.4015** ***	0.8318 ***	0.5822	-5.5916	-5.4264
United States	1980Q1-2009Q3	119	**0.3462** ***	**0.4243** ***	0.6381	-5.3935	-5.1295	**0.3747** ***	0.6155	0.6415	-5.3798	-5.0437	**0.3980** ***	0.2141	0.6497	-5.4603	-5.2950
	Panel MG estimates		***0.5777*** ***	*0.7431* ***				***0.5612*** ***	*1.2119* *				***0.5961*** ***	*0.4723* ***			

Panel A reports results from a model in first-differences with no long-run levels relation. Panel B reports results from a less parsimonious version of equation (1) with four lags for the export price and NEER changes and without the lagged dependent variable as regressor. Panel C corresponds to equation (1). *, ** and *** denote rejection of the hypothesis of zero pass-through at the 10%, 5% and 1% level. Bold denotes rejection of the hypothesis of complete pass-through at the 5% level. Shaded areas indicate the leading model in terms if adj.R^2, AIC and SBC criteria.

Table 2b. In-sample goodness-of-fit comparison of empirical pass-through models: balanced sample 1997Q1-2009Q3

Country	Estimation period	Estimation quarters (T)	A: First-differences model					B: ECM 4 lags					C: Parsimonious ECM				
			Short run ERPT	Long run ERPT	Adj. R2	AIC	SBC	Short run ERPT	Long run ERPT	Adj. R2	AIC	SBC	Short run ERPT	Long run ERPT	Adj. R2	AIC	SBC
Panel I: Emerging countries (N=18)																	
Argentina	1997Q1-2009Q3	51	**0.0878** **	**0.0404**	0.1020	-3.9269	-3.5102	**0.0899** **	**-0.0993** **	0.1650	-3.9599	-3.4296	**0.0081**	**0.0866** ***	0.0613	-3.9441	-3.6789
Brazil	1997Q1-2009Q3	51	**0.7586** ***	**0.3232**	0.3678	-1.7653	-1.3487	0.8974 ***	0.1603 ***	0.6770	-2.3971	-1.8668	0.8648 ***	0.9014 ***	0.6342	-2.3739	-2.1088
Chile	1997Q1-2009Q3	51	**-0.2039**	**-0.2435**	0.2770	-3.5822	-3.1656	**-0.2854** **	**-0.0199**	0.4311	-3.7824	-3.2521	**-0.2359** *	**-0.6309** ***	0.4517	-3.9204	-3.6553
China	1997Q1-2009Q3	51	**0.4895** ***	0.7377 ***	0.7643	-5.0629	-4.6462	**0.5690** ***	0.9684	0.7679	-5.0384	-4.5081	**0.5608** ***	0.6548	0.7323	-4.9972	-4.7320
Colombia	1997Q1-2009Q3	51	**0.5339** ***	**0.7480** ***	0.8206	-5.5468	-5.1301	**0.5299** ***	0.5182 ***	0.8512	-5.6937	-5.1634	**0.5527** ***	1.0804 ***	0.8403	-5.7244	-5.4592
Czech Republic	1997Q1-2009Q3	51	**0.4771** ***	0.6653 ***	0.4717	-5.3533	-4.9326	0.4510 ***	0.5231	0.4567	-5.2853	-4.7499	**0.3981** ***	0.2707	0.6011	-5.7317	-5.4615
Hong Kong	1997Q1-2009Q3	51	**0.2818** ***	**0.6850** ***	0.7263	-7.4886	-7.0719	**0.2856** ***	0.4664	0.7268	-7.4507	-6.9204	**0.2536** ***	0.9325 **	0.7257	-7.5477	-7.2826
Hungary	1997Q1-2009Q3	51	**0.7782** ***	0.9398 ***	0.8110	-5.9313	-5.5146	**0.7580** ***	0.6289 *	0.8371	-6.0400	-5.5097	**0.7501** ***	0.8748	0.8143	-6.0103	-5.7451
Israel	1997Q1-2009Q3	51	0.9130 ***	**0.7477** ***	0.8530	-5.5549	-5.1382	0.9296 ***	**0.7855** ***	0.8559	-5.5349	-5.0046	0.8825 ***	1.1030 ***	0.8367	-5.5111	-5.2459
Mexico	1997Q1-2009Q3	51	0.9787 ***	**0.7084** ***	0.9187	-5.7645	-5.3478	1.0129 ***	**0.6414** ***	0.9245	-5.7981	-5.2678	1.0082 ***	0.7966 **	0.9082	-5.7050	-5.4399
Pakistan	1997Q1-2009Q3	51	0.5956 **	0.7473 **	0.5380	-3.1244	-2.7077	0.8908 ***	**0.6366** ***	0.6516	-3.3670	-2.8367	0.9411 ***	**1.6571** ***	0.6214	-3.3852	-3.1200
Poland	1997Q1-2009Q3	51	**0.6208** ***	0.8914 ***	0.5439	-4.3171	-3.9005	**0.6317** ***	0.6457 ***	0.5636	-4.3217	-3.7914	**0.7089** ***	1.1136 ***	0.5854	-4.4742	-4.2091
Singapore	1997Q1-2009Q3	51	**0.2399** *	0.9699 **	0.7093	-5.5738	-5.1572	**0.2885** **	**0.1791**	0.7338	-5.6219	-5.0916	**0.2763** *	2.3222 ***	0.7516	-5.7925	-5.5273
South Africa	1997Q1-2009Q3	51	**1.5347** ***	**1.6746** ***	0.8704	-3.3744	-2.9577	**1.5278** ***	**1.6747** *	0.8826	-3.4328	-2.9025	**1.5837** ***	1.4707 ***	0.8903	-3.6019	-3.3367
South Korea	1997Q1-2009Q3	51	0.9807 ***	**0.4756** ***	0.9002	-4.1946	-3.7779	0.9776 ***	0.5741 ***	0.9172	-4.3421	-3.8118	0.9442 ***	**0.5714** ***	0.8545	-3.8791	-3.6140
