Comparative advantage as a source of exporters' pricing power: Evidence from China and India[*]

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ABSTRACT

The literature on ERPT has not considered product-level comparative advantage (CA) as a source of heterogeneous firm productivity. However, a firm's production choice may determine its productivity level and also its pricing decision as both the degree of market power and the fixed costs of exporting vary across products. This paper empirically analyses the export pricing behaviour of Chinese and Indian exporters in 1994-2007 while considering 6-digit product-level CA at the intercept and at the slope. Previous ERPT estimates that did not take product-level CA into account are biased as CA is significant in both cases. ERPT is more incomplete in high CA products but export prices increase with export specialization because a stronger presence in export markets allows higher market power. With the REER, ERPT becomes zero as relative prices offset depreciation. If China were to let its currency float, Chinese exporters' pricing strategy would become a classical case of incomplete ERPT. On the contrary, Indian exporters' pricing strategy remains robust regardless of the exchange rate regime. This result supports recent calls for the adoption of a flexible exchange rate regime, particularly in the case of China.

Keywords: *exchange-rate pass-through, pricing-to-market, comparative advantage, India, China*

JEL Classifications: *F14, F41, O11*

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1. Introduction

While China and India, the two continent-sized ancient societies, initiated their planning for national development at the same time in the early 1950s (Srinivasan, 1990), their outward-oriented policies were introduced at two different points in time (in late 1970s for China and in early 1990s for India) showing different comparative advantages from growing world trade. They have been undergoing substantial trade liberalization and specialization reorientation in the last 20 years, for which these countries have been increasingly attracting the attention of academics and policy-makers around the world (see for example Feenstra and Wei (2010) for China and Girma (2012) for India). The interest in the study of these two countries has recently been augmented by the fact that both are important emerging markets that under the current economic downturn have taken up the role of growth engines in the world economy (Hanson, 2012).

China started opening up to international trade and investment in 1979, with the creation of the special economic zones (Huang, 2012). In India, the direct trade controls including quotas, licensing, and trading rights that were prevalent before the 1990s were phased-out during the reform period. In addition, the indirect trade controls, such as tariffs and non-tariff measures, were reduced in order to regulate the trade flows. Such trade liberalization policies have been instrumental in enhancing the international competitiveness of Indian industries (Alessandrini et al., 2011). These policy developments reveal China and India as two key emerging economies with changing product specializations and consequent changes in competitiveness. Moreover, China has kept a fixed exchange rate regime (low exchange rate volatility), whereas India has moved on to a flexible exchange rate regime (high exchange rate volatility).

The exchange rate pass-through literature has shown that the observed pass-through of exchange rate changes to foreign market prices is incomplete due to the sluggish price adjustment originating in mark-up adjustment by the exporters following changes in costs or movements in the exporters' currency (see for example Devereux and Yetman (2003) and Nakamura and Zerom (2010)). Moreover, incomplete exchange-rate pass-through (ERPT) exists even in emerging economies (see Mallick and Marques (2012) for the case of India). Gust et al. (2010) find that with increased trade integration, exporters have become more responsive to the prices of their competitors, explaining a sizeable portion of the observed decline in the sensitivity of US import prices to the exchange rate. This suggests that industry-level competitiveness can be crucial in explaining ERPT along with considering the firm's pricing orientation and the degree of exchange rate uncertainty.

Recently, the ERPT literature has acknowledged the existence of firms with heterogeneous productivity and their role in the determination of the extensive and intensive margins of trade has started to be taken into account (see for example Auer and Chaney, 2009; Alessandria and Kaboski, 2011; Basile et al, 2012; Berman et al, 2012; Johnson, 2012). Assuming a home currency depreciation, Rodriguez-Lopez (2011) finds that, when firms have heterogeneous productivity, aggregate ERPT into home import prices can be negative even if at the firm level it is positive (although incomplete). This result is due to the adjustment of the extensive margin whereby only the most productive foreign exporters survive a depreciation of the home currency and each exporter adjusts the mark up differently depending on productivity.

On the other hand, the growing importance of North-South trade brought by the development of global value chains renewed the importance of inter-industry trade based on patterns of comparative advantage (Hanson, 2012). Hence it is not sufficient to study firm heterogeneity without looking into the characteristics of the industry the firms belong to. Bernard, Redding and Schott (2007) have shown that the effects of symmetric trade liberalization on a given country are different for comparative advantage (CA) and comparative disadvantage (CD) industries, so that resource reallocation takes place across firms within the same industry, as well as between industries.

Taking into account that China and India are two major emerging exporters that have been undergoing substantial trade liberalization which lead to important changes in competitiveness in the last 20 years, in this paper we compare their pricing-to-market decisions in response to exchange rate changes – as measured by the NEER (Nominal Effective Exchange Rate) – whilst controlling for the industry CA and CD levels. Firms operating within more competitive industries have a greater presence in international markets, which may allow them to have lower fixed costs of exporting, but on the other hand that presence allows them to exercise a greater degree of market power. So pricing strategies may differ according to the industry CA level. If the cost effect predominates, export prices should be lower in high CA industries, but if the market power effect dominates instead, export prices could actually be higher in those industries. The identification of these types of industries is done using a transformation of the Hanson (2012) RCA index, which is bounded between -1 (CD) and 1 (CA) with zero representing intra-industry trade. We use 6-digit product-level data across high- and low-income export destinations over the period 2000-2007. At 6-digits we obtain a lower bound for intra-industry trade (and an upper bound for inter-industry trade).

On the other hand, high exchange-rate volatility causes ERPT to be incomplete in both the short and the long run (Corsetti *et al.*, 2008). In this context, considering two key emerging market exporters (China and India), where exchange rate fluctuations are respectively fully and partially managed by the authorities of these two countries, can reveal whether exchange rate volatility tends to increase price discrimination and thereby reduce the degree of ERPT.

Section 2 starts by exposing the theoretical set-up. Section 3 describes some stylized facts about the patterns of CA in China and India and explains the construction of the transformed Hanson (2012) RCA index. Section 4 presents short-run ERPT estimates in a static panel model. Section 5 introduces long-run ERPT estimates in a dynamic panel setting (System GMM). Section 6 introduces relative price effects through the REER and section 7 presents a counterfactual experiment of a change in exchange rate regime. Section 8 concludes.

2. Theoretical set-up

Despite the influence of recent work on firm heterogeneity started off by Melitz (2003), the idea that industries may matter in trade has been rehabilitated by, among others, Bernard, Redding and Schott (2007). They take the argument that heterogeneous firms may react differently to market conditions depending on whether they operate in CA or CD industries. It is possible that export pricing behaviour also differs by industry type. On the one hand, because CA industries are those with a relatively large export margin, we can expect firms within these industries to have lower fixed costs of exporting. If this effect dominates, export prices should decrease with the industry's CA level. On the other hand, we can expect a greater presence of CA industries in international markets, allowing firms in these industries to exercise a greater degree of market power through their pricing behaviour. If this effect dominates instead, export prices may actually increase with the industry's CA level.

