

Exchange Rate Pass-Through:

Theory and Evidence

Economics 826: International Finance

David Tulk*

January 23, 2004

*This paper benefited from helpful comments from Stephen Tapp.

1 Introduction

For firms doing business in foreign countries, the exchange rate is one of the main sources of uncertainty. On an aggregate level, the ability of firms to insulate themselves from movements in the exchange rate is a function of the level of exchange rate pass-through. Formally defined, exchange rate pass-through (ERPT) measures the effect of movements in the nominal exchange rate on the price of imported goods. There is a long-standing debate as to the cause and implication for the economy of the less-than-complete level of ERPT seen in the data. This paper will provide the theory as well as review some of the empirical literature at the centre of the debate.

To provide a context for the ensuing treatment, it is helpful to review the implications of a less-than-complete ERPT for the economy. From the perspective of monetary policy, a less-than-complete ERPT means that domestic inflation will not be as susceptible to exchange rate shocks, which makes monetary policy more effective in dealing with real-side shocks. The second implication centres around the volatility of the exchange rate. Given that import prices adjust gradually to changes in the exchange rate, in the case of a foreign supply shock the exchange rate would need to adjust dramatically in order to push the domestic import price to a level that will return the market to equilibrium. In these cases, the exchange rate needs to move a lot more than it would in an environment of more complete ERPT. Clearly, the presence of an incomplete ERPT will have some significant effects on the economy.

The following section outlines the theory and evidence surrounding the level of ERPT. Section 3 is dedicated to examining the origin of ERPT in hopes of isolating what factors

affect the level across countries. Section 4 concludes.

2 Theory and Evidence on the Level of ERPT

2.1 General Theory

When choosing the price to charge in another country, an exporter will charge the cost plus a markup.¹ When converted into the foreign currency it will have the following specification, as measured by the import price:

$$p_m = (1 + \lambda) c \varepsilon \quad (2.1)$$

where λ represents the markup over the cost c and the nominal exchange rate is denoted by ε . Let the markup term be a function of the domestic price level of competing goods and the cost of production in the domestic currency:

$$(1 + \lambda) = \left(\frac{p_d}{c \varepsilon} \right)^\alpha \quad (2.2)$$

Note that α represents the level of ERPT. Writing the original import price relationship in natural logs gives the following result:

$$\ln p_m = \alpha \ln p_d + (1 - \alpha) \ln c + (1 - \alpha) \ln \varepsilon \quad (2.3)$$

Determining the level of ERPT is tantamount to looking at the extreme values of α . If $\alpha = 0$, pass-through is complete, in that the price of imports encompasses both the cost and the exchange rate. When $\alpha = 1$, the price of imports is equal to the domestic price (no pass-through) and the firm must absorb the cost and the effect of the exchange rate. Given the composition of the price of imports implied by various levels of ERPT, the next stage is

¹Adapted from Silvapulle and Wickremasinghe (2002).

to determine what level is supported by theory.

The theoretical prediction for the level of ERPT is related to the existence of purchasing power parity (PPP). For example, if the world economy was characterized by fully integrated markets, perfect competition and cost-less distribution, resale and transportation one would expect that a good would have an identical price across countries when measured by a common currency (otherwise known as the law of one price). In this environment ERPT would be complete. If some of the restrictive assumptions surrounding PPP are relaxed, ERPT will still be complete. For example, complete ERPT can exist with imperfect competition (firms share an identical markup) and with costly transportation and distribution (relative PPP holds versus absolute PPP).

When PPP fails to hold (which is supported by the majority of the literature on the subject) ERPT will be less than complete. This makes a certain amount of intuitive sense: given the existence of nominal rigidities, firms are not able to immediately adjust their prices in foreign markets in response to short-term and frequently volatile movements in the exchange rate. The following section will present the empirical evidence surrounding the level of ERPT.

2.2 Empirical Results on the Level of ERPT

Campa and Goldberg (hereafter referred to as C-G) in 2002 present an exhaustive survey of short-run and long-run pass-through elasticities for OECD countries. Their estimation technique is based on a model using micro-foundations in the pricing setting behaviour of

exporters. The regression equation takes the following form:

$$p_t = \alpha + \delta x_t + \gamma e_t + \phi Z_t + \varepsilon_t \quad (2.4)$$

where p_t is the import price in local currency, e_t is the nominal exchange rate, x_t represents exporter costs, and Z_t includes other control variables such as real GDP of the destination market. From this equation they calculate both short-run and long-run elasticities for 25 OECD countries. A partial summary of their results is presented in Table 1 which shows that ERPT is incomplete across the countries considered. The following section outlines some of the theory behind the origin of the different levels of ERPT in an effort to determine what country or industry-specific qualities are important.

3 Theory and Evidence on the Cause of ERPT

3.1 Theory: Where does it come from?

Once it was established that a less-than-complete ERPT was roughly congruent with the theory and the data, the focus shifted to its cause. The subsequent debate was divided along the micro / macro axis. The main advocate for the macro-foundations was John Taylor who articulated his theory in a 2000 paper. He cited the fall in world inflation rates and the rise in global competitiveness from the 1970's to the 1980's as eroding the ability of firms to set unique prices in individual markets. Once inflation expectations were entrenched at a low and stable level, price variability declined, forcing importing firms to absorb nominal exchange rate movements. In a 2001 paper, Devereux and Engel showed that an economy with stable monetary policy (measured in the stability of prices) would have, all things equal, lower

ERPT. Froot and Klemperer (1989) looked at nominal exchange rate variability as another macro-variable that would impact the level of ERPT. They concluded that ERPT would be lower in economies characterized by higher nominal exchange rate variability because foreign firms would be wary of losing market share by adjusting prices in response to the variability.