Thailand	1997Q1-2009Q3	51	1.0684 ***	1.1033 ***	0.9033	-4.9542	-4.5376	1.0923 ***	1.0245	0.9012	-4.8933	-4.3630	1.0577 ***	1.8691 **	0.9013	-4.9950	-4.7298
Turkey	1997Q1-2009Q3	51	1.0035 ***	0.9652 ***	0.9280	-4.4087	-3.9880	0.9751 ***	0.8384 ***	0.9298	-4.3935	-3.8581	0.9799 ***	**1.0604** ***	0.8943	-4.0681	-3.7979
Venezuela	1997Q1-2009Q3	51	**0.6670** ***	**0.8126** ***	0.8061	-4.7215	-4.3048	**0.6681** ***	**0.9721** ***	0.8451	-4.9063	-4.3760	**0.6815** ***	1.3105 ***	0.8239	-4.8796	-4.6145
	Panel MG estimates		***0.6559*** ***	*0.7218* ***				***0.6828*** ***	*0.6177* ***				***0.6787*** ***	*0.9692* ***			
Panel II: Developed countries (N=19)																	
Australia	1997Q1-2009Q3	51	**0.7581** ***	0.9498 ***	0.7766	-5.1670	-4.7504	**0.7438** ***	0.9265 ***	0.8248	-5.3703	-4.8400	**0.8323** ***	0.9182 ***	0.8146	-5.4153	-5.1501
Belgium	1997Q1-2009Q3	51	1.2724 ***	1.0040 ***	0.2475	-3.4564	-3.0397	1.4919 ***	**-1.0572**	0.3809	-3.6119	-3.0816	1.2804 ***	**3.0831** ***	0.2972	-3.5863	-3.3211
Canada	1997Q1-2009Q3	51	**0.7467** ***	0.7710 ***	0.6794	-5.3587	-4.9420	**0.7143** ***	0.6528	0.6682	-5.2848	-4.7544	**0.6632** ***	**0.3223**	0.6120	-5.2294	-4.9642
Denmark	1997Q1-2009Q3	51	**0.5139** ***	0.7060 ***	0.4150	-5.3046	-4.8879	**0.4320** **	0.6900 **	0.4601	-5.3452	-4.8149	**0.5604** ***	0.5736	0.4570	-5.4407	-5.1756
Finland	1997Q1-2009Q3	51	**0.4061** **	0.8472 ***	0.6553	-5.4458	-5.0292	**0.3882** **	1.1870	0.7229	-5.6245	-5.0942	**0.4631** ***	-0.9876	0.6474	-5.4849	-5.2197
France	1997Q1-2009Q3	50	**0.1536**	0.6992	0.1866	-4.7740	-4.3573	**0.2368**	0.8297 ***	0.3104	-4.8994	-4.3691	**0.4861** **	1.1018 ***	0.3099	-5.0000	-4.7348
Germany	1997Q1-2009Q3	51	**0.4883** **	1.0129 ***	0.4678	-4.9286	-4.5120	**0.5930** ***	**0.6447** ***	0.5884	-5.1460	-4.6157	0.6645 ***	1.1550 ***	0.6093	-5.2993	-5.0341
Greece	1997Q1-2009Q3	51	**-0.6047**	**-0.3722**	0.2623	-4.1796	-3.7629	**-0.7328**	0.1173	0.3129	-4.2109	-3.6806	**-0.4412**	-0.7967	0.1011	-4.0435	-3.7784
Ireland	1997Q1-2009Q3	51	0.6232 ***	0.8932 ***	0.2290	-4.7036	-4.2870	0.7599 ***	**0.3274** ***	0.4747	-5.0476	-4.5173	0.7491 ***	1.1418 ***	0.4719	-5.1435	-4.8784
Italy	1997Q1-2009Q3	51	1.1244 ***	1.4818 ***	0.5590	-4.8592	-4.4425	1.1259 ***	1.3694	0.5288	-4.7533	-4.2230	1.0904 ***	2.0852 *	0.4999	-4.7950	-4.5298
Japan	1997Q1-2009Q3	51	**0.6689** ***	**0.2933**	0.7994	-4.6880	-4.2713	0.6882 ***	0.6195	0.8640	-4.5428	-4.0125	**0.6692** ***	**0.3664** **	0.8621	-4.6298	-4.3647
Netherlands	1997Q1-2009Q3	51	**0.3902** **	**0.5358** ***	0.6076	-5.2447	-4.8280	**0.6188** ***	**1.6321** ***	0.7222	-5.5506	-5.0203	0.7260 ***	0.8146 ***	0.6720	-5.4856	-5.2205
New Zealand	1997Q1-2009Q3	51	**0.6469** ***	**0.7011** ***	0.7389	-4.9654	-4.5488	**0.6617** ***	**0.6136** ***	0.7608	-5.0135	-4.4832	**0.5622** ***	**0.6969** ***	0.6620	-4.7691	-4.5039
Norway	1997Q1-2009Q3	51	**0.4508** ***	**0.6033** ***	0.4514	-5.4252	-5.0086	**0.4279** ***	0.8605 ***	0.5208	-5.5208	-4.9905	**0.4393** ***	**0.3233** **	0.5339	-5.6497	-5.3845
Spain	1997Q1-2009Q3	51	0.5656 *	1.1762 *	0.5697	-5.2019	-4.7852	0.4604	1.4225	0.5589	-5.1374	-4.6071	0.4376	0.5213	0.4442	-5.0075	-4.7424
Sweden	1997Q1-2009Q3	51	**0.6350** ***	**0.5407** ***	0.5317	-5.3067	-4.8900	**0.6031** ***	0.4404	0.5432	-5.2918	-4.7615	**0.6496** ***	-0.8439	0.6078	-5.5456	-5.2804
Switzerland	1997Q1-2009Q3	51	**0.2450**	0.9040	0.1716	-4.5462	-4.1295	**0.1951**	1.3246 ***	0.3174	-4.7000	-4.1697	**0.2808** *	**0.2697**	0.1723	-4.6086	-4.3434
United Kingdom	1997Q1-2009Q3	51	**0.3898** ***	**0.5501** ***	0.6175	-5.7715	-5.3548	**0.4649** ***	**0.4076** ***	0.6791	-5.9074	-5.3771	**0.3473** ***	**0.6160** ***	0.6571	-5.9426	-5.6774
United States	1997Q1-2009Q3	51	**0.3191** ***	0.6874 ***	0.8523	-5.6502	-5.2335	**0.3160** ***	0.8152 ***	0.8572	-5.6446	-5.1143	**0.3723** ***	**0.2177**	0.8462	-5.6713	-5.4061
	Panel MG estimates		***0.5155*** ***	*0.7360* ***				***0.5363*** ***	*0.7276* ***				***0.5701*** ***	*0.6094* ***			

See note to Table 2a.