We outline a simple model of exchange rate pass-through in a similar spirit as Devereux and Yetman (2003), Ghironi and Melitz (2005), Melitz and Ottaviano (2008), Chaney (2008) and Rodriguez-Lopez (2011). In this class of models based on the work of Melitz (2003), it is assumed that only a subset of domestic firms are exporters due to the interplay between heterogeneous productivity across firms and, in some models, the existence of fixed costs of exporting. In this paper we further assume that each firm produces a single exportable 6-digit product.

A firm located in country i and exporting to country j faces marginal and fixed costs in terms of domestic currency and sets prices in terms of domestic currency. The demand faced by the exporter in the overseas market is given by:

$$C_{ijk} = \left(\frac{P_j^*}{p_{ijk}^*}\right)^{\lambda} C_j \qquad [1]$$

where p^*_{ijk} is the firm's price of its exports to the destination market given in foreign currency, P^*_j is the composite price index for all foreign goods sold on the destination market, also given in foreign currency, C_j is the expenditure level, or absorption, of the destination market; and λ is the price elasticity of external market demand, which is country-specific and a function of the exchange rate (see Corsetti and Dedola, 2005). This type of demand function is derived from the destination market's utility maximisation (see Betts and Devereux, 2000 or Helpman et al, 2008). As a result, the exporting firm gets a share of the destination market that depends on its price relative to the composite price index that includes the prices of all sellers.

Furthermore, the firm's price in foreign currency is obtained from its price in domestic currency by means of $p^*_{ijk} = e_{ij}p_{ijk}$, where e_{ij} is the bilateral exchange rate defined as the units of foreign currency per unit of domestic currency, such that an increase in the exchange rate means an appreciation. The composite price index in the foreign market can also be converted to domestic currency by the same means.

Following the formulation in Chaney (2008), the exporting firm's profit in terms of domestic currency is given by:

$$\pi_{ijk} = \left(p_{ijk} - \frac{w_{ik}\tau_{ijk}}{\varphi_{ik}}\right) C_{ijk} - F_{ij} \qquad [2]$$

where $\frac{w_{ik}}{\varphi_{ik}}$ is the productivity-adjusted wage cost at the producer's location, τ_{ijk} is the iceberg transport cost which depends on distance, and F_{ij} is the fixed cost of exporting, which is country-specific but not firm-specific. Thus the profit-maximization problem faced by a firm in an imperfectly competitive industry can be derived by maximizing profit with respect to the choice variable p_{ijk}. The first order condition can be written as:

$$f'(C_{ijk})\left(p_{ijk} - \frac{w_{ik}\tau_{ijk}}{\varphi_{ik}}\right) = -C_{ijk} \qquad [3]$$

Substituting the demand function [1] in this first order condition and assuming that the exporting firm could adjust its price at any time, the equilibrium export price can be derived as:

$$p^*_{ijk} = \frac{\lambda}{\lambda-1}\frac{e_{ij}w_{ik}\tau_{ijk}}{\varphi_{ik}} \qquad [4]$$

This pricing equation is a mark-up equation modified to reflect the existence of transport costs and heterogeneous firm productivities. Whilst wages and transport costs are defined at the country-level, productivity is defined at the firm level. This presents us with the problem of obtaining firm-level data and carry out the empirical work at the firm-level, as has been done by Chaney (2008) for the US, Berman et al (2012) for France, Manova and Zhang (2012) for China, Chatterjee et al (2010) for Brazil, among others.

Cadot et al (2013) make a case for the use of product-level comparative advantage in the absence of firm-level data. Their argument is based on the idea that higher comparative advantage in a particular product implies more exporters of that product (a proxy for network effects) and a higher survival probability of that product in foreign markets (a proxy for access to credit). Another argument for the importance of producing in a particular sector is provided by Costinot et al (2011). They show that firms in high routine sectors are necessarily less innovative and thus less productive due to the routine nature of the tasks they perform. In this paper we make a network-type assumption, according to which firms producing high comparative advantage products are also more productive, as they benefit from lower fixed costs of exporting through a greater presence in international markets. Hence we assume that unobservable firm productivity (φ_{ik}) is, in a given country, a measure of competitiveness and thus it is a function of product-specific comparative advantage (CA_{ik}) and of the exchange rate (e_{ij}). Thus we can write:

$$\varphi_{ik} = ex^{\;\gamma_i CA_{ik}} {e_{ij}}^{\gamma_j CA_{ik}} \qquad [5]$$

By taking logarithms, equation [5] can be written as:

$$\ln\varphi_{ik} = \gamma_i CA_{ik} + \gamma_j CA_{ik} ln e_{ij} \qquad [6]$$

Upon substitution, the pricing equation [4] can therefore be written as:

$$ln\left(p^*_{ijk}\right) = ln\left(\frac{\lambda}{\lambda-1}\right) - \gamma_i CA_{ik} + \left(1 - \gamma_j CA_{ik}\right) ln\left(e_{ij}\right) + ln(w_{ik}) + ln\left(\tau_{ijk}\right) \qquad [7]$$

Facing different demand levels in each market, the exporting firm will establish a market-varying mark-up over marginal costs. The mark-up established over destination country j partly depends on the wage level of that country (Alessandria and Kaboski, 2011) or relative wage between exporting and importing countries as opposed to absolute wage cost in the importing country. If we assumed, as in Rodriguez-Lopez (2011), that wages are sticky, we could proxy wages by an exporting country specific fixed effect. However, his model is a developed country model, whereas here we are working with emerging markets showing very fast growth, including wage growth. Indeed, Chamarbagwala and Sharma (2011) argue that industrial wages have risen in India due to the labour force's skill upgrading, among other factors. Therefore, it would not be appropriate to assume sticky wages. In a context of very fast growth, it is preferable to assume almost perfect sectoral mobility within each country and to use the average manufacturing wage in each country as a measure of production costs. In this way, we are still able to capture time variation in those costs. In studies on other emerging markets, Alvarez and Fuentes (2011) use the income per capita of Chile's export markets, whilst Marmolejo (2011) includes both Mexican and US wages in a model of exchange rate pass-through into Mexican import prices after the constitution of NAFTA. In the absence of wage data, using income per capita would be a good proxy to control for increasing globalisation of production activity, when a large share of international trade occurs through intra-firm transactions, leading to incomplete pass-through (see Hellerstein and Villas-Boas, 2010). Ferrantino, Feinberg and Deason (2012) have also used the per capita income of exporters to introduce vertical differentiation and the per capita income of importers to introduce pricing-to-market in a cross-section of 6-digit unit values for 2005. We will use income per capita in relative terms as data is available for the whole sample and this can also reflect external demand making it a key determinant of the extent of foreign exchange exposure in a particular market by exporters.

The lack of responsiveness of export pricing to exchange rate fluctuations may be partially on the back of hedging activities by trading agents due to foreign exchange volatility to eliminate exchange rate risk, as hedging against foreign exchange uncertainty can affect the structure of pricing behaviour and pass-through. In addition to the variables reflecting mark-up adjustment, a reduction in currency risk exposure due to hedging activities could lead to a decline in the transmission of changes in the exchange rate. Thus pricing-to-market estimates must be obtained by controlling for bilateral foreign exchange volatility in order to observe whether there is a differential impact of high and low volatile destination markets on international pricing.

