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# Pricing in International Markets: a "Small-country" Benchmark

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## Abstract

The paper studies export pricing to market (PTM) in a "small-country" context using a panel of disaggregated exports from Hong Kong since 1992. Conventional wisdom is that PTM is commonplace—except for US exports. This study provides a benchmark by which to interpret the puzzling behavior of US export prices. Empirically, Hong Kong's export price behavior is comparable to that of the US. This similarity reinforces the idea that PTM behavior is also a function of home market conditions and the ability to price discriminate across markets. There is little evidence of differences in PTM across Hong Kong's export destinations.

## 1. Introduction

The extent to which exchange rate changes are "passed-through" to import prices is part of an ongoing research agenda in both empirical macroeconomics and international finance. Theoretically, the most important factors affecting exchange rate passthrough include market conditions in the import market (Dornbusch, 1987; Krugman, 1987), the extent to which exporters' costs are affected by exchange rate changes, and the monetary policy environment in the import market (Parsley and Popper, 1998; Taylor, 2000). Importantly, *changes in* exchange rate passthrough reflect changes in these underlying determinants. Hence differences in passthrough often form the basis of cross-country, cross-sector, or time-series inferences about underlying market structure and/or about appropriate monetary policies.

Empirically, there are two broad approaches to studying the linkage between exchange rates and prices. The first, and more common approach, relates observed changes in prices to changes in exchange rates and other controls for demand conditions in the import market, and producer cost markups. This approach is essentially bilateral—though the estimation may be done in a panel context. An abbreviated list of recent studies in this tradition includes Mann (1986), Froot and Klemperer (1989), Parsley (1993, 1995), and McCarthy (2000). Alternatively, a second empirical approach—primarily due to Knetter (1989, 1993)—takes a more multilateral approach by comparing export (or import) prices across destinations (or from several sources) of the same good. This empirical approach to studying the exchange rate—price linkage—focuses on cross-market (or cross-good) differences in pricing-to-market (PTM) behavior. Since the goods being studied are the same across destinations (or sources), residual variations in the response of prices across markets of the good can

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be more directly associated with exchange rate changes. Thus, this approach has the advantage that errors in measuring changes in production costs and markups are mitigated.

To date, most empirical evidence regarding both passthrough and PTM is based on the experience of G-7 economies, and especially the US. For a recent review, see Goldberg and Knetter (1997). Several intriguing conclusions have emerged. First, foreign exporters (to the US market) price to market to a greater extent than do exporters from the US market. Indeed, US exporters often amplify exchange rate fluctuations. Secondly, overall, differences at the industry level seem to be more important than country-level differences. That is, with the exception of the US, it is typically not possible to reject the hypothesis that pricing-to-market behavior is identical across destination markets, while it is possible to reject the hypothesis that pricing-to-market behavior is the same across industries—even within a country.

The purpose of this study is to examine PTM in the context of a non-G-7, small open economy, Hong Kong SAR. The case of Hong Kong is interesting for several reasons. First, it has a history and reputation of fierce domestic competition and open markets. Openness, defined as the ratio of imports plus exports to domestic GDP, is typically in excess of 300%, a number far in excess of the representative G-7 country. As a result, the export market is of primary importance; more importantly, this openness limits exporters' ability to subsidize foreign sales with protected domestic markets. Second, with less than one-half of one percent of world GDP, Hong Kong would by most definitions more closely fit the "small-country" assumption of the standard competitive model. Thus, *a priori*, market power considerations are likely very different than for previous studies. In particular, is the finding that US exporters do not price to market unique, or is it the other way around; i.e., is the US import market uniquely competitive, thereby necessitating pricing to market? The dataset used in this study can shed light on these questions.

The effect of Hong Kong's peg to the US dollar (as it relates to export pricing) deserves comment. First, it is obvious that it is not possible to study the effects of exchange rate changes on export prices if there is no variation in the exchange rate. However, I include exports to the United States in the regressions reported below as a means of controlling for simultaneous changes in the "world" price.[1] I do, however, exclude exports to the mainland of China, primarily because China does not represent a final destination market; i.e., exports to China are often reimported, only to be exported to a final destination. In this study, the focus is on Hong Kong's next nine largest trading partners; excluding the US, there is ample bilateral exchange rate variation *vis-à-vis* this group. Secondly, the currency of invoicing may be an issue given that the Hong Kong dollar is pegged to the US dollar. Goldberg and Knetter (1997) note that exporter currency invoicing biases against finding PTM in the short run. Hence, the analysis in this study is conducted at an annual frequency. Moreover, the composition of domestic consumption is arguably only loosely related to that in the US, which would preclude viewing Hong Kong as part of an "extended" United States. Thus, in the context of export pricing to non-US, non-mainland Chinese destinations, the peg should be of secondary importance.

This study is facilitated by a unique dataset of disaggregated bilateral export unit values, commodity by country, for the nine-year period 1992–2000. These represent the most detailed data available on Hong Kong's external trade. As hinted above, this level of disaggregation is crucial for studies of PTM.

The next section sketches the textbook derivation of export pricing in the simplest possible context. The resulting first-order condition is well known and surprisingly general; perfect competition and monopoly are special cases. Section 2 also discusses estimation issues and the advantages that a combined cross-sectional time-series approach affords. Section 3 discusses the data examined. Section 4 presents the estimation results, and a final section concludes.