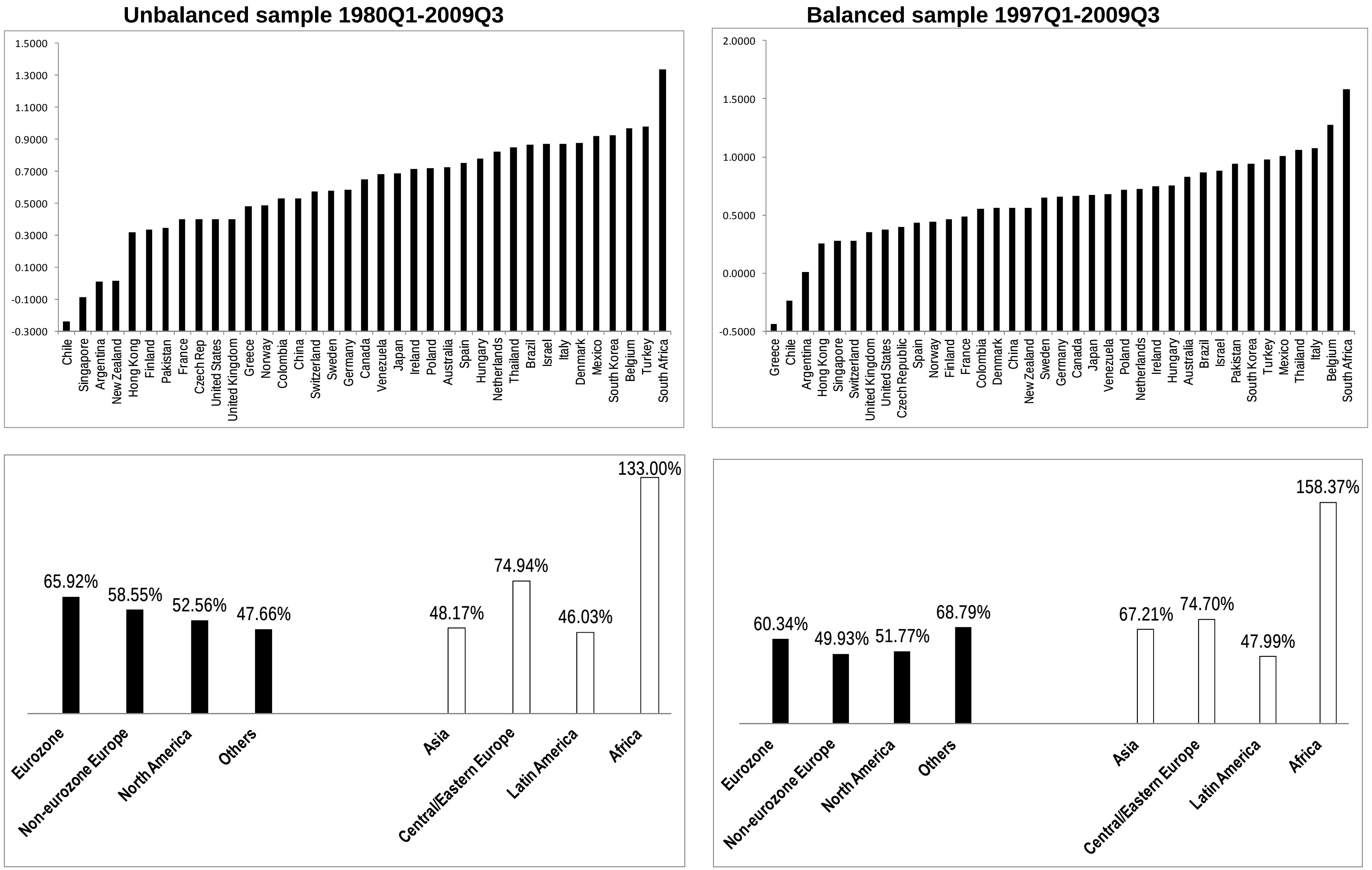


Figure 1. Short-run exchange rate elasticities of import prices.

In the bottom graphs the regions on the left-hand-side (shaded) are developed markets and those on the right-hand-side (non-shaded) are emerging markets.