3. Comparative advantage in China and India

In this paper we operationalize the theoretical concepts of CA and CD by means of a transformation of the Hanson (2012) RCA index. For product k exported by country i, RCA_{ik} is defined as the ratio between the difference and the sum of the share of product k in country i's exports and the share of product k in country i's imports:[1]

[1] There are of course many different formulations for CA indexes. Some use both export and import data, some are multiplicative, and others are additive (see, for example, Hoen and Oosterhaven (2006), who use

$$RCA_{ik} = \frac{\frac{X_{ik}}{X_i} - \frac{M_{ik}}{M_i}}{\frac{X_{ik}}{X_i} + \frac{M_{ik}}{M_i}} \qquad (8)$$

This index is bounded between –1 (maximum CD when product k is imported by country i but not exported) and 1 (maximum CA when product k is exported by country i but not imported). Values close to 0 are interpreted as a sign of predominance of intra-industry trade (see, for example, Neven 1995).

We employ a panel data set from UN Comtrade consisting of location- and product-specific export price data from China and India to show the relative market power of Chinese and Indian exporters in different product categories during our sample period, allowing us to identify price discrimination in traded goods at the 6-digit level. Given the global crisis that has been unfolding since 2008 which has interfered with the normal trade flows due to lack of credit to firms, we use data up to 2007. Still, at the 6-digit product level, we have over 1 million observations.

Some preliminary inspection of product export shares calculated for our data shows that no product takes more than 20% of any country's exports, but those few product groups with more than a 5% export share reveal some (already expected) differences in the specialization pattern (Figure 1). This pattern is somewhat dynamic for China and India, as would be expected of emerging markets. Also, contrary to the popular belief that China is mostly a clothing exporter, the fact is that exports of machinery have risen

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the formulation $\frac{X_k^A}{X^A} - \frac{X_k^{REF}}{X^{REF}}$. Hanson (2012), in turn, takes $\frac{X_k^A - M_k^A}{GDP^A}$ as a CA measure and $log\left(\frac{X_k^A}{X_k^W} \middle/ \frac{X^A}{X^W}\right)$ as an RCA measure.

sharply and in 2007 took about 40% of exports, four times more than clothing.[2] India, on the other hand, is a strong textile exporter, especially of cotton, and is thus more of a supplier than a competitor to advanced countries in the clothing industry. It also exports strongly products derived from natural resources such as mineral fuels, precious metals, stones and jewellery.

Figure 1 here

Imports are more concentrated than exports, with three sectors having import shares between 10% and 25% for China and between 10% and 35% for India (Figure 2). The reliance on imports of mineral fuels and machinery, together with the overlap of these same exports, shows the mixed condition of emerging markets. They are, above all, integrated in world supply chains (see Amiti and Freund, 2010).

Figure 2 here

Using export and import shares, we compute the RCA index of China and India as per equation (1) for 2-digit industries (upper panel of Figure 3). This level of aggregation provides an upper bound for the level of intra-industry trade (a lower bound for inter-industry trade). At this level, the RCA index is very evenly distributed across 2-digit industries for both China and India, such that we find cases of high CD, of predominance of intra-industry trade, and some cases of very high CA, with an RCA index between

[2] Hanson (2012) also proposes arguments based on outsourcing and accumulation of human and physical capital to explain China's move away from textiles and clothing into electronics. Amiti and Freund (2010) argue that outsourcing causes China's electronics exports to have low value-added. Nevertheless, the sectoral shift may have an impact on the export pricing strategy, which is the object of this paper.

0.90 and 1, where China and India almost only export.[3] The RCA index for 6-digit products (lower panel of Figure 3) provides an upper bound for the level of inter-industry trade and essentially controls for extreme values.

Figure 3 here

Table 1 further shows that China's mean and median started very close to zero (intra-industry trade) but progressively shifted to positive values (CA). India, on the contrary, started out with a mean and median CD, improved up to 2004, but has since then deteriorated its mean and median CA. Moreover, China has more industries at the top RCA index quartile than India. On the other hand, the extensive margin of China decreased over the sample period, whilst the extensive margin of India increased, so that China specialized whilst India diversified up to 2006. Probably this is the case because India opened up to trade relatively late, having been a rather closed economy until the 1991 reforms (see Mallick and Marques, 2012). The consequence was that China, having started from a broader product base in 2000, got to 2007 with a product base similar to that of India.

Table 1 here

[3]Melitz and Trefler (2012) show that, due to outsourcing, high shares of intra-industry trade can be found in emerging markets. A very detailed analysis of China and India's foreign trade, including the issue of outsourcing, can be found in Amiti and Freund (2010), Harrigan and Deng (2010) and Hsieh and Klenow (2009), among others. Although in this paper we focus on the relevance of CA for the measurement of export pricing strategies, Figure 3 shows a hump of intra-industry trade for China at 2-digits, which is compatible with the integration in world value chains.

4. Pricing-to-market estimates in the short-run

The empirical panel specification for the export price of product k is a log-linear equation with discrete change obtained from equation (7):

$$\begin{aligned}\Delta \ln p^{*}_{ijk,t} &= \beta_0 + \beta_1 \Delta \ln\left(neer_{i,t-1}\right) + \beta_2 \ln GDPpc_{i,t-1} + \beta_3 \ln GDPpc_{j,t-1} + \\ &+ \beta_4 \mathrm{var}\left[\Delta \ln\left(neer_{i,t-1}\right)\right] + \beta_5 psha_{ij,t-1} + \beta_6 HSshare_{ik,t-1} \\ &- \gamma_i CA_{ik,t-1} - \gamma_j CA_{ik,t-1} \Delta \ln\left(neer_{i,t-1}\right) + u_{ijk,t} \qquad (9)\end{aligned}$$

where $GDPpc_i$ and $GDPpc_j$ are the exporter and the importer GDP per capita and $\beta_0 = \ln\left(\frac{\lambda}{\lambda - 1}\right)$.[4] A rise in the exporting country's NEER indicates an appreciation of the exporter's currency. Beladi *et al.* (2010) develop a model of exchange rate pass-through allowing for a stochastic process of the exchange rate. Here we capture that stochastic process by including a lagged exchange rate variable. Moreover, Tarasov (2012) shows that high-income countries have better market access, that is, lower average trade costs, and so they trade more along the intensive and the extensive margins, whilst Johnson (2012) shows that a positive correlation between export prices and market income exists if exports are of heterogeneous quality, whilst with homogeneous quality exports there should be a negative correlation between export prices and market income.

[4] This implies that the constant term gives us information about the price elasticity of external market demand for each market in each moment in time. This elasticity determines the base price level.

