

Has Exchange Rate Pass-Through Really Declined? Some Recent Insights from the Literature

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- *A substantial empirical literature has shown that the correlation between changes in consumer prices and changes in the nominal exchange rate has been quite low and declining over the past two decades for a broad group of countries.*
- *The issue of exchange rate pass-through (ERPT) has recently been explored more fully in the context of sticky-price, open-economy, dynamic stochastic general-equilibrium (DSGE) models. The findings of these studies put into question results from previous work based on reduced-form equations. In particular, ERPT to import prices may remain larger than the estimated parameters from reduced-form regressions would indicate, owing to an econometric bias related to the endogeneity of the exchange rate.*
- *Nevertheless, there is fairly convincing evidence to suggest that measured short-term ERPT to consumer prices has declined because of a shift to more credible monetary policy regimes, and, in this case, the findings from DSGE models confirm the results of reduced-form models.*
- *Studies using microdata are a promising area of research, since they provide additional insights that help us to better understand the phenomenon of ERPT by providing evidence of some of its drivers at the micro level.*

The extent to which exchange rate movements are “passed through” to prices has long been a question of interest to both central bankers and academics. Exchange rate pass-through (ERPT) typically refers to the direct effect that a change in the external value of a currency has on the domestic price of imported goods and services and on domestic prices more generally. For instance, a depreciation in the Canadian dollar is usually expected to increase the prices of goods that are imported into Canada. If the effect of the depreciation is fully reflected in import prices, then pass-through is said to be complete. If only a portion of the depreciation is reflected in import prices, then the pass-through is described as partial or incomplete.

The pass-through process consists of two stages. In the first stage, exchange rate movements are transmitted to import prices, while in the second stage, changes in import prices are reflected in the consumer price index (CPI).¹ While the response of import prices to exchange rate movements is important, it is the behaviour of the CPI that matters most for monetary policy in Canada and in other inflation-targeting countries. The extent of pass-through to the CPI will depend on the rate of pass-through to import prices, the share of imports in the consumption basket, and the response of the prices of domestically produced goods to movements in the exchange rate. The extent and speed of the pass-through to import prices will also depend on several factors, including expectations as to the duration of the depreciation or appreciation, the cost of adjusting prices, demand conditions, and the

¹ It should be noted that ERPT to the CPI would include any effects of changes in the exchange rate on the prices of import-competing goods and on the prices of imported inputs.

Exchange Rate Pass-Through and the Bank of Canada's Inflation Projection

The Bank of Canada's inflation projection—a key element in the conduct of monetary policy—is based on a fully articulated, five-sector, structural DSGE model of the Canadian economy called ToTEM.¹ In ToTEM, the extent to which movements in the exchange rate are passed through to prices depends on many factors, such as the share of imports in the CPI basket, the frequency of price changes, and the expected response by

the monetary authority. Notably, it is assumed that monetary policy can significantly influence ERPT in the short run through its effect on inflation expectations. Pass-through from the exchange rate to the core CPI is quite low in the short run (about 0.03 after one year and 0.05 after two years), and in the long run, the model assumes that all prices, including the exchange rate, will change by the same proportion after an exchange rate shock.

¹ For more information on ToTEM, see Murchison and Rennison (2006).

elasticity of substitution among alternative domestic and foreign suppliers.²

Several stylized facts on ERPT have emerged from the large body of research that has examined this issue. First, it appears that the full effect of a depreciation or appreciation of the domestic currency is typically not passed through to the local-currency prices of imports, even in the long run. Second, exchange rate movements are passed through to prices with a lag, such that ERPT in the short run seems to be much lower than in the longer run. Third, there is considerable heterogeneity in the extent of ERPT at the industry level: pass-through seems to be higher in industries that produce homogeneous goods, such as energy and raw materials, and lower for those that produce more differentiated manufactured goods. Finally, it has been suggested, based on casual observation and empirical work, that ERPT to consumer prices may have diminished over time.

