

# Interactions Between Exchange Rates and Import Prices: **What Have We Learned?**

By Mina Kim



**G**lobalization has deepened economic interdependence among countries as firms seek to take advantage of international trade to source production where it is cheapest, and investors look to global financial markets to diversify their portfolios. One need only look at the global financial crisis of 2007–08 and the associated global recession to grasp the extent of globalization.

During the Great Recession, almost all advanced economies and some developing economies experienced a drop in gross domestic product (GDP) growth. Chart 1 shows the synchronous decline in GDP growth rates for selected Organization for Economic Cooperation and Development (OECD) countries that trade frequently with each other. Simultaneously, the world experienced a trade collapse that was worse than the drop

in GDP growth, reflected in export growth rates of the same OECD countries (*Chart 2*).<sup>1</sup>

As the global financial crisis illustrates, this interdependence has serious implications for the international transmission of shocks and the ability of monetary policy to stabilize national economies. Consequently, policymakers are being forced to take greater account of the global economic landscape when formulating policy.

Exchange rates are at the center of the international transmission of shocks via trade linkages. Given the United States' growing reliance on imports, the potential impact of exchange rate movements has become more important (*Chart 3*). These movements directly affect the competitiveness of U.S. firms in the global market and at home and, therefore, affect firms' production, employment and earnings, and, in turn, consumer prices. Indirectly, exchange rate movements also induce expenditure switching toward countries with cheaper goods, affecting consumer prices. This essay focuses on these interactions between exchange rates and prices.

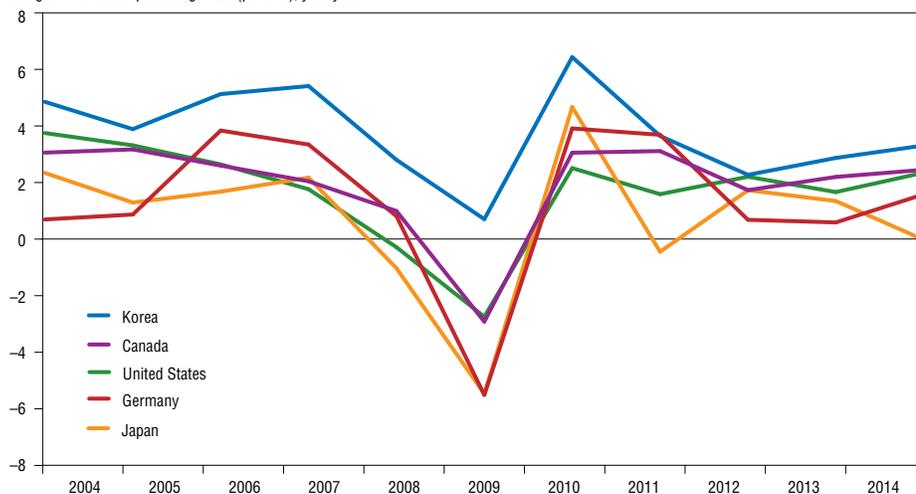
## Exchange Rates, Trade Prices

There is evidence that firms are sensitive to exchange rate changes when setting export prices. Given the U.S.' increasing reliance on imports, the extent to which exchange rate changes are passed through to import prices (also known as exchange rate pass-through) has critical implications for domestic inflation and the appropriate response of monetary policy.

More specifically, exchange rate pass-through is most commonly defined as “the

Chart 1  
**GDP Growth Rates for Selected OECD Countries Synchronously Fall**

Real gross domestic product growth (percent), year/year



NOTE: OECD stands for Organization for Economic Cooperation and Development.  
SOURCE: International Monetary Fund World Economic Outlook.

percent change in import (or export) prices for a percent change in the exchange rate” (Chinn, 2006). For example, suppose that an exchange rate (defined as the number of units of the domestic currency needed to purchase a unit of foreign currency) increases 10 percent. If the exchange rate pass-through is 1, then the price of imports will increase by 10 percent. If exchange rate pass-through is 0.5, then the price of imported goods will increase by only 5 percent. If pass-through is 0, then the price of imported goods will be unchanged.