We take three variables as measures of trade costs τ_{ij}. The first measure is exchange rate volatility, specifically currency risk expressed as $\text{var}\left[\Delta\ln\left(e_{ij,t-1}\right)\right]$, which may explain why markets have not become fully integrated, as in the case of deviation from absolute PPP as evidenced in Alessandria and Kaboski (2011). Hedging is one such activity that aims to reduce trade costs and hence we need to control for this factor before deriving the PTM or ERPT estimates. If these hedging activities are not taken into account, the average pass-through coefficient could be underestimated. If the estimated degree of pass-through is used to measure the market or pricing power, such power in the industry may also have been underestimated without considering the impact of exchange rate volatility. Our measure of exchange rate volatility is obtained according to the procedure explained in Mallick and Marques (2010). Briefly, we use a GARCH(1,1) model for variance as the simplest and most robust of the family of volatility models which looks like this:

$$h_t = \omega + \alpha h_{t-1}\varepsilon_{t-1}^2 + \beta h_{t-1}.$$

This model computes the variance (*h*) of the current exchange rate as a weighted average of a constant and previous period's variance forecast and squared error.

The two other measures of trade costs, or the costs of exporting, are the share of exporter *i* in market *j* $\left(pshare_{ij,t-1}\right)$ and the share of product *k* in exporter *i*'s export basket $\left(HSshare_{i,t-1}^{k}\right)$. As in Helpman et al (2008), we consider that a high presence in a destination market or in a product market lowers the costs of exporting to that country or of exporting that product. However, that measure differs from the RCA index in equation

(8), where intra-industry trade (exports and imports of the same product) is taken into account as a measure of net competitiveness in a given product.[5]

Table A1 in the Appendix shows export price data availability for our sample of those high and low-income markets defined as in Hanson (2012) which are the main markets of China and India. Overall, we have a very large number of export price observations (over 1 million). NEER data (and later REER) is taken from Datastream (2005=100). GDP per capita is taken from the World Bank Development Indicators.

Table 2 presents the results of estimating equation (9) using fixed effects as determined by the Hausman test.[6] China's export price changes more than one-to-one with the exchange rate (the foreign currency price absorbing 15% in excess of the exchange rate change), but in the case of India we find incomplete ERPT (the foreign currency price absorbing around 70% of the exchange rate change). With depreciating currencies, this means that China's exporters decrease their yuan price in addition to the yuan's depreciation, but India's exporters use the depreciation to disguise rupee price increases. Hence China has shown a more aggressive pricing strategy geared towards gaining market share, whereas India has shown more interest in increasing mark-ups. The CA level does not show any direct short-run effect on the pricing strategy of exporters, but in

[5] The sample correlation between the share of exporter i in market $j\left(pshare_{ij,t-1}\right)$ and the share of product k in exporter i's export basket $\left(HSshare^{k}_{i,t-1}\right)$ is 0.0416 and the sample correlation between each of these variables and the RCA index is -0.1171 and 0.0572, respectively.

[6] The Hausman test carried out for random and fixed effects rejects the null of no correlation between the covariates and the error term. As this renders the random effects estimator inconsistent, we prefer the consistent, although less efficient, fixed effects estimator. Moreover, we use variance-covariance estimates clustered by exporter-importer-product groups to account for correlation of observations within each group. This essentially recognizes that exports of the same product to the same market are correlated over time and accounts for some persistence in export patterns.

the case of India it is possible to detect an indirect effect operating through the exchange rate whereby the mark-up increase in response to exchange rate changes declines according to the CA level of their industry. In general, exporters are more concerned with defending their market share in more competitive industries.

Table 2 here

5. Pricing to market estimates in the long-run

The model presented in the previous section allows us to study short-run ERPT. Following equation (9), we estimate a System GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) in order to examine long-run ERPT:[7]

$$\Delta \ln p^{*}_{ijk,t} = \beta_0 + \beta_1 \Delta \ln\left(neer_{i,t-1}\right) + \beta_2 \ln GDPpc_{i,t-1} + \beta_3 \ln GDPpc_{j,t-1} + $$
$$+\beta_4 \mathrm{var}\left[\Delta \ln\left(neer_{i,t-1}\right)\right] + \beta_5 psh_{ij,t-1} + \beta_6 HSshare_{ik,t-1} - \gamma_i CA_{ik,t-1}$$
$$-\gamma_j CA_{ik,t-1} \Delta \ln\left(neer_{i,t-1}\right) + \beta_7 \Delta \ln p^{*}_{ijk,t-1} + \beta_8 \Delta \ln p^{*}_{ijk,t-2} + u_{ijk,t} \quad (10)$$

This equation includes two lagged terms for the dependent variable.[8] The negative and significant estimated lagged values of the dependent variable shown in the dynamic

[7]Campa et al (2008) and Brun-Aguerre et al (2012), for example, estimated an Error Correction Model to obtain long-run estimates. However, given that the cross-sectional dimension of our panel is so large compared to its time-series dimension, a system GMM is more appropriate. Moreover, we have a high number of gaps in our data and this prevents us from testing a full error correction model using a test such as the Westerlund (2007) panel test. Still we can incorporate both the level and difference exchange rate terms in order to determine long-run ERPT using the system GMM.

[8] We could have inserted more price lags, but given that we have an unbalanced panel where the average number of years observed per importer-product group is between 5 and 6 on average, we prefer to use only one and two-period lags for the dependent variable.

model results of Table 3 imply that there is a long-term declining trend in export prices and at the same time justifies the use of the dynamic model.

Table 3 here

The short-run ERPT estimates maintain the characteristics found in the short-run model in Table 2: China's export pricing amplifies exchange rate changes, whereas for India exporters absorb a part of the exchange rate change (ERPT is incomplete). Moreover, in the dynamic system GMM model export prices increase with competitiveness, although we detect once again that competitiveness decreases ERPT. Note, however, that the direct effect of competitiveness on export prices is higher than its indirect effect operating through the exchange rate (15 times higher for China and 3 times higher for India). So, the overall effect of competitiveness is to increase export prices. This is because, although the fixed costs of exporting may be lower, firms in strongly exporting industries have more market power that allows them to have higher mark-ups even if costs are lower. So, with imperfect competition, higher competitiveness is reflected in higher mark-ups rather than in lower prices.

6. The REER as a measure of relative producer prices

Instead of using the NEER and the per capita GDP of the importer and the exporter, we can use the REER, which is the NEER weighted by the ratio of importer and exporter prices, in this way already accounting for the price or income differential. Figure 4 shows that the evolution of REER has followed that of NEER in India, implying a stable price ratio, whilst in China the NEER exceeded the REER between 1997 and 2004, implying inflationary pressures in China, that were controlled from 2005.