The issue of whether ERPT has declined is an important one for central banks because a decline in pass-through would imply that movements in the exchange rate have smaller effects on consumer prices and, hence, on short-run inflation, than previously thought. Assessing this view thus has important implications for Canadian monetary policy, particularly in an environment characterized by sizable

movements in the Canadian dollar. Indeed, when the Canadian dollar moves on a sustained basis, it is important for the Bank of Canada to accurately estimate its impact on the Bank's forecast of the future path of inflation—a key element in the conduct of monetary policy. For more on ERPT and the Bank of Canada's inflation projection (**see Box**).

In this article we build on an earlier *Review* article by Bailliu and Bouakez (2004) and critically reassess the premise that ERPT has declined, in light of recent work that analyzes this issue in the context of a dynamic stochastic general-equilibrium (DSGE) framework. These more-recent contributions to the literature help to emphasize the potential pitfalls of studies based on reduced-form equations, which have formed the basis for much of the evidence to date. We also discuss insights from recent studies of ERPT based on microdata. We conclude with a discussion of policy implications.

Has Exchange Rate Pass-Through Declined?

Before discussing the evidence which suggests that ERPT may have declined, we review the explanations put forward in the literature to explain how a decline in ERPT could arise, focusing first on import prices and then on consumer prices.

² If the price of an imported good rises because of a depreciation, domestic importers may simply switch suppliers. This would be measured as low pass-through, even though pass-through may be complete.

Why might we expect pass-through to import prices to have declined in recent years?

One reason links a decline in ERPT to import prices to increased trade integration, because supply chains have become more interconnected and globalized. Multinational firms generally produce and trade in both intermediate and final goods. Under this vertical relationship, exchange rate changes can influence decisions about the production of final goods directly and indirectly through changes to input prices (Aksoy and Riyanto 2000). The increased use of cross-border production within the same firm may thus have contributed to lower ERPT to import prices by distributing production over a wide set of countries, subject to different currency movements. It is important to note, as pointed out by Murray (2008), that any change in the exchange rate that is not passed through to the price of imports must be absorbed by foreign exporters. Thus, from the importers' perspective, declining pass-through will be associated with increased exchange rate sensitivity with regard to export prices.

In addition, the role of large importers may suggest that the recent process of globalization has contributed to the observed decline in ERPT (Dvir 2007). Large importers have significant market power, in particular, the power to discriminate between suppliers based on location. Thus, when there are exchange rate movements, it is optimal for large importers to conduct trade through discriminatory procurement auctions and simply switch suppliers. This way, measured import-price indexes would attach a larger weight to lower prices, and the observed ERPT would be smaller.

The composition of imports may have shifted towards sectors that have lower degrees of ERPT.

An alternative, and possibly complementary, explanation for the decline in ERPT to import prices is based on the notion that the composition of imports may have shifted towards sectors that have lower degrees of ERPT. Campa and Goldberg (2005) find support for this hypothesis in their study of OECD countries over the period 1975–2003. The decline in pass-through to aggregate import prices can therefore be attributed to changes in the underlying composition of products in each country's import bundle, particularly the move

away from commodities and towards products in sectors with higher degrees of product differentiation and lower degrees of ERPT, such as manufacturing.

Finally, the recent decline in ERPT to import prices has been linked to the growing importance of emerging markets in the world economy. Indeed, the swift and significant integration of emerging economies into global markets may have contributed to the fall in ERPT to import prices in many industrial countries by increasing the prevalence of pricing-to-market (PTM). The decline in pass-through to import prices in some advanced economies, notably the United States, is consistent with a rise in the proportion of imports coming from firms in emerging markets, many of whom practise PTM (Bussière and Peltonen 2008). China's surging exports to the United States may also have contributed to the decline in observed pass-through in recent years (Marazzi and Sheets 2007). Interestingly, Marazzi and Sheets find that the U.S. markets that have experienced the greatest reductions in pass-through in recent years are those in which China has recorded an increased market share.³

Why might we expect pass-through to consumer prices to have declined recently?