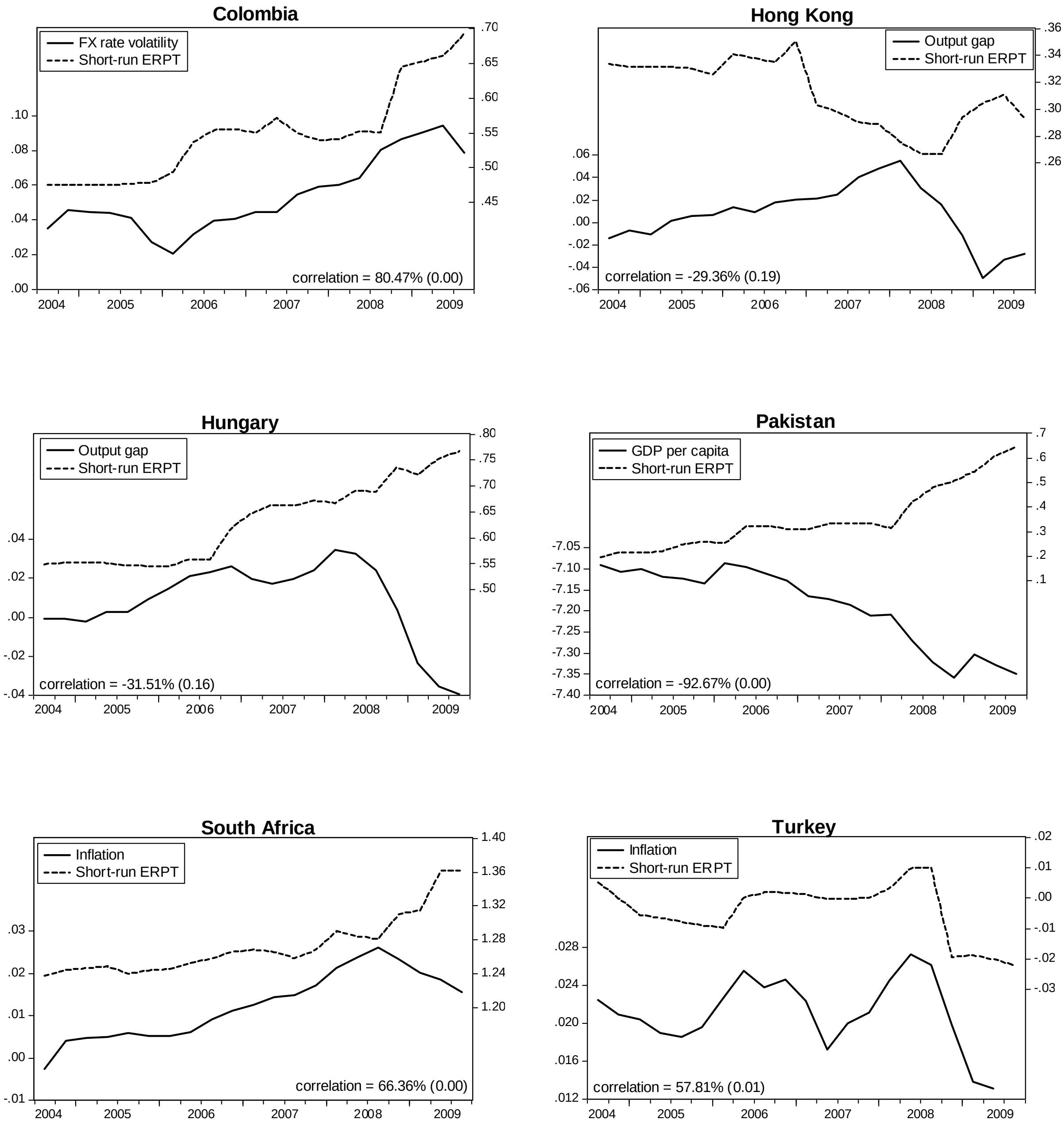


Figure 2a. Time evolution of ERPT and economic factors (EMs)

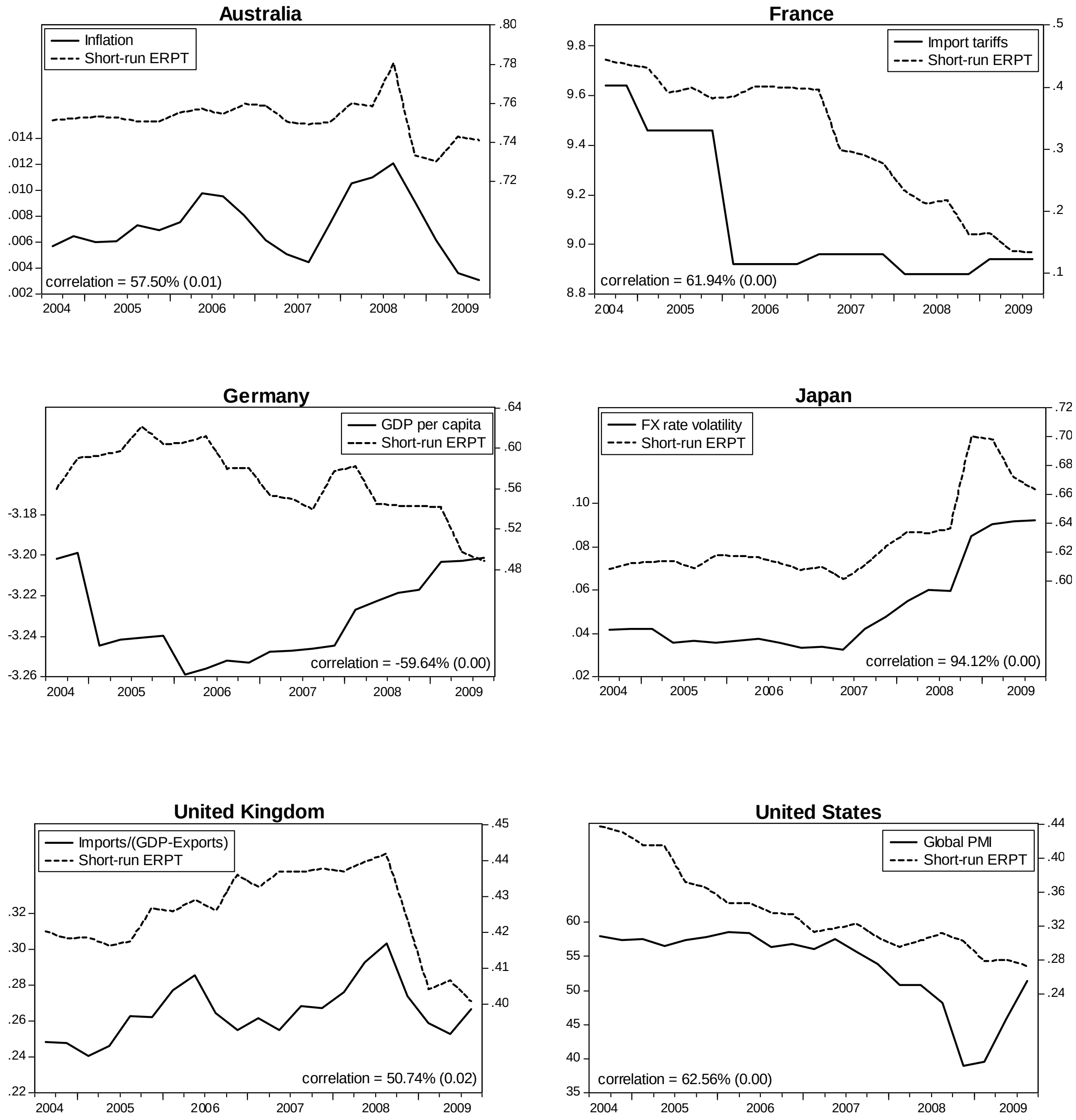


Figure 2b. Time evolution of ERPT and economic factors (DMs)