## 2. Factors Influencing Passthrough

Starting with the textbook model of perfect competition, profit maximization implies price equals marginal cost, or $P_i = C_i$, where $P_i$ is the price of the $i$th good. If the good is traded internationally, the price in foreign currency, $P_i^*$, is simply $P_i^* = C_i/S$, where $S$ is the domestic currency price of foreign exchange. With constant marginal cost, passthrough—i.e., the elasticity of foreign currency price with respect to the exchange rate ($d\ln P^*/d\ln S$)—is equal to one (in absolute value). Thus, in the small-country, perfect-competition benchmark, local currency import prices fully reflect exchange rate changes.

If we relax the perfect-competition assumption, the first-order condition must include a markup:

$$P_i^* = \lambda C_i / S. \tag{1}$$

The markup ($\lambda$) is a function of the elasticity of demand ($\varepsilon$), $\lambda = \varepsilon_i/(\varepsilon_i - 1)$. Thus, passthrough can be less than complete if the markup varies. As noted by Goldberg and Knetter (1997), the condition in equation (1) is actually more general than the simple textbook monopoly case. On the one hand, we can consider the elasticities to be associated with a residual demand curve that takes into account the firm's perceptions of competitors' responses to changes in the firm's price. Additionally, the perfect-competition case is also a special case of equation (1) when the demand elasticity is infinite.

Alternatively, if the import market is perfectly competitive with many sources of supply—both home and abroad (and not all from the same country)—passthrough will be muted. Indeed, in the limit, PTM will be complete.

Thus to estimate passthrough, empirical measures of marginal cost and factors influencing markups need to be obtained. Traditional estimates of passthrough (e.g., Mann, 1986), are derived from log-linear regressions of equation (1) using aggregate (e.g., import price index) data.[2] Typically these equations include a cost index (e.g., a domestic wholesale price index) and import demand shifters (e.g., a competing price and importer's income). In these studies, passthrough to the US was typically found to be around 60%; changes in markup thus accounted for the residual 40% of the exchange rate change.

Two problems with these estimations include measurement error and simultaneity bias. If marginal costs are not well approximated by cost indices, which is likely, and this measurement error is correlated with the equation disturbance, then OLS estimates will be biased. Moreover, Goldberg and Knetter (1997) suggest the measurement error of existing cost indices may be correlated with exchange rates such that passthrough estimates are biased downward. In their example, foreign outsourcing increases this problem. While this is certainly a problem for estimation, it is not clear why measurement errors would produce relatively more downward bias for passthrough to the US than elsewhere. The second, related problem, afflicting these early estimations is simultaneity bias. At the aggregate level, exchange rates and prices are both endogenous variables. Thus by definition, the exchange rate will be correlated with the disturbance term and, as before, OLS estimates will be biased (e.g., Parsley and Popper, 1998).

Both of these issues suggest that a different estimation procedure is appropriate. Consequently, the empirical approach adopted here follows that developed in Knetter (1993). These econometric problems are mitigated both by the estimation method, and by the choice of data. The empirical model is an analysis-of-covariance model, and it is estimated via a fixed-effects regression model. The model is estimated using a panel of disaggregated export unit-value data from Hong Kong to the top nine export destinations simultaneously. Markups and marginal costs are not directly observable, but including a full set of time dummies in the estimation controls for common (across-destination) movements in price. As noted by Knetter (1993), the interpretation of the time effects as capturing the behavior of marginal cost is oversimplified when more than one firm is in the export sector. He notes that the model still controls for common, underlying changes in industry cost.

The extent of pricing to market, then, will be measured by changes in destination-specific exchange rates. An additional advantage of this dataset is that it includes prices to a major fixed exchange rate market. Since the US receives the lion's share of Hong Kong's exports, and since the Hong Kong dollar is pegged to the US dollar, adding the US price to the equation affords a degree of freedom not normally available in studies of PTM. Other factors such as income and competitors' prices in the destination market may be important for establishing the absolute level of prices in the export market, but (relative) changes in these variables will generally be of much smaller magnitude than the corresponding bilateral exchange rate. Thus the export pricing model to be estimated is

$$\Delta p_{jt} = \theta_t + \beta_j \Delta s_{jt} + \alpha_j + \gamma \Delta p_{US,t} + \mu_{jt}. \tag{2}$$

In equation (2), lower-case letters indicate natural logarithms, and $\Delta$ represents the first-difference operator. The subscripts now refer to country $j$ at time $t$. It is thus a generalization of equation (1) in that the condition now considers an exporter selling the same product to multiple markets. In equation (2), $\alpha_j$ is a country-specific intercept, and $\theta_t$ is a time effect. Common (across export destinations) movements in marginal costs are the primary factor captured by $\theta_t$. As noted, a separate control is entered into the equation for movements in the US price at time $t$. None of the results reported below is sensitive to the inclusion of this control. The error term, $\mu_{jt}$, is assumed to be independently and identically distributed with mean zero and variance $\sigma_\mu^2$. Initially, the model is estimated separately for each export product examined.

The statistical interpretation of the $\beta$ is straightforward. PTM requires a nonzero estimate of $\beta$; in particular PTM occurs when $\beta < 0$. Note the ability to price to market requires market segmentation. Moreover, market segmentation enables losses in one market to be subsidized by profits in another. A value of zero for $\beta$ implies that markups do not vary in response to exchange rate changes. Thus there is no pricing to market. In the case of Hong Kong, the null hypothesis is that PTM is zero.