The opposing view point centred on a micro-foundation analysis of market power, product differentiation and other structural factors. In a Canadian study, Kardasz and Stollery (2001) found that there is a wide variation in ERPT elasticities across 31 manufacturing industries. Their subsequent analysis (looking at variables such as export share and non-tariff barriers) reveal that industries characterized by high levels of protectionism, high import-based market share tend to have higher levels of ERPT. Other micro-based papers include Herzberk, Kapetanios and Price (2003), who use UK data in a pricing-to-market framework to find that the price level of competing domestic firms plays a role in determining the overall level of ERPT.

3.2 Empirical Findings: Settling the Debate?

One consequence of Taylor's macro-based theory is that one would expect ERPT to fall inline with the increase in price stability. C-G test this hypothesis directly by running a number of stability tests in search of either a structural break in the level of ERPT or general parameter instability. Their first step is to run a Chow-test over a split sample: 1977 to 1989 and then 1977 to 1999. This analysis is summarized in Table 2. Clearly there has been some decrease in the level of ERPT but when measured by statistical significance, the number is relatively small. They also consider an endogenously determined break-point test and conclude that the instability that exists in the measure of ERPT is gradual over time, lending some support

to Taylor's theory.

In an effort to directly assess the role of macro-economic variables on the level of ERPT, C-G generate elasticities using the following formula:

$$\gamma^i = \alpha + \beta x^i + \varepsilon^i \quad (3.1)$$

where γ is the elasticity of ERPT and x represents the following exogenous macroeconomic variables: money growth, inflation rate, changes in the nominal exchange rate and real GDP. The elasticities are then evaluated in a time-series setting to evaluate the influence of the underlying macroeconomic variables. The results from this regression show macroeconomic variables are significant when considering short-run elasticities but the correlation disappears in the long run.

C-G also offer a direct comparison between the role of micro versus macro variables in the following horse-race regression:

$$\Delta\gamma = \beta_1\Delta \ln money_t + \beta_2\Delta \ln inflation_t + \beta_3\Delta \ln exchvol_t + \beta_4\Delta \ln imputed_t + \varepsilon_t \quad (3.2)$$

where *imputed*_{*t*} represents the micro variables. The authors find that although the joint insignificance of the macro variables cannot be rejected at the one-percent level, the majority of the explanatory power comes from the micro variables.

The empirical evidence dedicated to determining the origin of ERPT is mixed. It is clear that although the micro variables have a dominant role in explaining ERPT there is some evidence that supports some macro foundations. It is a realistic conclusion that the true level of ERPT may be a function of all the variables considered, regardless if they are micro

or macro in definition.

4 Conclusion

In addition to reviewing some of the theory behind the level and cause of ERPT, this paper has provided some of the supporting empirical evidence. Whereas it is understood by both theory and empirical results that less-than-complete ERPT exists, such a consensus does not exist when considering the origin of the pass-through.

Tables

Table 1: Exchange Rate Pass-Through Elasticities for Selection of Countries (from C-G)

Country	Short-Run	Long-Run
Australia	0.55	0.69
Canada	0.65	0.68
United Kingdom	0.39	0.47
Japan	0.88	1.26
USA	0.26	0.59
25 OECD Average	0.61	0.77

Table 1: Elasticities are statistically different from zero at the five-percent level. The exception is Japan, which is statistically different from 1.

Table 2: Chow Test Results (from C-G)

	Short-Run	Long-Run
Number of Countries With ERPT Increase (number significant)	8 (2)	9 (1)
Number of Countries With ERPT Decrease (number significant)	16 (4)	15 (5)

References

- Campa J.M. and L.S. Goldberg. 2002. "Exchange Rate Pass-Through Into Import Prices: A Macro or Micro Phenomenon?" NBER Working Paper 8934.
- Devereux M.B. and J. Yetman. 2002. "Price Setting and Exchange Rate Pass-Through: Theory and Evidence." Hong Kong Institute for Monetary Research Working Paper No. 22.
- Froot, K.A. and P.D. Klemperer. 1989. "Exchange Rate Pass-Through when Market Share Matters" *American Economic Review*, vol 79, 637-654.
- Herzberg V., Kapetanios G., and S. Price. 2003. "Import Prices and Exchange Rate Pass-Through: Theory and Evidence from the United Kingdom" Bank of England Working Paper No. 182.
- Kardasz J.M. and K.R. Stollery. 2001. "Exchange Rate Pass-Through and its Determinants in Canadian Manufacturing Industries" *Canadian Journal of Economics*, vol 34, no 2, 719-738.
- Silvapulle, P and G. Wickremasinghe. 2002. "Exchange Rate Pass-Through to Manufactured Import Prices: The Case of Japan" Proceedings of the Econometric Society Australasian Meeting.
- Taylor, J.B. 2000. "Low Inflation, Pass-Through and the Pricing Power of Firms" *European Economic Review*, vol 44,1389-1408.