While the response of import prices to exchange rate movements is important, it is the behaviour of the CPI that matters most for monetary policy in Canada and in other inflation-targeting countries. Although the degree of ERPT to import prices is important in determining the extent of ERPT to consumer prices, other factors are at play.

First, distribution costs—such as transportation, marketing, and services—will cause import and consumer prices to diverge, and the wedge between the two prices can be significant. For example, U.S. distribution margins are in the order of 50 to 70 per cent, according to research by Berger et al. (2009). The large non-tradable component in distribution margins thus significantly insulates consumer prices from exchange rate movements (Burstein, Neves, and Rebelo 2003; Goldberg and Campa 2008; Berger et al. 2009).

Second, monetary policy may have played an important role in the decline in ERPT to consumer prices. Taylor (2000) and others argue that the

³ Moreover, with the increase in globalization, many retailers now have access to a larger number of potential suppliers. Thus, when the exchange rate changes, the importer could simply switch suppliers, making it appear as though ERPT had declined.

establishment of a strong nominal anchor in many countries over the past two decades may have contributed to the decline in ERPT. According to this argument, ERPT is primarily a function of the persistence of exchange rate and price shocks, which tends to be reduced in an environment where inflation is low and monetary policy is more credible.⁴ Work by Bailliu and Fujii (2004) and Gagnon and Ihrig (2004), showing that break points in pass-through estimates coincide with changes in the monetary policy regime in a panel of countries, including Canada, supports Taylor's view. Studies by Bouakez and Rebei (2008) and Murchison (2009), based on DSGE models, also suggest that short-run ERPT has declined as a result of the move to inflation targeting.

Finally, increased competition among retailers in the local market can also lead to a decline in ERPT to consumer prices. As discussed by Bacchetta and van Wincoop (2003), the insensitivity of consumer prices to changes in the exchange rate may be the outcome of an optimal strategy from the retailer's perspective. Indeed, when there is rising competition in the local market, it may be optimal for retailers to absorb some of the fluctuations in the exchange rate into their margins, regardless of the sensitivity of border prices to exchange rates. Moreover, when there is limited substitution between non-tradable goods and imported goods, the prices of non-tradable goods can be very sticky, even after large exchange rate movements, leading to very little response in aggregate consumer prices.

Evidence from Reduced-Form Macroeconomic Models

A substantial empirical literature has shown that the correlation between changes in consumer prices and changes in the nominal exchange rate has been quite low and declining over the past two decades for a broad group of countries. Ihrig, Marazzi, and Rothenberg (2006) show that all G-7 countries experienced a decline in ERPT to import prices from 1990 to 2004, relative to the period from 1975 to 1989, with the decline being statistically significant for the United States, Japan, and France. There is also evidence of declining ERPT in developing countries, where the pass-through of exchange rate changes has traditionally appeared to be greater and more rapid than in

⁴ As predicted by Taylor (2000), Canada's adoption of an inflation-targeting monetary policy regime has been matched by a significant decline in inflation persistence (Mendes and Murchison 2009–10).

advanced economies (Frankel, Parsley, and Wei 2005).

Marazzi and Sheets (2007) document a robust and sustained decline in ERPT to U.S. import prices, suggesting that it has fallen from above 50 per cent in the 1970s and 1980s to about 20 per cent during the past decade. Di Mauro, Ruffer, and Bunda (2008) find that the extent of exchange rate pass-through to import prices may have declined somewhat in the euro area over recent years. And in their study on Japan, Otani, Shiratsuka, and Shirota (2003) find that ERPT to Japan's import prices fell in the 1990s.

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Some of the most striking macro evidence of the weak correlation between exchange rates and inflation comes from case studies of episodes in which prices respond by very little to large currency depreciations (Burstein, Eichenbaum, and Rebelo 2007). For example, following a sharp depreciation of their currencies in the autumn of 1997, inflation in some Asian countries, such as Korea, remained relatively stable; and after the United Kingdom withdrew from the Exchange Rate Mechanism in 1992, inflation there also remained low.