Two additional points merit discussion. First, the model is estimated using annual data. Recent research has indicated that short-run exchange rate changes may not be passed through if they are thought to be temporary (e.g., Froot and Klemperer, 1989; Parsley, 1995). Related, is the problem of invoicing currency noted previously. If exporters invoice in the importer's currency, estimates of passthrough using high-frequency data are spuriously biased downward, simply because of infrequent price adjustment (e.g., Marston, 1990). Consequently, annual data are employed in this study. Annual data have the further benefit that measurement issues are less severe, since higher frequency data could more easily be influenced by changes in the composition of exports within a given category. That is, the unit values are likely to have a higher noise content at higher frequencies. As another precaution against the impact of large data outliers, the tables below report analysis where the top and bottom 5% of the data have been discarded. This filter affects none of the qualitative conclusions reported below. Finally, the data are disaggregated to the greatest extent possible. At a disaggregated level, exchange rate changes can arguably be treated as exogenous.

## 3. The Data

The original source data for this study are domestic exports (Hong Kong dollar) value and quantity, disaggregated to the five-digit SITC commodity level, from the *Hong Kong Trade Statistics: Country by Commodity Domestic Exports and Re-exports*, published by the Census and Statistics Department of Hong Kong SAR. For this study, the data were taken from the CD-ROM, *Hong Kong External Trade*, *Vol. 5 (1992–2000)*.

Unit-value data have well-known limitations as proxies for price (e.g., Kravis and Lipsey, 1974). In particular, unit values may change due to changes in the commodity composition of trade. The problem is especially salient at the aggregate level. Hence the focus of this study is on unit values at the most disaggregated level possible in the data. Other authors have used apparently even greater disaggregations; for example, Knetter (1989, 1993) used seven-digit industries, and Takagi and Yoshida (2001) examined nine-digit industries. However, on closer inspection, the unit values employed in this study appear to be of a comparable level of disaggregation. For example, Knetter examines beer, autos over 2 liters, books, and snap action switches, while Takagi and Yoshida examine plugs and sockets, microscopes, and brakes and parts. Some examples of the data included in this study are soy sauce, children's picture, drawing or coloring books, and playing cards.

Despite this level of disaggregation, there still remains the possibility for measurement error, and Hong Kong's entrepot trade data provides some unique perspective on the extent of the problem.[3] Specifically, unit values are computed for Hong Kong exports as well as for Hong Kong re-exports. These unit values are in many cases strongly related, but evidence is presented below that there are differences in unit value movements between these two datasets. Such differences presumably (largely) reflect differences in the composition of the five-digit categories. Hence all of the analysis in this study uses both sources—exports and re-exports. None of the paper's conclusions is dependent on the particular unit-value series chosen. Additionally, it should be reiterated that these are the best data available. Finally, from a purely statistical standpoint, the issue involves the dependent variable; thus any measurement errors are incorporated into the disturbance term. Statistical problems in this case are arguably less severe than those related to mis-measurement of an independent variable.

For this study, the top nine export destinations were chosen, ignoring China. Twenty-nine five-digit export commodities were chosen from across the full spectrum of export (type) classifications. As noted, these 29 products are also studied as purely re-export products as a robustness check on the data. Overall, the aim was to provide variation in terms of the types of products chosen, and to choose important export industries. Thus, despite using micro-level data, the goal was to be representative, and not dependent on a particular product or single export destination. Finally, the goal in choosing the largest export destinations was to improve the accuracy of the unit-value data as a measure of price and to minimize the number of missing observations.

Econometrically, a key requirement of the data is for the commodities to be exported to as many of the export destinations as possible. This is the important

*Table 1. Countries in the Study*

| | *Share of Hong Kong's domestic exports (2000)* |
|---|---|
| Canada | 1.8% |
| Germany, Fed. Rep. | 5.1% |
| Netherlands | 2.2% |
| France | 1.5% |
| United Kingdom | 5.9% |
| Taiwan | 3.4% |
| Japan | 2.8% |
| Singapore Republic | 2.6% |
| United States | 26.3% |

variation that enables the common change in markups or marginal cost to be more accurately estimated. Unit values were constructed as the value of exports of the good divided by the quantity exported. I begin by looking at domestic exports and subsequently examine domestic re-exports.

Tables 1 and 2 list the countries and goods included in this study. Note that excluding the mainland of China has a nontrivial effect on Hong Kong's measured trade. The next largest nine trading partners make up only roughly 50% of Hong Kong's external trade.

The nominal exchange rate data were obtained from the CEIC database provided by the Hong Kong Monetary Authority, and wholesale price indices were obtained from the April 2001, *International Financial Statistics* CD, except for Taiwan, where data from CEIC were used. Real exchange rates were constructed as equal to the nominal exchange rate deflated by the wholesale price index in the export market.