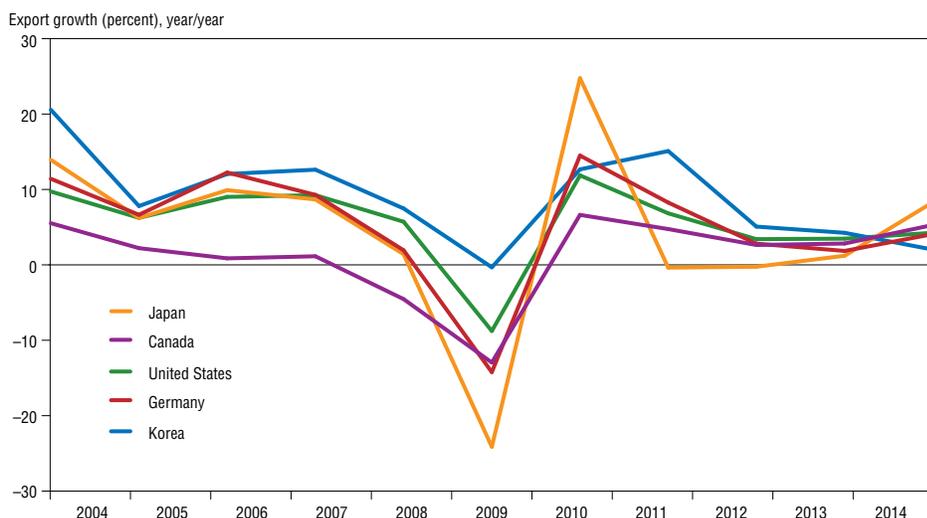
The academic literature on exchange rate pass-through is expansive, and there is wide variation in the empirical estimates of exchange rate pass-through across countries, goods and time periods.<sup>2</sup> The empirical evidence for the U.S. shows that pass-through is incomplete and low. In the aggregate data, the long-run pass-through estimate is around 0.4 (Campa and Goldberg, 2005); in product-level data, the estimate is similar (Gopinath and Itskhoki, 2010). The empirical evidence also shows that exchange rate pass-through in the U.S. has been declining since at least the 1980s.<sup>3</sup> These empirical regularities can be explained by understanding the price setting behavior of firms.

**Exporter Response to Exchange Rate Fluctuations**

The literature outlines many factors affecting how exporters respond to exchange rate changes, of which four are highlighted:

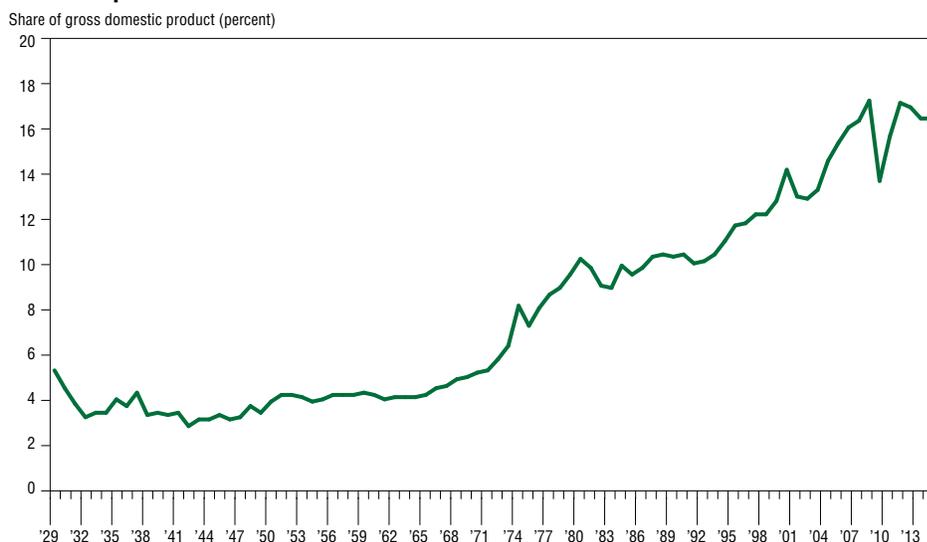
- Menu costs
- Desired pass-through
- Market structure
- Policy environment

**Chart 2**  
**Export Growth Rates Simultaneously Drop for Selected OECD Countries**



NOTE: OECD stands for Organization for Economic Cooperation and Development.  
SOURCE: International Monetary Fund World Economic Outlook.