Table 3. Unweighted country-average unconditional correlations between potential drivers of ERPT

I. Unbalanced sample 1980Q1-2009Q3

	FX volat.	*Inflation*	*Output gap*	*GDP per capita*	*Import dependence*	*Tariffs*	*|Δ FX rate|*	*PMI*
FX volat.	1							
Inflation	-0.0058	1						
Output gap	-0.3438	0.0832	1					
GDP per capita	-0.0556	-0.4820	0.0386	1				
Import depend.	-0.0948	-0.1240	0.2149	0.0584	1			
Tariffs	-0.1036	-0.0626	-0.1380	-0.0128	-0.0511	1		
|Δ FX rate|	0.3697	0.1694	-0.0961	-0.0658	-0.0584	0.0241	1	
PMI	-0.4697	-0.1481	0.0990	-0.0120	-0.0338	0.1942	-0.3104	1

II . Balanced sub-sample 2004Q3-2009Q3

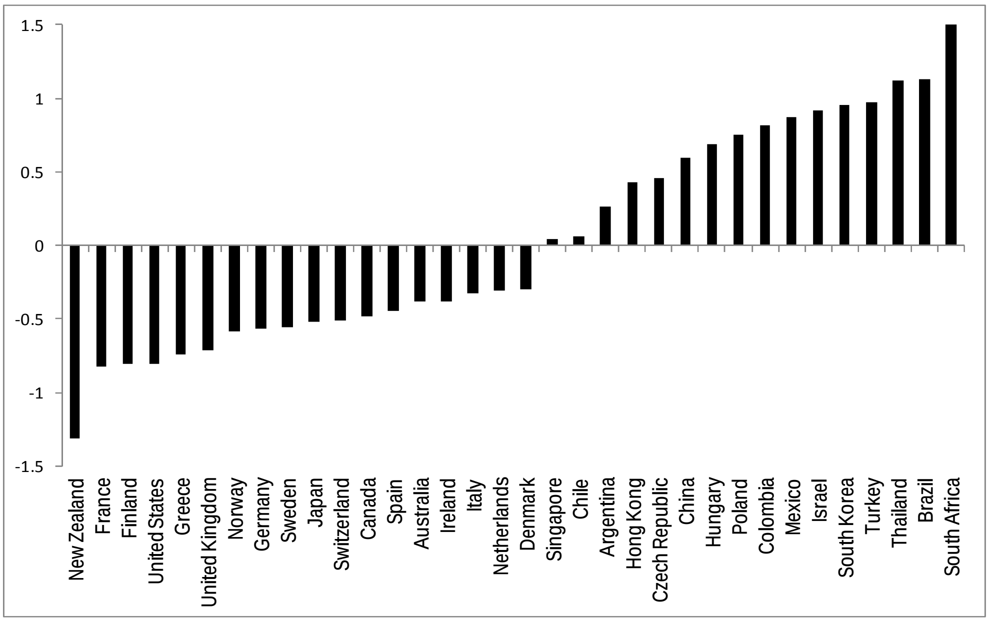
	FX volat.	*Inflation*	*Output gap*	*GDP per capita*	*Import dependence*	*Tariffs*	*|Δ FX rate|*	*PMI*
FX volat.	1							
Inflation	-0.1467	1						
Output gap	-0.4668	0.4087	1					
GDP per capita	0.0863	-0.1206	0.1819	1				
Import depend.	-0.3494	0.5030	0.5522	-0.1613	1			
Tariffs	-0.0758	-0.0806	-0.3294	-0.0831	-0.2171	1		
|Δ FX rate|	0.3702	0.2326	-0.0124	-0.0101	0.0431	-0.0715	1	
PMI	-0.7322	-0.1775	0.1553	-0.1040	0.1001	0.2391	-0.5175	1