## 4. Basic Results

Prior to reporting regression results examining PTM coefficients, I begin with a comparison of the two export unit-value series available in this panel; i.e., the series computed from Hong Kong domestic exports, and those computed from Hong Kong's re-exports. If these two series do indeed measure the same thing, their movements should be positively correlated. A strong test of this hypothesis is whether, after controlling for individual effects ($\alpha_j$), the two series move together. More formally, the test would be whether $\hat{\gamma} = 1$ in equation (3). Note that, as before, $\Delta p$ represents the first difference in log price.

$$\Delta p_{jt}^{\text{exports}} = \alpha_j + \gamma \Delta p_{jt}^{\text{re-exports}} + \mu_{jt}. \tag{3}$$

Table 3 reports the results from the 29 separate regressions. In column 1 the coefficient estimates for $\gamma$ are given and heteroskedasticity-consistent standard errors are in parentheses. Notice that the coefficient estimates range from *negative* 0.252 to 1.088, and the adjusted $R^2$ statistics are similarly dispersed, but generally appear small. Indeed, in only five equations is more than 50% of the variation in the domestic export unit value explained by the estimated regression. Among the estimates of $\gamma$, the results are slightly more encouraging. Eighteen of the positive coefficients are statistically significant at the 5% level, and none of the negative coefficients is statistically significant.

*Table 2. Goods Included in the Study*

| | | |
|---|---|---|
| *Food* | | |
| 1 | 09841 | Soya sauce |
| 2 | 09849 | Other sauces and preparations thereof, mixed condiments & seasonings |
| 3 | 09891 | Pasta, cooked or stuffed; couscous |
| 4 | 11102 | Waters (including mineral and aerated), containing added sugar or other sweetening matter or flavor, and other nonalcoholic beverages, NES |
| *Intermediate goods* | | |
| 5 | 58130 | Flexible pipes and tubes, having minimum burst pressure of 27.6 MPA |
| 6 | 64212 | Folding cartons, boxes and cases, of noncorrugated paper or paperboard |
| 7 | 65243 | Other woven fabric, containing 85% or more of cotton, denim, weighing >200 g/m$^2$ |
| 8 | 69631 | Razors, nonelectric |
| 9 | 77119 | Other electrical transformers |
| 10 | 77121 | Static converters |
| 11 | 77255 | Other switches for a voltage not >1000 V |
| 12 | 77258 | Plugs & sockets for a voltage not >1000 V |
| 13 | 77811 | Primary cells and primary batteries |
| 14 | 77884 | Electric sound or visual signalling apparatus |
| *Clothing and accessories* | | |
| 15 | 83199 | Other handbags |
| 16 | 84119 | Men's or boy's anoraks, ski-jackets, wind cheaters and the like, not knitted or crocheted |
| 17 | 84140 | Men's or boy's trousers, bib and brace overalls & shorts, not knitted or crocheted |
| 18 | 84151 | Men's or boy's shirts, of cotton, not knitted or crocheted |
| 19 | 84260 | Women's or girl's trousers, shorts, breeches and bib and brace overalls & shorts, not knitted or crocheted |
| 20 | 84482 | Women's or girl's briefs and panties, not knitted or crocheted |
| 21 | 84530 | Jerseys, pullovers, cardigans, waistcoats & similar articles knitted or crocheted |
| 22 | 84692 | Other gloves, mittens and mitts, knitted or crocheted |
| 23 | 84812 | Gloves, mittens and mitts, of leather or composition leather, not for sports |
| 24 | 84843 | Hats and other headgear, knitted or crocheted, or made up from lace, felt, or other textile fabric in the piece; hairnets |
| 25 | 88423 | Spectacles, goggles and the like, corrective, protective or other |
| 26 | 88541 | Wrist watches, battery or accumulator powered w/case not made of or clad w/precious metals |
| *Other* | | |
| 27 | 89212 | Children's picture, drawing or coloring books |
| 28 | 89437 | Playing cards |
| 29 | 89829 | Musical boxes, fairground & mechanical street organs & other musical instrument, NES; decoy calls, whistles etc. |

Finally, column 3 reports the $F$-statistic for the null hypothesis that $\hat{\gamma} = 1$; fully half of the equations reject this hypothesis. As noted above, this result suggests measurement error in these unit-value series. Unfortunately, there is no way to determine which series is more accurately measured. Hence all subsequent analysis will examine domestic exports and re-exports separately.

*Table 3. Comparison of Domestic Exports and Re-export Unit-value Series*

| | $\beta$ | *Obs.* | *F-statistic* | *Adjusted* $R^2$ |
|---|---|---|---|---|
| *Food* | | | | |
| Soy sauce | 0.413* | 53 | 19.93* | 0.30 |
| | (0.132) | | | |
| Other sauces | 0.294* | 65 | 78.33* | 0.18 |
| | (0.080) | | | |
| Pasta | 0.217 | 65 | 74.72* | 0.05 |
| | (0.091) | | | |
| Sports drinks | 0.058 | 48 | 297.32* | –0.09 |
| | (0.055) | | | |
| *Intermediate goods* | | | | |
| Flexible pipes | –0.056 | 26 | 127.92* | –0.38 |
| | (0.093) | | | |
| Folding cartons | 0.875* | 65 | 0.68 | 0.31 |
| | (0.151) | | | |
| Other woven fabric | 0.480* | 44 | 30.71* | 0.37 |
| | (0.094) | | | |
| Razors, nonelectric | –0.252 | 34 | 20.84* | –0.18 |
| | (0.274) | | | |
| Other electrical transformers | 0.111 | 65 | 33.82* | –0.07 |
| | (0.153) | | | |
| Static converters | 0.721* | 65 | 2.13 | 0.14 |
| | (0.191) | | | |
| Other switches | 0.167 | 64 | 17.82* | –0.08 |
| | (0.197) | | | |
| Plugs and sockets | 0.335 | 59 | 1.67 | –0.13 |
| | (0.515) | | | |
| Primary cells and batteries | –0.215 | 65 | 10.44* | –0.07 |
| | (0.376) | | | |
| Signaling apparatus | 0.760 | 63 | 0.48 | –0.03 |
| | (0.346) | | | |
| *Clothing and accessories* | | | | |
| Other handbags | 1.037 | 32 | 0.01 | 0.47 |
| | (0.474) | | | |
| Men's or boy's ski-jackets | 0.922* | 65 | 0.42 | 0.89 |
| | (0.122) | | | |
| Men's or boy's trousers | 0.998* | 65 | 0.00 | 0.87 |
| | (0.045) | | | |
| Men's or boy's shirts | 0.937* | 65 | 1.80 | 0.79 |
| | (0.047) | | | |
| Women's or girl's trousers | 0.927* | 65 | 1.34 | 0.18 |
| | (0.063) | | | |
| Women's or girl's briefs | 0.392* | 65 | 41.35* | 0.94 |
| | (0.095) | | | |
| Jerseys, pullovers | 0.958* | 65 | 1.63 | –0.16 |
| | (0.033) | | | |
| Other gloves & mittens | –0.074 | 55 | 35.33* | 0.02 |
| | (0.181) | | | |