**Chart 3**  
**Share of Imports in U.S. GDP Rises**



SOURCE: Bureau of Economic Analysis.

**When prices are sticky and cannot be adjusted instantaneously, the currency of invoicing determines the amount of exchange rate fluctuation that can be passed through.**

First, the cost of adjusting prices, or menu costs, matters (Blinder et al., 1998; Schoenle, forthcoming; Fabiani et al., 2006). Small exchange rate movements may not warrant incurring the cost of adjusting prices. Instead, the exchange rate change is absorbed in firms' margins. However, firms may be unable to keep prices fixed when movements are large. Menu costs result in prices that exhibit infrequent change, what economists commonly refer to as "sticky" prices.

When prices are sticky and cannot be adjusted instantaneously, the currency of invoicing determines the amount of exchange rate fluctuation that can be passed through. Exporters desiring low exchange rate pass-through in the short run will choose to invoice in the local currency, or the currency of the destination country (Gopinath, 2015). However, exporters desiring high exchange rate pass-through in the short run will choose to invoice in their own (or the producer's) currency, the currency of the origin country. One explanation is that exporters facing more competition in the destination market may desire to keep prices stable relative to their competitors. Exporters can better maintain stable prices by pricing in the local currency.<sup>4</sup>

Third, market structure can affect how firms set prices (Campa and Goldberg, 2005). In competitive sectors, firms are less able to absorb any losses from exchange rate changes and must thus adjust prices quickly. This is not the case for firms in differentiated goods sectors. Relatedly, firms with market power are better able to absorb exchange rate shocks and are less likely to adjust prices (Atkeson and Burstein, 2008).

Lastly, the policy environment can be important for exporters' pricing decisions. For example, in countries that have credible inflation-targeting monetary policy, there is less inclination for firms to change prices when exchange rates change since they have confidence that the shocks are temporary (Taylor, 2000, and Gagnon and Ihrig, 2004).

Kim et al. (2013) argue that the pricing behavior of firms also depends on a country's exchange rate policy. The abandonment of

China's hard peg to the U.S. dollar in 2005 can be used to study how firms change import and export prices in response to changed exchange rate policy. The switch in exchange rate policy from a hard peg to a managed float resulted in gradual appreciation of the Chinese yuan against the dollar (*Chart 4*).

The degree of price stickiness in U.S.–China trade prices is examined using goods-level data on trade prices from the Bureau of Labor Statistics (BLS). The duration of U.S.–China trade prices, based on the frequency of price changes in each month (the frequency-implied duration), appears to have declined almost 30 percent since China abandoned its hard peg to the U.S. dollar.

We extend a menu-cost model to reflect this stylized fact and find that the change in exchange rate policy can explain about 60 percent of the decline in price stickiness. In our model, exchange rate fluctuations influence price-setting behavior through aggregate demand. The appreciation of the Chinese yuan leads to an increase in aggregate demand for U.S. exports to China, inducing U.S. exporters to raise their prices.

Our results are complementary to those found in Floden and Wilander (2006). They present a menu-cost model in which firms adjust prices in response to exogenous exchange rate fluctuations. In their model, large exchange rate changes raise the opportunity cost of holding prices fixed, so firms change prices more frequently, and exchange rate pass-through is dependent on the size of the exchange rate change. Furthermore, the Floden and Wilander model generates asymmetric responses to exchange rate changes based on the direction of the change. They find that appreciation of the exporter's currency leads to higher exchange rate pass-through than depreciations, especially during periods of inflation.

### **Asymmetric and Nonlinear Responses**

Evidence of asymmetric and nonlinear responses to exchange rate fluctuations has important consequences for monetary policy and suggests that policymakers and forecast-

ers at least reconsider the effectiveness of the “rule of thumb” used to estimate how currency movements will affect inflation.<sup>5</sup> The appropriate policy response to dollar appreciation may be different than that for depreciation if the price responses are different. Likewise, the appropriate policy response to a large change in exchange rates may not be the same as the one for a small change if nonlinearities are present.