Figure 4 here

The GARCH variability of NEER and REER has been very low in India, but in China the variability of REER started out from high levels, decreasing dramatically during the sample period (Figure 5). The variability is very small for India due to its central bank's regular intervention in minimising FX volatility on a regular basis. In the case of China, the fixed rate has been adjusted a few times and the inflation has fluctuated widely from double digit levels to negative numbers (deflation). In the case of India, inflation has remained somewhat stable although at a high single digit level that has made India's REER more stable than China's REER.[9]

Figure 5 here

The estimating equations for the short and the long-run follow equations (9) and (10), respectively, simply omitting income terms as the REER already contains the relative price ratio. Results are presented in Table 4 for the short-run and in Table 5 for the long-run. The use of REER to account for relative production prices does not change the signs and relative magnitudes of the direct and indirect effects of competitiveness on export prices. It does, however, change the ERPT estimates. In the static model of Table 4, it is now India's export pricing that amplifies exchange rate changes, whereas China's exporters absorb a part of the exchange rate change (ERPT is incomplete). In the

[9] However, if we had plotted the REER variability separately with different y-axis scales, then India's REER variability would reveal more fluctuation.

dynamic system GMM model of Table 5, we cannot reject zero ERPT (the USD export price does not react to REER changes). This is due to the inflationary pressures described above that counteract the effect of currency depreciation on foreign currency export prices.

Tables 4 and 5 here

7. A counterfactual experiment: what if China was a floater and India was a fixer?

Table 6 summarizes the ERPT and implied PTM coefficients in the short and long-run for the system GMM model. It shows that the long-run estimates are quantitatively similar to those of the short-run, however the introduction of relative prices offsets NEER changes to an extent that ERPT becomes zero even in the short-run and exporters effectively absorb nominal exchange rate changes through inflationary pressures.

Table 6 here

Let us now ask whether this outcome would be changed if China was a floater and India a fixer. Table 7 repeats the estimates of Table 6 interchanging the volatility measures of China and India. The results remain qualitatively the same, with the role of comparative advantage being robust in all cases. When introducing relative price effects with the REER, China's pricing strategy changes with the change of exchange rate regime. If China became a floater, it would increase yuan prices around 10% above an appreciation so that USD prices would increase by around 10%. This is a more standard behaviour, in line with what one would expect given the exchange rate policy of China. India's pricing strategy, however, is robust to a change in exchange rate regime. This counterfactual result for China does reflect the recent thinking in policy debates regarding China's exchange rate policy that China should move to a more flexible exchange rate regime (see for example, Granville et al., 2011).

Table 7 here

8. Conclusions

China and India have undergone significant shifts in trade policy from import substitution to outward orientation in recent decades, which has changed comparative advantage patterns, measured as the share of inter-industry trade (net of intra-industry trade). The changing comparative advantage influences fixed entry costs faced by exporters through a changing presence of a country's products in international markets. Furthermore, China and India have different exchange rate regimes (fixed currency regime versus a managed floating) and different modes of participation in world value chains (outward processing trade versus arms-length trade).

This paper attempts a comparative analysis of China's and India's exporters pricing strategies taking the comparative advantage channel into account. The paper further controls for the per capita income of the exporter and destination market, and introduces three proxies for trade costs (the volatility of the exporter's currency, the product share in the export basket and the exporter share in the destination market). The conventional wisdom that ERPT is always complete and rapid in developing economies, as they are price takers and hence cannot exercise PTM, is challenged for these emerging market economies.

We find diverse pricing strategies at a 6-digit product level for Chinese and Indian exporters. Faced with a 1% NEER depreciation, China reduces yuan prices, amplifying the depreciation, whilst India raises rupee prices, leading to incomplete ERPT. In the system GMM model, the long-run estimates are quantitatively similar to those of the short-run, however the introduction of relative prices offsets NEER changes to an extent that ERPT becomes zero even in the short-run and exporters effectively absorb nominal exchange rate changes through inflationary pressures. However, should China become a floater, it would increase yuan prices around 10% above an appreciation so that USD prices would increase by around 10%. On the contrary, India's pricing strategy is robust to a change in exchange rate regime.

Comparative advantage is a rotation factor that flattens the impact of exchange rate fluctuations by decreasing ERPT and increasing export prices. Exporters prefer to defend their market share more in high comparative advantage industries, but also have more market power in those industries. This result is robust to using NEER or REER, and significant in the long-run. Since in this sample comparative advantage is a significant positive determinant of export prices and is positively correlated to the exchange rate, ERPT estimates that do not take comparative advantage into account may be upward biased. This bias may go up to 1.56% for China and 0.36% for India and underestimates mark-up adjustment by exporters.

We conclude that external demand conditions, the degree of currency volatility and changing comparative advantage according to commodity groups play an important role in relating exchange rate changes to price variations in the buyers' currency. In this way we establish some evidence for differences in PTM behaviour by Chinese and Indian exporters across their more competitive industries relative to less competitive industries and demonstrated the existence of an industry-specific component in export pricing strategies.

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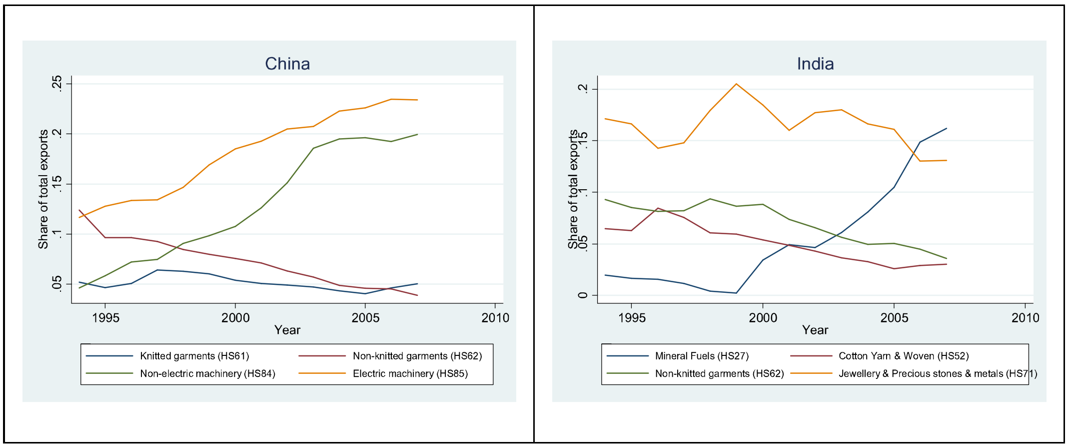
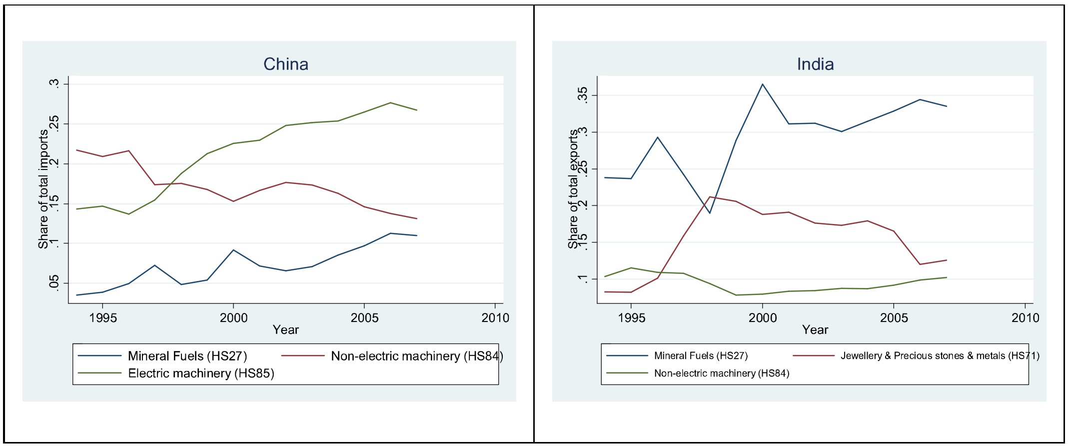
Figures and Tables