Potential Pitfalls of Reduced-Form Models

The empirical findings discussed above, regarding the decline in ERPT, are generally based on reduced-form regressions, which tend to be motivated by partial-equilibrium models. This methodology typically consists of estimating an equation where the rate of inflation (for the relevant price index) depends on current and lagged changes in the nominal exchange rate, as well as on other control variables suggested by economic theory. The coefficients associated with the exchange rate variables are then interpreted as estimates of ERPT. Reliance on this methodology to draw strong conclusions for policy has raised concerns, mainly in three areas.

By assuming that exchange rates are exogenously given, the reduced-form approach misses the important feedback effect running from prices to interest rates and from interest rates to exchange rates, and, ultimately, back to prices.

First, exchange-rate movements are treated as an exogenous process in studies based on reduced-form models, whereas, in practice, exchange rates are determined endogenously and are often a function of macrofundamentals. This framework therefore overlooks the channels through which these macrofundamentals might influence the exchange rate. For example, domestic interest rates may rise as a result of the monetary policy response to inflationary pressures, leading to an appreciation of the domestic currency. In this situation, an appreciating exchange rate may be linked to rising rather than falling prices, producing what appears to be a perverse ERPT effect. By assuming that exchange rates are exogenously given, the reduced-form approach misses the important feedback effect running from prices to interest rates and from interest rates to exchange rates, and, ultimately, back to prices.

Second, reduced-form specifications can generate misleading results because they rely on models with too little structure. The reduced-form framework links variables of interest but not in a structural way. In particular, pass-through coefficients derived with this method cannot attribute the extent of ERPT to specific factors, such as the degree of price stickiness, and can also result in false attribution.

Finally, the reduced-form approach provides limited insight into the extent and manner in which the degree of ERPT depends on the nature of shocks. Exchange rate movements are symptomatic of some underlying change in world markets. Some changes have a direct impact on the relative demand for Canadian goods and services, while others do not. Depending on the nature of the shocks, their effects on the economy can be quite different. Specifically, exchange rates and prices are jointly determined, and both respond to structural shocks. Thus, the degree of ERPT will be a function of the nature of the shocks affecting the economy.

The issue of ERPT has been explored more fully in the context of sticky-price, open-economy, DSGE

models. The DSGE framework avoids the endogeneity issue, since it takes into account the fact that prices and the nominal exchange rate are determined simultaneously. With a structural model, the analysis can be made conditional on the shocks. The findings of these studies put into question results from previous studies based on reduced-form equations.

Murchison (2009) uses an open-economy DSGE model to illustrate the types of misleading results that can be generated from reduced-form models. He finds that as monetary policy responds more aggressively to the output gap and inflation, the estimated pass-through coefficient declines dramatically. Moreover, calibrations of the Bank's reaction function consistent with the observed behaviour of Canadian monetary policy since the adoption of an explicit inflation target in 1991 result in pass-through estimates close to zero. In this model, wages and prices display some short-run stickiness but adjust completely in the long run to ensure that temporary shocks do not generate permanent changes in relative prices. Exchange rate shocks are eventually matched by a proportionate increase in import prices that is, in turn, fully reflected in consumer prices. ERPT is thus complete in the long run by assumption, but incomplete in the short run, owing to the presence of a combination of nominal and real rigidities. Nevertheless, as policy responds more aggressively to expected inflation, *measured* short-run pass-through declines rapidly to zero, even when positive short-run pass-through exists in the underlying structural model.

Bouakez and Rebei (2008) provide supportive evidence for Murchison's results. They estimate a DSGE model for Canada over two subsamples, covering the periods before and after the adoption of inflation targeting. They find that pass-through to Canadian import prices has been stable and significant, contrary to findings from studies based on reduced-form models.⁵ Like Murchison, they find that ERPT to Canadian consumer prices may, nevertheless, have declined, as a result of the adoption of the inflation-targeting regime.

⁵ Since a significant number of Canadian import prices are constructed by multiplying the foreign-currency price by the nominal exchange rate, the estimated degree of pass-through reported by reduced-form studies is likely to be biased upwards. A general-equilibrium perspective, however, allows estimating the degree of pass-through to import prices without using data on import prices: the structural parameters that affect the behaviour of import prices can be identified indirectly through links in the structural model.