The asymmetries and nonlinearities described in Floden and Wilander (2006) primarily point to menu costs and strategic choice of invoicing currency as the mechanisms generating those price responses. Aside from Floden and Wilander (2006), there are several other theories as to why asymmetries in exchange rate pass-through might exist. These mechanisms include:

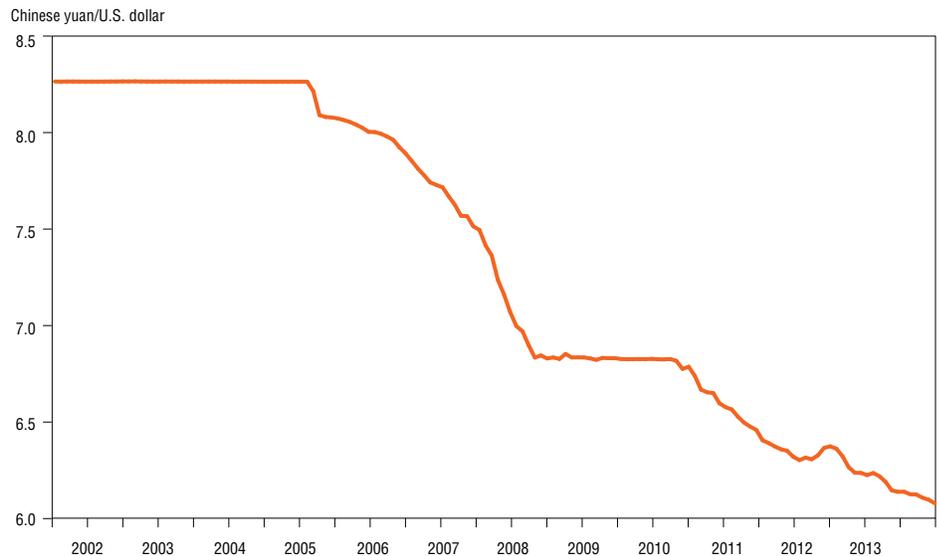
- Competition for market share
- Production switching
- Binding quantity constraints

When exporters are concerned about market share, they adjust markups to increase their future profits. When the importer’s currency appreciates, the exporter updates prices, but only to increase market share. When the importer’s currency depreciates, the exporter will instead absorb some of the exchange rate change in order to hold market share. Under this strategy, exchange rate pass-through is greater when the importer’s currency appreciates than when it depreciates.

Alternatively, the mechanism through which asymmetries can arise is through production switching (Ware and Winter, 1988). Exporters may switch between domestic inputs and foreign inputs in response to exchange rate changes as a means of reducing cost. Assuming the extreme case in which a firm can use either the domestic or foreign input, the firm switches to the cheaper domestic input when the importer’s currency appreciates. Since the marginal cost is unaffected, the price of the final good drops as output increases with the marginal revenue increase. On the other hand, when the

Chart 4

#### Monthly Chinese Yuan/U.S. Dollar Exchange Rate Falls After Unpegging



SOURCE: Board of Governors of the Federal Reserve System.

importer’s currency depreciates, marginal revenue and marginal cost both decrease, and the firm does not change output or price, resulting in zero pass-through.

In both of these cases, appreciation of the importer’s currency results in greater pass-through than during depreciation. That direction of asymmetry will not hold when exporters face binding quantity constraints. These binding quantity constraints occur when firms have limited ability to increase production when the importer’s currency appreciates. Instead, the exporter will raise markups to hold prices fixed and increase profits. On the other hand, when the importer’s currency decreases, the exporter may reduce markups, but will still increase prices somewhat to offset increased costs. Thus, appreciation of the importer’s currency will instead produce lower pass-through than depreciation.