Figure 1: Industries with over 5% share of exports



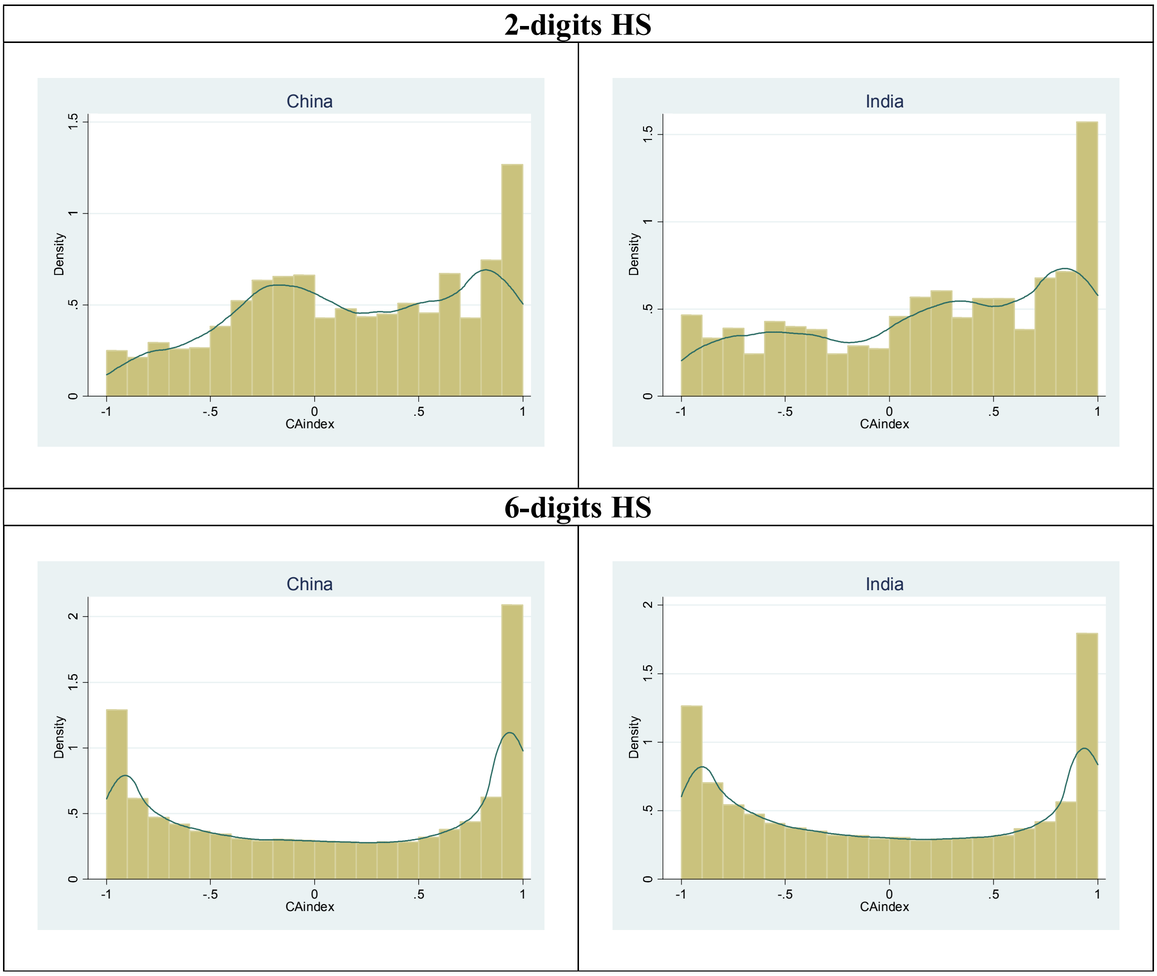
Source: COMTRADE data

Figure 2: Industries with over 10% share of imports



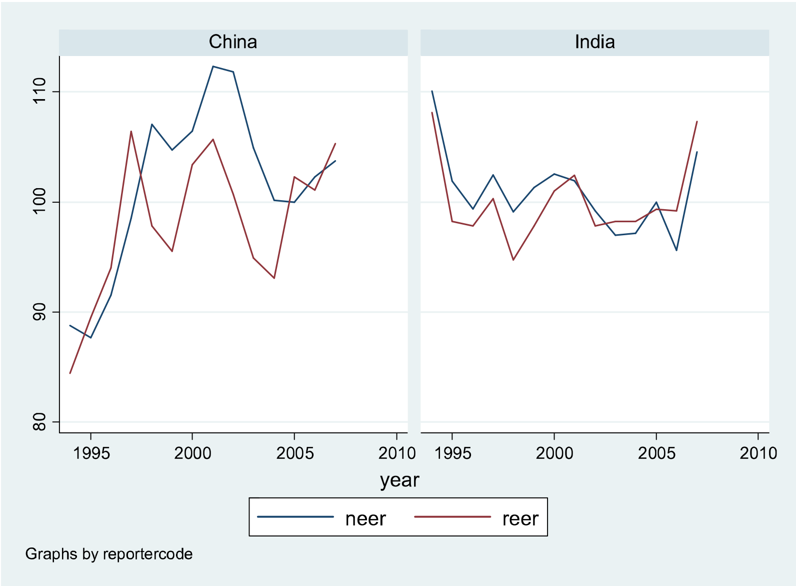
Source: COMTRADE data

Figure 3: CA index distribution for China and India (1994-2007)



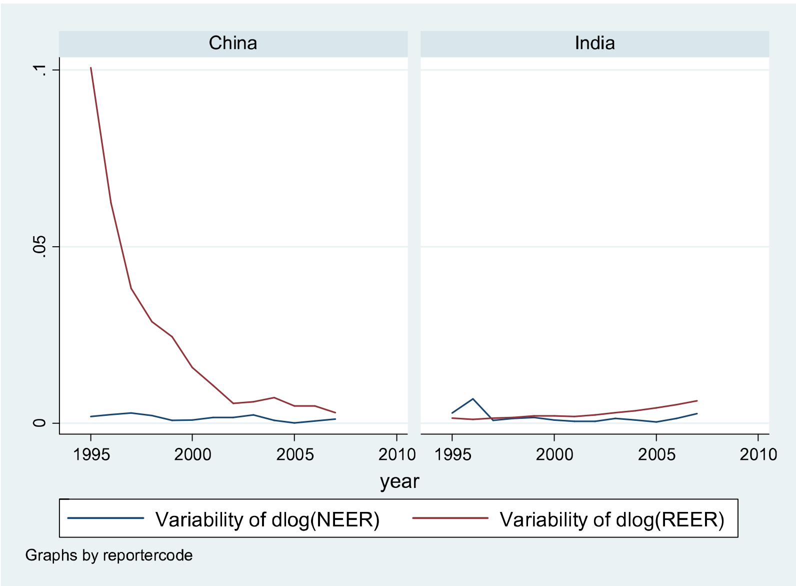
Source: COMTRADE data

Figure 4: Evolution of NEER and REER in China and India (1994-2007)