Table 4. Determinants of country- and time-variation in import pass-through

	Sample 2004Q3-2009Q3								Sample ending 2007Q4		
	All countries				EMs	DMs	EMs	DMs	(*excl. recent crisis*)		
	1-way country effects		2-way country & time effects		1-way country effects		2-way country & time effects		All countries	EMs	DMs
	Fixed	Random	Fixed	Random	Fixed	Fixed	Fixed	Fixed	1-way country Fixed effects		
FX rate volatility	0.2111	0.2137 *	0.2221	0.0044	0.0498	0.2353	0.1531	0.0325	0.5676 **	1.0653 **	0.1015
	(0.1481)	(0.1234)	(0.1702)	(0.0935)	(0.1219)	(0.3278)	(0.1655)	(0.2616)	(0.2773)	(0.4273)	(0.2561)
Inflation	-0.0102	-0.0319	-0.0394	-0.2893	1.3886 **	-0.8546	1.4257 **	-0.5695	1.5130 ***	4.1111 ***	-0.1977
	(0.3483)	(0.3585)	(0.4492)	(0.3481)	(0.5913)	(0.5332)	(0.7182)	(0.5749)	(0.2395)	(1.3834)	(0.4307)
Output gap	-0.2877 ***	-0.3018 ***	-0.1711	-0.2761 ***	-0.0606	-0.4777 ***	-0.0207	-0.3602 ***	-0.2373 *	0.2925 **	-0.6863 ***
	(0.0769)	(0.0751)	(0.1238)	(0.0713)	(0.0995)	(0.1031)	(0.1368)	(0.1343)	(0.1240)	(0.1200)	(0.1123)
GDP per capita	-0.0541 ***	-0.0466 ***	-0.0596 ***	-0.0564 ***	-0.0991 ***	-0.0113	-0.0962 ***	-0.0062	-0.0786 ***	-0.1772 ***	-0.0105
	(0.0198)	(0.0150)	(0.0207)	(0.0148)	(0.0301)	(0.0289)	(0.0270)	(0.0261)	(0.0184)	(0.0249)	(0.0136)
Import dependence	0.0244 ***	0.0277 ***	0.0246 ***	0.0306 ***	0.0339 ***	-0.0097	0.0321 ***	-0.0084	0.0335 ***	0.0598 ***	-0.0970
	(0.0085)	(0.0085)	(0.0089)	(0.0076)	(0.0087)	(0.0383)	(0.0090)	(0.0381)	(0.0090)	(0.0105)	(0.0781)
Tariffs	0.0139 ***	0.0141 ***	0.0165 ***	0.0189 ***	0.0018	0.0199 **	0.0039	0.0333 ***	0.0108 ***	0.0061 *	0.0793 ***
	(0.0041)	(0.0042)	(0.0048)	(0.0048)	(0.0039)	(0.0077)	(0.0047)	(0.0081)	(0.0037)	(0.0036)	(0.0095)
$(\boldsymbol{\beta}^{\mathbf{dep}}-\beta^{app})_{SMALL}$	0.2701 *	0.2678 *	0.2555	0.2619 *	-0.2333	0.5416 ***	-0.2503	0.4755 ***	0.1664	-0.3015	0.2397
	(0.1486)	(0.1558)	(0.1564)	(0.1516)	(0.3471)	(0.1851)	(0.3813)	(0.1745)	(0.1024)	(0.2547)	(0.2007)
$(\boldsymbol{\beta}^{\mathbf{dep}}-\beta^{app})_{LARGE}$	-0.0151	-0.0163	-0.0318	-0.0299	0.0981	-0.5267 ***	0.1078	-0.5510 ***	0.0603	0.0426	-0.0951
	(0.1746)	(0.1777)	(0.1916)	(0.1798)	(0.2149)	(0.0857)	(0.2246)	(0.0694)	(0.1600)	(0.1762)	(0.2962)
$(\boldsymbol{\beta}_{\mathbf{LARGE}}-\beta_{SMALL})^{app}$	0.5428 **	0.5416 **	0.5552 **	0.5814 **	0.6293 *	0.4788 **	0.6205 *	0.4540 **	0.1009	0.2633	-0.0071
	(0.2470)	(0.2665)	(0.2613)	(0.2598)	(0.3288)	(0.1866)	(0.3397)	(0.1868)	(0.1783)	(0.2531)	(0.2215)
$(\boldsymbol{\beta}_{\mathbf{LARGE}}-\beta_{SMALL})^{dep}$	0.2577 ***	0.2575 **	0.2678 **	0.2896 ***	0.9607 ***	-0.5894 ***	0.9786 ***	-0.5726 ***	0.1852 **	0.6074 **	-0.3419 *
	(0.0987)	(0.1124)	(0.1170)	(0.1117)	(0.3417)	(0.2112)	(0.3647)	(0.2167)	(0.0787)	(0.2583)	(0.1966)
Global PMI	0.0481 **	0.0485 **	–	–	-0.0034	0.0658 *	–	–	0.0293	0.0087	-0.1669 *
	(0.0205)	(0.0192)			(0.0272)	(0.0402)			(0.0653)	(0.0640)	(0.0919)
Adj. R^2 (%)	98.584	7.339	98.553	6.782	98.632		98.603		99.310	99.491	
Adj. R^2 w/o fixed effects (%)	23.009	–	23.002	–	30.090		30.053		22.547	32.073	
F-stat (prob)	1128.819 ***	6.134 ***	771.970 ***	6.187 ***	935.775***		690.279***		1555.703 ***	1491.962***	
CS var/Tot. var (%)	–	98.050	–	98.010	–		–		–	–	
No. of obs.	714	714	714	714	714		714		476	476	

Panel regressions of short term pass-through elasticities on one-quarter-lagged drivers. White Period standard errors reported are robust to arbitrary heteroskedasticity and within cross-section serial correlation. For the random effects models, the reported adj.R^2 and F-stat statistics are for GLS weighted data; CS var/Total var refers to the proportion of the total composite-error variance that can be attributed to unobserved country heterogeneity. All regressions include a constant in the common coefficients portion of the specification which ensures that the fixed and random effects sum to zero. Bold is significant at 10% (*), 5% (**) or 1% (***) level.

I. Unobserved country-specific effects



II. Unobserved time-specific effects

Figure 3. Unobserved effects on import ERPT elasticity.

The top figure represents the country-specific intercepts α_i in the panel fixed effects regression (2) as deviations from an overall mean. The bottom figure represents the time-specific intercepts γ_i in (2) as deviations from an overall mean alongside the Global PMI.