*Table 3. Continued*

| | $\beta$ | *Obs.* | *F-statistic* | *Adjusted $R^2$* |
|---|---|---|---|---|
| Gloves & mittens | 0.763 | 37 | 0.65 | –0.03 |
| | (0.293) | | | |
| Hats | 0.555 | 65 | 2.57 | 0.03 |
| | (0.278) | | | |
| Spectacles | 0.986* | 65 | 0.00 | 0.21 |
| | (0.218) | | | |
| Wrist watches | 1.088* | 65 | 0.82 | 0.66 |
| | (0.097) | | | |
| *Other* | | | | |
| Coloring books | 0.040 | 64 | 16.13* | –0.11 |
| | (0.239) | | | |
| Playing cards | 0.097 | 56 | 56.95* | –0.12 |
| | (0.120) | | | |
| Musical boxes | 0.324 | 43 | 6.86* | 0.09 |
| | (0.258) | | | |

*Notes*: Heteroskedasticity-consistent standard errors in parenthesis; * denotes significant at the 1% level.

Table 4 presents PTM estimates for domestic exports for the 29 separate export industry estimations. As before, the estimation period is 1992–2000. First note that the model as outlined by equation (2) allows the PTM coefficient ($\beta$) to vary by destination country. However, the table reports results imposing the constraint that $\beta$ was the same across countries. Likelihood ratio tests of this restriction are reported in the column labeled $\beta_j = \beta$. The restriction is rejected for only seven of the equations. This is consistent with the hypothesis that PTM behavior does not depend critically on the destination market. This is also consistent with what Knetter (1993) finds in his examination of export behavior from Germany, Japan, the US, and the UK—i.e., PTM behavior does not depend critically on the destination market. Hence, we shall focus on the results of the constrained regressions.

Table 4 presents results using the nominal exchange rate as the measure of the exchange rate. Knetter (1993) argues the optimal export price should be neutral with respect to changes in the nominal rate that correspond to inflation in the destination market. Hence he reports estimates using the real exchange rate. One problem with this adjustment is that measurement error is introduced to the extent that the overall inflation rate diverges from the rate of change of the $i$th commodity. Moreover, Parsley and Popper (1998) argue that the exchange rate may reflect central bank actions in response to the behavior of prices—as in the case where monetary policy insulates prices from exchange rate changes. Prices then appear unresponsive to changes in the exchange rate. The observed relationships between prices and the exchange rate will reflect central bank actions instead of the underlying relationship between exchange rates and prices. Thus endogeneity of monetary policy can bias estimates of passthrough downward. For these reasons, in this study, $\beta$ was estimated using both nominal and real exchange rates for robustness, but only the estimates using the nominal exchange rate are reported.[4]

The estimates of $\beta$ are given in the first column of Table 4, and heteroskedasticity-consistent standard errors are given in parenthesis beneath each estimate. Recall that