Source: Datastream

Figure 5: Evolution of the GARCH variability of NEER and REER in China and India (1994-2007)



Source: Datastream

Table 1: Summary statistics of CA index in China and India at 6-digits HS level (2000-2007)										
	China					India				
Year	Mean	P25	Median	P75	Freq.	Mean	P25	Median	P75	Freq.
1994	0.003	-0.765	-0.036	0.808	4807	-0.075	-0.806	-0.206	0.715	3354
1995	0.040	-0.710	0.026	0.834	4682	-0.079	-0.808	-0.204	0.704	3510
1996	0.030	-0.725	0.014	0.817	4725	-0.037	-0.777	-0.140	0.742	3599
1997	0.022	-0.736	-0.014	0.827	4759	-0.026	-0.764	-0.109	0.757	3802
1998	0.021	-0.730	-0.029	0.830	4753	-0.011	-0.733	-0.102	0.775	3914
1999	0.013	-0.732	-0.033	0.815	4742	0.009	-0.725	-0.017	0.771	4028
2000	0.040	-0.706	0.027	0.826	4725	0.035	-0.669	0.021	0.797	4140
2001	0.039	-0.710	0.026	0.833	4719	0.029	-0.675	0.017	0.782	4291
2002	0.061	-0.685	0.102	0.831	4668	0.024	-0.696	0.014	0.766	4358
2003	0.081	-0.656	0.130	0.842	4653	0.066	-0.630	0.087	0.789	4440
2004	0.107	-0.597	0.190	0.855	4649	0.079	-0.608	0.113	0.805	4435
2005	0.138	-0.557	0.249	0.860	4665	0.052	-0.635	0.059	0.764	4466
2006	0.169	-0.503	0.291	0.873	4675	0.040	-0.627	0.018	0.759	4486
2007	0.189	-0.470	0.331	0.870	4426	0.019	-0.673	-0.017	0.764	4372
Source: COMTRADE data										

Table 2: static ERPT net of relative price effects			
	ALL	CHINA	INDIA
$\boldsymbol{\Delta ln(neer_{i,t-1})}$	-1.161**† (0.024)	-1.154**† (0.027)	-0.692**† (0.110)
$\boldsymbol{CA_{ik,t-1}*\Delta ln(neer_{i,t-1})}$	-0.005** (0.002)	-0.004 (0.002)	-0.006* (0.003)
$\mathbf{ln}\boldsymbol{GDPpc_{i,t-1}}$	0.045** (0.004)	0.017** (0.005)	0.125** (0.010)
$\mathbf{ln}\boldsymbol{GDPpc_{j,t-1}}$	0.049** (0.006)	0.063** (0.007)	-0.012 (0.013)
$\mathbf{var}[\boldsymbol{\Delta ln(neer_{i,t-1})}]$	12.445** (1.295)	2.658 (1.836)	24.356** (2.689)
$\boldsymbol{pshare_{ij,t-1}}$	-0.327** (0.021)	-0.430** (0.026)	-0.151** (0.036)
$\boldsymbol{HSshare_{ik,t-1}}$	-3.081** (0.440)	-3.720** (0.672)	-2.221** (0.611)
$\boldsymbol{CA_{ik,t-1}}$	-0.008 (0.006)	-0.004 (0.007)	-0.011 (0.010)
Constant	-0.721** (0.040)	-0.642** (0.049)	-0.673** (0.080)
Observations	926175	688064	238111
Importer-product groups	152599	106926	45673
F-test	699.80**	597.95**	134.13**
*NOTES: Panel fixed effects regression. Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. † different from 1 at 5%.*			

Table 3: dynamic ERPT net of relative price effects			
	ALL	CHINA	INDIA
$\boldsymbol{\Delta ln(neer_{i,t-1})}$	-1.371** † (0.036)	-1.584** † (0.042)	-0.316** † (0.112)
$\boldsymbol{CA_{ik,t-1}*\Delta ln(neer_{i,t-1})}$	-0.010** (0.002)	-0.011** (0.003)	-0.012** (0.003)
$\mathbf{ln}\boldsymbol{GDPpc_{i,t-1}}$	0.118** (0.011)	0.067** (0.013)	-0.045 (0.025)
$\mathbf{ln}\boldsymbol{GDPpc_{j,t-1}}$	0.024 (0.014)	0.072** (0.017)	0.141** (0.022)
$\mathbf{var}[\boldsymbol{\Delta ln(neer_{ij,t-1})}]$	5.751** (1.726)	13.745** (2.225)	22.278** (5.353)
$\boldsymbol{pshare_{ij,t-1}}$	-0.437** (0.039)	-0.605** (0.052)	-0.159** (0.059)
$\boldsymbol{HSshare_{ik,t-1}}$	-4.554** (0.668)	-5.902** (1.140)	-4.142** (0.832)
$\boldsymbol{CA_{ik,t-1}}$	0.067** (0.012)	0.156** (0.016)	0.035* (0.017)
$\boldsymbol{\Delta}\mathbf{ln}\boldsymbol{p^{*}_{ijk,t-1}}$	-0.327** (0.003)	-0.303** (0.004)	-0.390** (0.005)
$\boldsymbol{\Delta}\mathbf{ln}\boldsymbol{p^{*}_{ijk,t-2}}$	-0.114** (0.002)	-0.087** (0.003)	-0.188** (0.005)
Constant	-0.993** (0.080)	-1.128** (0.102)	-1.004** (0.154)
Observations	675783	499760	176023
Importer-product groups	116933	83445	33488
Wald chi2test	15850.59**	10802.57**	6978.02**
*NOTES: System GMM dynamic panel estimation . Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. † different from 1 at 5%. Instruments for differenced equation: GMM-type: L(2/.).D.ln_uv. Standard: LD2.ln_neer LD2.CA_neer LD.ln_GDPpc_x LD.ln_GDPpc_m D.garch_var_neer LD.pshare LD.HSshare D.CAindex. Instruments for level equation: GMM-type: LD2.ln_uv. Standard: _cons. Number of instruments = 85.*			

Table 4: static ERPT inclusive of relative price effects			
	ALL	CHINA	INDIA
$\Delta\ln(reer_{i,t-1})$	-0.305**† (0.018)	-0.240**† (0.018)	-1.136**† (0.077)
$CA_{ik,t-1}$*$\Delta\ln(reer_{i,t-1})$	-0.009** (0.002)	-0.007** (0.002)	-0.009** (0.003)
$\text{var}[\Delta\ln(reer_{i,t-1})]$	-1.035** (0.084)	-1.163** (0.086)	25.545** (1.028)
$pshare_{ij,t-1}$	-0.325** (0.021)	-0.413** (0.026)	-0.127** (0.036)
$HSshare_{ik,t-1}$	-2.974** (0.427)	-3.481** (0.640)	-2.181** (0.611)
$CA_{ik,t-1}$	0.021** (0.006)	0.034** (0.007)	-0.007 (0.010)
Constant	0.059** (0.003)	0.060** (0.003)	-0.040** (0.006)
Observations	828719	605975	222744
Importer-product groups	137727	95290	42437
F-test	173.06**	163.10**	143.48**