Table 5. Out-of-sample forecasting ability of economic factors

Country	FX rate volatility RMSE	FX rate volatility MAE	Inflation RMSE	Inflation MAE	Output gap RMSE	Output gap MAE	GDP per capita RMSE	GDP per capita MAE	Import dependence RMSE	Import dependence MAE	Tariffs RMSE	Tariffs MAE	Sign asymmetry RMSE	Sign asymmetry MAE	Size asymmetry RMSE	Size asymmetry MAE	Global PMI RMSE	Global PMI MAE
Panel I: Emerging countries (N=18)																		
Argentina	4.923 (1.08%)	3.418 (1.54%)	5.124	3.449 (0.65%)	4.953 (0.48%)	3.502	5.029	3.402 (2.00%)	5.788	3.876	4.349 (12.61%)	2.963 (14.65%)	5.185	3.524	5.227	3.512	4.461 (10.36%)	2.940 (15.29%)
Brazil	10.445 (4.28%)	8.069	10.540 (3.42%)	7.880 (1.88%)	12.105	8.633	10.544 (3.38%)	7.975 (0.70%)	10.440 (4.33%)	8.005 (0.33%)	9.861 (9.64%)	7.221 (10.09%)	11.679	8.955	11.674	8.987	10.407 (4.64%)	6.517 (18.86%)
Chile	4.672	3.494	3.528 (10.68%)	2.685 (12.68%)	3.762 (4.76%)	3.083	3.724 (5.72%)	2.835 (7.79%)	3.739 (5.36%)	2.942 (4.34%)	3.708 (6.14%)	2.867 (6.77%)	3.864 (2.18%)	2.837 (7.72%)	4.048	2.989 (2.79%)	4.542	3.293
China	4.064	2.670	3.928 (3.16%)	2.604 (2.18%)	4.194	2.852	3.990 (1.64%)	2.539 (4.59%)	4.033 (0.56%)	2.641 (0.75%)	3.649 (10.04%)	2.198 (17.42%)	4.036 (0.49%)	2.705	3.851 (5.05%)	2.592 (2.61%)	3.823 (5.76%)	2.625 (1.36%)
Colombia	1.913 (69.49%)	1.336 (61.21%)	6.976	4.640	5.996 (4.36%)	3.323 (3.54%)	6.672	4.427	1.942 (69.02%)	1.371 (60.19%)	2.029 (67.64%)	1.434 (58.37%)	6.673	3.690	6.354	3.701	2.036 (67.52%)	1.533 (55.51%)
Czech Republic	1.838	1.397 (0.27%)	1.796 (0.07%)	1.388 (0.96%)	1.682 (6.43%)	1.299 (7.31%)	1.813	1.362 (2.80%)	1.928	1.508	1.772 (1.40%)	1.466	2.024	1.427	2.044	1.317 (6.02%)	1.893	1.451
Hong Kong	0.765	0.656	0.589 (2.00%)	0.463 (1.77%)	0.604	0.470 (0.13%)	0.610	0.480	0.610	0.472	n/a	n/a	0.612	0.472	0.555 (7.62%)	0.449 (4.73%)	0.711	0.612
Hungary	1.808 (0.02%)	1.456	1.643 (9.10%)	1.189 (14.52%)	1.898	1.393	1.929	1.399	1.897	1.407	1.686 (6.74%)	1.251 (10.11%)	2.254	1.661	2.263	1.639	1.712 (5.33%)	1.050 (24.51%)
Israel	3.591	2.447	3.283	2.350 (0.08%)	3.347	2.295 (2.40%)	3.343	2.450	3.383	2.373	3.906	2.940	3.401	2.532	3.471	2.531	3.739	2.478
Mexico	1.286 (28.85%)	0.890 (13.09%)	1.676 (7.28%)	1.024 (0.08%)	1.807 (0.07%)	1.029	1.673 (7.44%)	1.023 (0.14%)	1.779 (1.61%)	1.088	1.486 (17.79%)	1.099	1.639 (9.35%)	0.965 (5.84%)	1.851	1.057	1.372 (24.10%)	0.941 (8.13%)
Pakistan	n/a	n/a	7.562 (19.88%)	5.911 (15.65%)	n/a	n/a	6.680 (29.22%)	5.498 (21.54%)	n/a	n/a	7.906 (16.23%)	5.919 (15.54%)	11.108	7.696	11.177	7.729	8.239 (12.71%)	5.515 (21.30%)
Poland	4.024	3.162	3.738 (1.70%)	2.905 (2.90%)	3.864	3.067	3.800 (0.07%)	2.982 (0.34%)	4.097	3.250	3.515 (7.57%)	2.699 (9.79%)	6.505	3.789	5.844	3.581	4.190	3.403
Singapore	2.305 (3.33%)	1.644	2.835	1.890	2.557	1.806	2.640	1.881	2.688	1.805	2.738	2.261	2.361 (0.95%)	1.573 (2.84%)	2.557	1.724	2.222 (6.80%)	1.623
South Africa	9.348 (14.10%)	7.158 (5.64%)	9.748 (10.43%)	6.763 (10.85%)	11.337	7.789	10.577 (2.81%)	7.564 (0.29%)	9.700 (10.86%)	6.693 (11.77%)	13.235	8.258	11.441	7.907	10.872 (0.10%)	7.496 (1.18%)	9.018 (17.13%)	6.133 (19.15%)
South Korea	7.075 (24.14%)	3.838 (21.02%)	9.519	5.172	9.681	5.041	9.198 (1.37%)	4.836 (0.48%)	11.200	5.623	7.166 (23.16%)	4.621 (4.91%)	9.319 (0.08%)	4.806 (1.09%)	9.828	4.923	8.732 (6.37%)	5.087
Thailand	3.196 (23.16%)	2.186 (10.81%)	3.989 (4.10%)	2.416 (1.45%)	3.531 (15.12%)	2.214 (9.66%)	2.745 (34.00%)	1.823 (25.62%)	3.321 (20.16%)	2.010 (17.98%)	3.425 (17.66%)	2.378 (2.98%)	4.281	2.501	4.073 (2.07%)	2.395 (2.28%)	3.747 (9.92%)	2.546
Turkey	3.560 (8.18%)	2.405 (15.34%)	4.023	2.908	4.199	2.938	3.884	2.838 (0.13%)	3.288 (15.19%)	2.415 (14.99%)	3.823 (1.39%)	2.682 (5.61%)	4.325	2.934	3.734 (3.69%)	2.737 (3.68%)	2.947 (23.99%)	2.071 (27.12%)
Venezuela	4.313 (4.41%)	3.521 (1.90%)	4.557	3.576 (0.38%)	4.199 (6.95%)	3.438 (4.22%)	4.584	3.684			4.326 (4.14%)	3.788	4.234 (6.18%)	3.268 (8.95%)	3.987 (11.65%)	3.006 (16.26%)	4.409 (2.28%)	3.453 (3.79%)
MEAN forecast gain:	16.46%	14.53%	6.53%	4.72%	5.45%	4.54%	9.52%	5.53%	15.89%	15.77%	14.44%	14.20%	3.20%	5.29%	6.02%	5.48%	15.15%	19.50%
SUM forecast gain:	181.04%	130.80%	55.78%	43.16%	38.16%	27.26%	85.64%	66.41%	127.10%	110.36%	202.14%	156.23%	19.23%	26.44%	30.08%	38.37%	196.91%	195.03%