Insights from Recent Microdata Studies

In addition to the studies of ERPT based on aggregate price indexes, some authors have examined the issue at the sectoral, firm, and goods levels, using microdata, which have become more accessible in recent years. A general insight that emerges from these studies is that the stickiness observed in aggregate price indexes masks a substantial amount of flexibility and diversity in the behaviour of prices at a more disaggregated level (Nakamura and Steinsson 2008; Crucini and Telmer 2007). In particular, substantial heterogeneity characterizes the frequency of price adjustment at the goods level.

Gopinath and Itskhoki (2010) examine the link between the frequency of price adjustment and long-run ERPT using microdata on U.S. import and export prices collected by the Bureau of Labour Statistics. They find that firms that adjust prices infrequently also tend to pass through the effects of exchange rate movements to a lesser extent—even after several periods and multiple rounds of price adjustment—compared with high-frequency adjusters. From a macro perspective, if more firms were to adjust prices infrequently, the degree of exchange rate pass-through would decline.

The increased availability of microdata also helps us to better understand the structural determinants of ERPT. Such an understanding is important not only for forecasting future pass-through patterns, but also because it provides guidance regarding the measurement of pass-through. Existing micro studies have examined a variety of industries (e.g., autos, beer, coffee), and the results have been surprisingly robust regarding the sources of incomplete pass-through, such as non-tradable local costs (Goldberg and Hellerstein 2008). Although there are relatively few studies of ERPT based on microdata, this is a promising area of research.

Policy Implications

If exchange rate movements were regarded simply as additional noise—distorting domestic-price signals and subverting market efficiency—any decline in pass-through could be treated as a positive development. However, to the extent that exchange rates are believed to move for a reason, in response to underlying fundamentals, any interference in this transmission mechanism would be cause for concern. Movements in the exchange rate can significantly influence inflation dynamics, both in terms of their

direct effect on prices and their indirect effect through changes in aggregate expenditure and production. Policy-makers must be able to gauge how large these effects are likely to be, in order to determine the size and persistence of underlying inflation pressures and any monetary policy responses that might be required to deal with them.

Changes in relative prices across borders are important for allocative efficiency and are a critical element of the global macroeconomic adjustment process.

More broadly, exchange rate pass-through can act as a “shock absorber” mechanism for the economy. In this context, the economy converges to a new equilibrium after a shock through an expenditure-switching effect. Changes in relative prices across borders are important for allocative efficiency and are a critical element of the global macroeconomic adjustment process. For example, the expenditure-switching effect helps to redirect consumption and investment in a country with a trade deficit away from imports, as the exchange rate depreciates, making the country’s exports more attractive to foreigners. The benefits of a flexible exchange rate regime are also a function of the extent of ERPT, since the existence of expenditure-switching effects is often cited as a critical element in the case for flexible exchange rates, and these effects depend on ERPT to import prices for their genesis.

Concluding Remarks

Several key insights on ERPT emerge from this critical assessment of recent findings in the literature. First, there is fairly convincing evidence to suggest that short-run measured ERPT to consumer prices has declined because of a shift to more credible monetary policy regimes. In this case, the findings from DSGE models confirm the results of reduced-form models. Second, ERPT to import prices may, nevertheless, remain larger than the estimated parameters from reduced-form regressions would indicate, owing to an econometric bias related to the endogeneity of the exchange rate. Taking liberties with the warning that often appears on the rear-view mirrors of cars, one might say that “the import-price effects caused by exchange rate movements may be larger than they

appear.” The benefits of a flexible exchange rate may also be larger than they appear, since the existence of expenditure-switching effects is often cited as a critical element in the case for flexible exchange rates, and these effects depend importantly on ERPT to

import prices for their genesis. Third, studies using microdata are a promising area of research, since they provide additional insights that help us to better understand the phenomenon of ERPT by providing evidence of some of its drivers at the micro level.

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