*Table 4. Estimated Pricing to Market, Hong Kong Domestic Exports*

| | $\beta$ | *Obs.* | $H_0$: $\beta_j = \beta$ | $H_0$: $\beta = -1.0$ | $\bar{R}^2$ |
|---|---|---|---|---|---|
| *Food* | | | | | |
| Soy sauce | –0.751 | 67 | 27.0* | 0.10 | –0.01 |
| | (0.800) | | | | |
| Other sauces | –0.472 | 72 | 9.8 | 3.37** | –0.05 |
| | (0.288) | | | | |
| Pasta | 0.474 | 72 | 10.4 | 4.10* | –0.11 |
| | (0.727) | | | | |
| Sports drinks | –1.109* | 61 | 16.2** | 0.04 | –0.03 |
| | (0.560) | | | | |
| *Intermediate goods* | | | | | |
| Flexible pipes | 0.530 | 47 | 24.0* | 6.51* | 0.08 |
| | (0.599) | | | | |
| Folding cartons | –0.117 | 72 | 8.9 | 1.99 | 0.33 |
| | (0.625) | | | | |
| Other woven fabric | –0.625 | 62 | 15.6* | 0.95 | 0.20 |
| | (0.385) | | | | |
| Razors, nonelectric | –1.954 | 39 | 19.5* | 0.13 | –0.14 |
| | (2.616) | | | | |
| Other electrical transformers | 0.123 | 72 | 8.1 | 1.31 | –0.14 |
| | (0.982) | | | | |
| Static converters | 2.816 | 72 | 5.9 | 4.41* | –0.05 |
| | (1.816) | | | | |
| Other switches | –1.844 | 71 | 1.9 | 0.45 | –0.13 |
| | (1.248) | | | | |
| Plugs and sockets | 0.154 | 66 | 2.2 | 0.40 | –0.06 |
| | (1.819) | | | | |
| Primary cells and batteries | –0.319 | 72 | 5.9 | 0.35 | –0.20 |
| | (1.140) | | | | |
| Signaling apparatus | 8.023* | 54 | 5.6 | 15.1* | 0.02 |
| | (2.323) | | | | |
| *Clothing and accessories* | | | | | |
| Other handbags | 3.796 | 29 | 11.1 | 2.90** | 0.19 |
| | (2.814) | | | | |
| Men's or boy's ski-jackets | 1.222 | 72 | 6.5 | 3.89* | –0.15 |
| | (1.126) | | | | |
| Men's or boy's trousers | 0.568* | 72 | 12.2 | 52.6* | 0.03 |
| | (0.216) | | | | |
| Men's or boy's shirts | 0.360* | 72 | 8.4 | 67.2* | 0.25 |
| | (0.166) | | | | |
| Women's or girl's trousers | 0.306 | 72 | 7.7 | 22.0* | –0.04 |
| | (0.278) | | | | |
| Women's or girl's briefs | 0.326 | 72 | 9.5 | 8.74* | –0.01 |
| | (0.448) | | | | |
| Jerseys, pullovers | 0.015 | 72 | 19.5* | 34.6* | –0.02 |
| | (0.173) | | | | |
| Other gloves & mittens | –3.342* | 62 | 16.6** | 4.76* | –0.12 |
| | (1.073) | | | | |

*Table 4. Continued*

| | $\beta$ | *Obs.* | $H_0$: $\beta_j = \beta$ | $H_0$: $\beta = -1.0$ | $\bar{R}^2$ |
|---|---|---|---|---|---|
| Gloves & mittens | 2.408 (1.766) | 43 | 11.7 | 3.72* | –0.18 |
| Hats | –0.604 (0.959) | 72 | 8.2 | 0.17 | –0.07 |
| Spectacles | –0.898 (0.798) | 72 | 4.6 | 0.02 | –0.12 |
| Wrist watches | –0.036 (0.468) | 72 | 13.5 | 4.25* | –0.17 |
| *Other* | | | | | |
| Coloring books | –0.102 (1.331) | 71 | 12.8 | 0.46 | 0.00 |
| Playing cards | –0.563 (0.849) | 68 | 8.2 | 0.26 | –0.11 |
| Musical boxes | 2.036 (2.705) | 52 | 12.2 | 1.26 | –0.04 |

*Notes*: Heteroskedasticity-consistent standard errors in parenthesis; *, ** denote significant at the 1% and 5% levels, respectively. All equations include time and country dummies.

the null hypothesis is $\beta = 0$, which is consistent with a lack of market segmentation and no pricing to market by Hong Kong exporters. In the table there are only five cases (at the 10% level) where we can reject the null; one food, one intermediate good, and three goods in clothing and accessories (three of these cases, however, imply that local currency prices exacerbate exchange rate movements).[5] The one food case (sports drinks) suggests that PTM might be more important in branded goods markets; however, PTM in Knetter's (1993) sample was as likely to occur in homogeneous goods (e.g., titanium dioxide) as in branded items. Looking across products in Table 4, there are roughly as many positive point estimates as negative; again, these results most closely mirror Knetter's findings for US exports, but the overall lack of statistical significance in Table 3 prevents stronger cross-industry (or product) conclusions.

At first blush, this overall lack of PTM is somewhat counterintuitive since it suggests destination-country (local-currency) import prices vary with exchange rates. The lack of PTM is often associated with market power on the part of the exporter. Recall, however, that with a competitive export market, the ability to price-discriminate (i.e., PTM) implies the ability to subsidize losses in one market with gains in another—possibly the home market. *A priori*, this is not the case for Hong Kong exporters.[6] Thus (by implication) the empirical puzzle of low US export PTM may plausibly be the result of a similar inability to subsidize across markets. Finally, in column 4 of the table, I test the hypothesis that PTM is complete; i.e., $\beta = -1$. This hypothesis is rejected for 15 of the 29 cases, usually at the 1% significance level.

In summary, there is no overwhelming evidence that PTM behavior depends critically on export destination; indeed there is very little evidence of *any* price discrimination. Apparently Hong Kong exporters fully pass through exchange rate changes to destination-market local currency prices. These results are consistent with what Knetter (1993) finds for exports from the US. Moreover, the results differ starkly from what he finds for exports from Germany, Japan, and the UK. For exports from these countries Knetter finds much stronger evidence of PTM—though even for these countries he finds "weak" evidence that PTM behavior does not depend critically on export destination. This suggests there may indeed be a difference in the behavior of exporters from (non-US) G-7 countries and from smaller economies.

*Robustness*

Most studies of the Hong Kong economy recognize the historical importance of its role as an entrepot. In Table 4, the focus was on Hong Kong exports only. However, for this study the distinction between purely domestic, and so-called re-exports, is less compelling. Moreover, as noted in Table 3, the export unit-value series computed from domestic exports and those for re-exports are less than perfectly correlated. Thus, in Table 5 the analysis is repeated for Hong Kong's re-exports. For comparability, the same goods are studied as before.