Panel II: Developed countries (N=19)																		
Australia	7.645	4.471	4.083 (1.29%)	2.385 (0.77%)	4.455	2.501	4.388	2.504	5.317	2.861	6.606	3.600	4.296	2.517	4.250	2.555	5.934	3.429
Belgium	4.830	4.070	4.309	3.161	4.224	3.158	4.227	3.125	n/a	n/a	10.299	6.218	3.875 (7.60%)	2.968 (4.63%)	3.854 (8.12%)	2.958 (4.96%)	7.102	4.976
Canada	4.033	2.189	2.698	1.815 (3.83%)	2.612 (0.66%)	1.849 (2.02%)	2.671	1.905	2.563 (2.52%)	1.819 (3.62%)	3.510	1.770 (6.20%)	2.454 (6.66%)	1.893	2.686	2.185	3.920	2.291
Denmark	2.355 (4.99%)	1.884 (6.96%)	2.516	2.016 (0.43%)	2.486	2.025	2.565	2.055	2.392 (3.46%)	1.866 (7.85%)	1.962 (20.83%)	1.492 (26.31%)	2.466 (0.50%)	1.987 (1.86%)	2.415 (2.54%)	1.999 (1.30%)	2.285 (7.79%)	1.834 (9.42%)
Finland	2.139 (31.97%)	1.873 (4.41%)	3.125 (0.60%)	1.969	3.149	1.968	3.204	1.978	3.194	1.992	1.935 (38.46%)	1.639 (16.37%)	3.140 (0.14%)	2.036	3.075 (2.21%)	2.000	1.879 (40.25%)	1.496 (23.64%)
France	3.146 (6.29%)	2.032 (1.06%)	2.955 (11.96%)	2.131	3.460	2.105	3.497	2.165	3.507	2.201	3.056 (8.97%)	2.159	3.438	2.076	3.438	2.058	3.395	2.377
Germany	2.414 (0.95%)	1.959	2.525	1.902	2.662	1.993	2.560	1.927	2.712	1.976	3.074	2.101	2.417 (0.80%)	1.821 (0.76%)	2.362 (3.07%)	1.763 (3.93%)	3.012	2.205
Greece	2.566	2.113	2.691	1.939	2.582	2.126	2.861	2.047	2.730	2.010	4.462	3.172	2.579	1.877	2.525	1.896	4.098	3.188
Ireland	2.498	2.140	1.936 (0.39%)	1.439 (1.32%)	2.400	1.636	1.932 (0.63%)	1.450 (0.52%)	2.321	1.765	2.566	2.002	1.885 (3.04%)	1.453 (0.36%)	1.895 (2.53%)	1.439 (1.28%)	3.089	2.190
Italy	4.911	2.987	4.073 (4.46%)	2.821 (2.99%)	4.262 (0.02%)	2.930	4.263 (0.00%)	3.134	4.660	3.231	3.591 (15.77%)	2.304 (20.76%)	4.259 (0.09%)	2.867 (1.38%)	4.319	2.904 (0.13%)	3.740 (12.26%)	2.425 (16.60%)
Japan	6.118	4.301	6.877	4.688	6.373	4.168	6.535	4.846	6.328	4.314	4.917 (19.40%)	3.730 (6.78%)	6.156	4.080	6.247	4.137	5.698 (6.59%)	4.339
Netherlands	2.324 (30.55%)	1.766 (26.02%)	3.202 (4.31%)	2.347 (1.69%)	3.488	2.517	3.033 (9.36%)	2.172 (9.02%)	2.924 (12.61%)	2.153 (9.84%)	3.194 (4.54%)	2.264 (5.19%)	3.214 (3.96%)	2.325 (2.61%)	3.276 (2.09%)	2.396	2.520 (24.70%)	1.954 (18.17%)
New Zealand	5.719	3.478 (4.40%)	4.702 (3.69%)	3.049 (16.18%)	4.473 (8.38%)	2.684 (26.23%)	5.006	3.029 (16.73%)	3.974 (18.60%)	2.459 (32.42%)	6.570	3.665	4.704 (3.63%)	2.847 (21.75%)	4.642 (4.92%)	2.885 (20.71%)	7.798	4.262
Norway	1.485 (3.96%)	1.162 (6.41%)	1.541 (0.37%)	1.204 (3.08%)	1.583	1.315	1.550	1.234 (0.65%)	1.545 (0.07%)	1.261	1.935	1.462	1.523 (1.51%)	1.221 (1.64%)	1.530 (1.04%)	1.215 (2.18%)	1.921	1.554
Spain	3.574	2.632	2.988 (0.04%)	2.297	2.982 (0.25%)	2.277	2.977 (0.39%)	2.284	3.003	2.284	3.343	2.195 (3.52%)	2.993	2.270 (0.19%)	2.905 (2.82%)	2.211 (2.81%)	3.142	2.363
Sweden	2.933 (5.83%)	2.055	3.017 (3.12%)	2.012 (1.40%)	3.009 (3.36%)	1.996 (2.20%)	3.421	2.157	3.011 (3.33%)	2.074	2.894 (7.08%)	2.141	3.027 (2.81%)	1.923 (5.75%)	2.704 (13.18%)	1.881 (7.83%)	3.233	2.392
Switzerland	2.807	2.250	2.281 (0.07%)	1.891 (0.00%)	2.306	1.909	2.282 (0.03%)	1.894	2.383	1.886 (0.24%)	3.297	2.708	2.306	1.905	2.308	1.912	2.557	2.219
United Kingdom	2.680 (1.80%)	2.072	2.986	2.011	2.754	1.896	2.923	1.968	2.544 (6.79%)	1.812 (4.37%)	4.879	2.705	2.754	1.842 (2.78%)	2.595 (4.90%)	1.784 (5.86%)	4.802	3.064
United States	2.281 (11.35%)	1.689	2.582	1.668	2.418 (6.02%)	1.676	2.420 (5.93%)	1.515 (3.94%)	2.278 (11.46%)	1.491 (5.49%)	1.110 (56.87%)	0.983 (37.70%)	2.378 (7.58%)	1.647	2.453 (4.66%)	1.666	1.207 (53.10%)	0.974 (38.26%)
MEAN forecast gain:	10.86%	8.21%	2.75%	3.17%	3.11%	10.15%	2.72%	6.17%	7.35%	9.12%	21.49%	15.35%	3.19%	3.97%	4.34%	5.10%	24.11%	21.22%
SUM forecast gain:	97.70%	49.27%	20.06%	17.88%	18.68%	30.45%	16.33%	30.87%	58.76%	63.82%	171.91%	122.82%	38.32%	43.71%	52.08%	51.00%	144.68%	106.09%

The table compares the forecast error of the baseline ECM equation (1) with that of a modified version (3) that allows for time-variation in the ERPT elasticity according to each of the drivers. Bold shaded indicates a reduction in forecast errors and the corresponding figures in parenthesis are the percentage reduction in RMSE or MAE relative to the baseline equation. Results are based on one-quarter-ahead forecasts obtained for the last 20 quarters of the sample (2004Q4-2009Q3) using a fixed-length rolling window approach.