*NOTES: Panel fixed effects regression. Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. † different from 1 at 5%.*

Table 5: dynamic ERPT inclusive of relative price effects			
	ALL	CHINA	INDIA
$\Delta\ln(reer_{i,t-1})$	0.027† (0.020)	0.031† (0.021)	-0.066† (0.092)
$CA_{ik,t-1}$*$\Delta\ln(reer_{i,t-1})$	-0.009** (0.002)	-0.009** (0.003)	-0.012** (0.003)
$\text{var}[\Delta\ln(reer_{i,t-1})]$	-3.249** (0.329)	-3.997** (0.333)	23.287** (2.462)
$pshare_{ij,t-1}$	-0.443** (0.039)	-0.599** (0.052)	-0.165** (0.059)
$HSshare_{ik,t-1}$	-4.537** (0.676)	-5.825** (1.155)	-4.036** (0.828)
$CA_{ik,t-1}$	0.064** (0.012)	0.137** (0.016)	0.036* (0.017)
$\Delta\ln p^{*}_{ijk,t-1}$	-0.328** (0.003)	-0.305** (0.004)	-0.389** (0.005)
$\Delta\ln p^{*}_{ijk,t-2}$	-0.117** (0.002)	-0.092** (0.003)	-0.187** (0.005)
Constant	0.077** (0.006)	0.067** (0.007)	-0.039** (0.012)
Observations	675783	499760	176023
Importer-product groups	116933	83445	33488
Wald chi2test	13040.32**	7977.22**	6708.06**

*NOTES: System GMM dynamic panel estimation. Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. † different from 1 at 5%. Instruments for differenced equation: GMM-type: L(2/.).D.ln_uv. Standard: LD2.ln_reer LD2.CA_reer D.garch_var_reer LD.pshare LD.HSshare D.CAindex. Instruments for level equation: GMM-type: LD2.ln_uv. Standard: _cons. Number of instruments = 83.*

Table 6: System GMM PTM and ERPT estimates			
	ALL	**CHINA**	**INDIA**
Net of relative price effects			
CA slope	-0.010**	-0.011**	-0.012**
CA intercept	0.067**	0.156**	0.035*
[SR ERPT] $\boldsymbol{\Delta \ln(neer_{i,t-1})}$	-1.371**†	-1.584**†	-0.316**†
[SR PTM with $\boldsymbol{\Delta}$**NEER** $= -1\%$**]**	-0.371**†	-0.584**†	0.684**†
[LR ERPT using 5% CI]	-0.951**†	-1.140**†	-0.200**†
[LR PTM with $\boldsymbol{\Delta}$**NEER** $= -1\%$**]**	0.049**†	-0.140**†	0.800**†
Inclusive of relative price effects			
CA slope	-0.009**	-0.009**	-0.012**
CA intercept	0.064**	0.137**	0.036*
[SR ERPT] $\boldsymbol{\Delta \ln(reer_{i,t-1})}$	0.027†	0.031†	-0.066†
[SR PTM with $\boldsymbol{\Delta}$**REER** $= -1\%$**]**	1.027**	1.031**	0.934**
[LR ERPT using 5% CI]	0.019†	0.022†	-0.042†
[LR PTM with $\boldsymbol{\Delta}$**REER** $= -1\%$**]**	1.019**	1.022**	0.958**
*NOTES: ** significant at 5%; † different from 1 at 5%.*			

Table 7: A counterfactual experiment			
	ALL	**CHINA**	**INDIA**
Net of relative price effects			
CA slope	-0.008**	-0.008**	-0.011**
CA intercept	0.054**	0.121**	0.048**
[SR ERPT] $\boldsymbol{\Delta \ln(neer_{i,t-1})}$	-1.331**†	-1.511**†	-0.457**†
[SR PTM with $\boldsymbol{\Delta}$**NEER** $= -1\%$**]**	-0.331**†	-0.511**†	0.543**†
[LR ERPT using 5% CI]	-0.923**†	-1.083**†	-0.291**†
[LR PTM with $\boldsymbol{\Delta}$**NEER** $= -1\%$**]**	0.077**†	-0.083**†	0.709**†
Inclusive of relative price effects			
CA slope	-0.008**	-0.008**	-0.011**
CA intercept	0.052**	0.129**	0.040*
[SR ERPT] $\boldsymbol{\Delta \ln(reer_{i,t-1})}$	0.062**†	0.112**†	0.089†
[SR PTM with $\boldsymbol{\Delta}$**REER** $= -1\%$**]**	1.062**†	1.112**†	1.089**
[LR ERPT using 5% CI]	0.043**†	0.080**†	0.056†
[LR PTM with $\boldsymbol{\Delta}$**REER** $= -1\%$**]**	1.043**†	1.080**†	1.056**
*NOTES: ** significant at 5%; † different from 1 at 5%.*			

Appendix

Table A1: Export price data availability for high and low-income markets using the 10,000USD classification as in Hanson (2012)							
High-income (1994-2007 GDP per capita average higher than 10,000USD)				Low-income (1994-2007 GDP per capita average lower than 10,000USD)			
China		India		China		India	
Australia	34760	Canada	22919	Argentina	23896	Argentina	8469
Austria	15292	Hong Kong	19429	Brazil	26461	Brazil	11508
Belgium	21433	France	25938	Bulgaria	12475	Chile	8547
Canada	36431	Germany	33225	Chile	25746	China	16211
Hong Kong	57011	Israel	15027	Colombia	17638	Colombia	6358
Cyprus	13147	Italy	27169	Czech Rep.	15717	Egypt	16198
Denmark	19485	Japan	23943	Egypt	27193	Indonesia	17997
Finland	18656	Korea Rep.	16585	Estonia	8347	Iran	11821
France	33845	USA	42905	Hungary	15739	Jordan	10553
Germany	40910	UK	37458	India	31805	Malaysia	25845
Greece	21764			Indonesia	38279	Mexico	10882
Iceland	4756			Iran	22991	Morocco	6836
Ireland	13541			Jordan	18453	Pakistan	9030
Israel	26480			Latvia	9909	Peru	4818
Italy	37066			Lithuania	10568	Philippines	12838
Japan	53661			Malaysia	35607	Russian Fed.	12413
Luxembourg	2753			Mexico	22063	South Africa	16719
Malta	9106			Morocco	16582	Thailand	20109
Netherlands	30015			Pakistan	26052	Tunisia	4224
New Zealand	24535			Peru	16974	Turkey	14756
Norway	16346			Philippines	30580	Viet Nam	10218
Portugal	16605			Poland	20321		
Korea Rep.	5420			Romania	16184		
Singapore	37356			Russian Fed.	28005		
Slovenia	10529			Slovakia	8097		
				South Africa	20990		