Table 5 conveys much the same story as Table 4, but now even fewer—i.e., just over one-third—of the point estimates of the PTM coefficients are negative. Additionally, of the three statistically significant coefficients, two are greater than zero, implying that local currency prices amplify exchange rate movements. Thus, again we generally cannot reject the hypothesis that exporters from Hong Kong pass through 100% of all exchange rate changes to local currency import prices. This is exactly the "small-country, perfect-competition" prediction. As in Table 4, we are able to reject the hypothesis that PTM is complete ($\beta = -1$) for slightly more than half of the products. Overall, of the G-7 countries for which we have similar estimates, PTM behavior of Hong Kong exporters most closely mirrors the US case.

The low $R^2$ statistics and large standard errors reported in Tables 4 and 5 suggest that the minimalist specification estimated and reported there may be inadequate. Hence, the equations were reestimated incorporating a lagged dependent variable in each equation. A second reestimation excluded destination-specific fixed effects. A third reestimation excluded country-specific effects; and finally, the analysis was done including all observations (i.e., not excluding price changes above the 95th and below the 5th percentiles of the empirical distributions). The rationale for adding the lagged

*Table 5. Estimated Pricing to Market, Hong Kong Re-exports*

| | $\beta$ | *Obs.* | $H_0$: $\beta_j = \beta$ | $H_0$: $\beta = -1.0$ | $\bar{R}^2$ |
|---|---|---|---|---|---|
| *Food* | | | | | |
| Soy sauce | –0.552 | 55 | 0.33 | 0.25 | 0.02 |
| | (0.895) | | | | |
| Other sauces | 0.240 | 64 | 0.07 | 2.19 | –0.17 |
| | (0.837) | | | | |
| Pasta | –1.651** | 64 | 2.29 | 0.43 | –0.04 |
| | (0.991) | | | | |
| Sports drinks | 0.014 | 58 | 0.00 | 0.40 | –0.14 |
| | (1.608) | | | | |
| *Intermediate goods* | | | | | |
| Flexible pipes | –1.679 | 36 | 0.52 | 0.06 | 0.04 |
| | (2.795) | | | | |
| Folding cartons | –0.169 | 64 | 0.23 | 8.01* | 0.55 |
| | (0.294) | | | | |

*Table 5. Continued*

| | $\beta$ | *Obs.* | $H_0$: $\beta_j = \beta$ | $H_0$: $\beta = -1.0$ | $\bar{R}^2$ |
|---|---|---|---|---|---|
| Other woven fabric | –0.712 (1.016) | 46 | 0.58 | 0.08 | 0.01 |
| Razors, nonelectric | –1.506 (1.230) | 38 | 0.60 | 0.17 | –0.14 |
| Other electrical transformers | –0.063 (0.543) | 64 | 0.01 | 2.98 | –0.02 |
| Static converters | 1.853 (1.239) | 64 | 2.03 | 5.29** | –0.06 |
| Other switches | 0.293 (0.670) | 64 | 0.11 | 3.72** | –0.12 |
| Plugs and sockets | 0.255 (0.619) | 64 | 0.22 | 4.11** | –0.01 |
| Primary cells and batteries | 0.465 (0.319) | 64 | 1.88 | 21.1* | –0.04 |
| Signaling apparatus | 1.131 (0.727) | 48 | 1.74 | 8.59* | 0.24 |
| *Clothing and accessories* | | | | | |
| Other handbags | –0.291 (1.016) | 40 | 0.08 | 0.48 | –0.23 |
| Men's or boy's ski-jackets | 0.369 (0.420) | 64 | 2.02 | 10.6* | –0.08 |
| Men's or boy's trousers | 0.065 (0.235) | 64 | 0.05 | 20.6* | 0.08 |
| Men's or boy's shirts | 0.828* (0.331) | 64 | 5.87 | 30.4* | 0.16 |
| Women's or girl's trousers | 0.380 (0.2449) | 64 | 1.23 | 30.7* | 0.11 |
| Women's or girl's briefs | 0.583 (0.511) | 64 | 0.74 | 9.62* | –0.12 |
| Jerseys, pullovers | 0.475* (0.201) | 64 | 5.60 | 53.7* | 0.35 |
| Other gloves & mittens | 0.035 (0.620) | 64 | 0.00 | 2.78 | 0.20 |
| Gloves & mittens | 0.665 (0.458) | 56 | 1.68 | 13.2* | 0.03 |
| Hats | 0.124 (0.464) | 64 | 0.09 | 5.86* | –0.11 |
| Spectacles | –0.583 (0.597) | 64 | 1.38 | 0.48 | 0.02 |
| Wrist watches | 0.369 (0.336) | 64 | 1.13 | 16.6* | 0.19 |
| *Other* | | | | | |
| Coloring books | 0.362 (0.544) | 64 | 0.33 | 6.26* | –0.07 |
| Playing cards | –0.587 (1.032) | 58 | 0.13 | 0.16 | –0.24 |
| Musical boxes | –0.196 (1.566) | 62 | 0.01 | 0.26 | 0.05 |

*Notes*: Heteroskedasticity-consistent standard errors in parenthesis; *, ** denote significant at the 5% and 10% levels, respectively. All equations include time and country dummies.

*Table 6. Estimated Pricing to Market, Pooled Results*

| | $\beta$ | *Obs.* | $H_0$: $\beta_j = \beta$ | $H_0$: $\beta = -1.0$ | $\bar{R}^2$ |
|---|---|---|---|---|---|
| *Hong Kong exports* | | | | | |
| Food | –0.042 (0.181) | 216 | 9.66 | 27.9* | –0.02 |
| Intermediate goods | 0.115 (0.336) | 502 | 5.31 | 11.0* | 0.02 |
| Clothing and accessories | 0.150 (0.149) | 625 | 8.87 | 59.2* | 0.03 |
| Other consumer goods | –0.384 (0.749) | 149 | 13.11 | 0.67 | –0.03 |
| *Hong Kong re-exports* | | | | | |
| Food | –0.221 (0.261) | 225 | 8.81 | 8.91* | –0.01 |
| Intermediate goods | 0.255 (0.171) | 500 | 9.08 | 53.7* | 0.04 |
| Clothing and accessories | 0.159 (0.137) | 650 | 16.04 | 71.1* | 0.02 |
| Other consumer goods | 0.157 (0.557) | 162 | 6.53 | 4.32** | –0.01 |

*Notes*: Heteroskedasticity-consistent standard errors in parenthesis; *, ** denote significant at the 1% and 5% levels, respectively. All equations include time, good, and country dummies.

dependent variable to the basic specification given in equation (2) is to mitigate possible effects of autocorrelation in the residuals. These alternative specifications are not included here to conserve space, but had no impact on the results.

Finally, the data were pooled across products in an attempt to increase the power of the statistical tests. These results are reported in Table 6. The top panel presents the results for Hong Kong exports, and the lower panel focuses on re-exports. In each panel I report four pooled regressions: food, intermediate goods, clothing and accessories, and other consumer goods. The pooled results tell the same story. Namely, we cannot reject the hypothesis of zero PTM for any of the regressions. Additionally, we are able to reject the hypothesis of complete PTM for seven of the eight regressions. I also tested—and rejected for seven of the eight cases (not reported)—one specific case of partial PTM; i.e., $\beta = -0.5$.

Thus, we can conclude that Hong Kong exporters typically fully pass through exchange rate changes to local currency import prices. This conclusion is robust to the exclusion or inclusion of statistically extreme values, and to several alternate econometric specifications. It holds whether one examines nominal or real exchange rates, or whether we consider either domestic exports, or re-exports. Moreover, these conclusions do not appear sensitive to the particular destination market considered (at least among the nine destination markets considered here).

## 5. Conclusions

Using nine export destinations, this study has examined the PTM behavior of a panel of five-digit exports from Hong Kong for the years 1992–2000. The simple, competitive model predicts complete passthrough to (foreign) local currency prices, or alternatively no pricing to market. This competitive model is somewhat counterintuitive, however, in the case of a small country. In the small-country (exporter) case, it is at least plausible that the buyer (importer) may exert pressure for the exporter to absorb some of the exchange rate change. Similarly, it is sometimes conjectured that a large exporting country (e.g., the US) may exert market power in the export market, and hence refuse to absorb any of the impact of exchange rate changes.

Most existing evidence, taken from G-7 countries, finds varying (but positive) degrees of pricing to market. The notable exception is for exports from the United States. Existing evidence suggests that exporters from the US apparently do not price to market, while other countries routinely pass through less than 100% of exchange rate changes. By bringing new, non-G-7 evidence to this issue, this study provides a benchmark by which to interpret the puzzling behavior of US export prices. *A priori*, Hong Kong represents the small-country, competitive case. In particular, Hong Kong's highly competitive business environment has been well documented. Moreover, there would appear little risk of violating the "small country" assumption in the case of Hong Kong.

Empirically, Hong Kong's export price behavior is consistent with the competitive paradigm. In only a few cases is there evidence of local currency pricing to market by Hong Kong's exporters. Moreover, consistent with results found by Knetter (1993), there is no compelling evidence of differences in PTM across the destination countries in the sample. An alternative interpretation suggests itself for future research. Namely, intermediaries in the import market may vary profit margins, thus mitigating local currency retail price fluctuations.

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## Notes

1. It is not necessary to believe that the US price represents the "world" price. However, the volume of Hong Kong's exports going to the US market alone accounts for roughly as much as the next eight export destinations (excluding China) combined.

2. Typically, estimations are in percentage change form; i.e., variables included in regression equations are first-differenced, natural log values.

3. That is, this dataset permits two unit-value series to be computed for each export product and country. In principle, these series measure the same thing—especially for unbranded goods. To my knowledge, this feature is unique to Hong Kong's external trade data.

4. In practice the real and nominal exchange rates are very highly correlated—suggesting little impact on PTM estimates. The correlation coefficients, by country, are Canada 0.70, Germany 0.99, Netherlands 0.98, France 0.92, Britain 0.98, Taiwan 0.93, Japan 0.99, and Singapore 0.77.

5. Finding that local currency price movements (statistically significantly) amplify exchange rate movements is not unique to this study. Interestingly, Knetter (1993) reports similar cases for US exports but not for exports from Germany, Japan, or the UK.

6. However, another possibility (consistent with the findings) is that importer profit margins vary—with the net result that local currency retail prices remain relatively unaffected by exchange rate changes. This is more consonant with the findings of studies examining prices of imports. Unfortunately, it is not possible to isolate this channel with the available data.