Recent empirical evidence on nonlinearities or asymmetries in exchange rate pass-through is limited, especially involving the U.S. Older studies focused on how price responses differed between appreciations

**Unfortunately, economists have little understanding as to why exchange rate pass-through varies along these different dimensions.**

and depreciations. The results have been mixed, with no clear evidence whether appreciation or depreciation is associated with higher pass-through. Mann (1986) used aggregate U.S. data and found that exchange rate pass-through was higher in periods of appreciation than depreciation. However, the difference was not statistically significant. Kadiyali (1997) and Goldberg (1995) focused on a single industry and found the opposite outcome. Other industry studies found that the direction of asymmetry depended on the industry (for example, Mahdavi, 2002, and Olivei, 2002).

Pollard and Coughlin (2004) consider both asymmetries and nonlinearities in exchange rate pass-through to U.S. import prices. They use industry-level exchange rate changes and find no clear direction of asymmetry across industries, as in the previous literature. They find nonlinearities such that larger exchange rate fluctuations are generally associated with higher exchange rate pass-through, even when accounting for asymmetries.

Kim et al. (2017) incorporate more recent time periods in their examination of

asymmetries and nonlinearities in exchange rate pass-through to U.S. import prices. Unlike Pollard and Coughlin (2004), the authors use goods-level transaction price data from the BLS and match it with country-level data on exchange rates and consumer price indexes to better understand the importance of asymmetries and nonlinearities to U.S. inflation.

Throughout the period considered, the U.S. experienced episodes of appreciation and depreciation of varying degrees. Chart 5 shows a histogram of the average monthly exchange rate change seen in the data, where exchange rate is defined as foreign currency per dollar. The distribution is bell-shaped and roughly centered around zero, suggesting that asymmetries and nonlinearities might be masked in aggregate data.

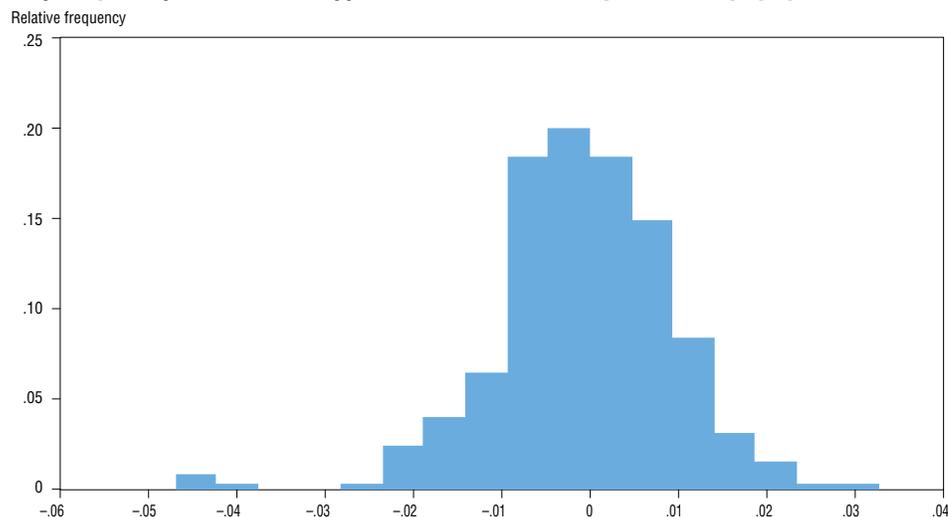
Unlike Pollard and Coughlin (2004), we find no economically significant evidence of nonlinearities, even when the data is disaggregated by sector. However, we find that asymmetries in exchange rate pass-through exist to varying degrees across different aggregations of the data, with depreciations tending to pass through faster than appreciations. Stickiness in nominal prices does not seem to drive our results, as these asymmetries persist even when we restrict our analysis to goods that experience at least one price change. On the other hand, nominal price stickiness can explain why we see significant asymmetries disappear in the long run.

It may be that the asymmetries found are a result of firms exiting because of currency depreciation. No asymmetries were found when examining the probability of a good exiting the dataset because of exchange rate fluctuation.

These preliminary findings suggest that the nature of competition and price setting is important when determining the extent of pass-through. Menu costs may reconcile the short-run and long-run results on exchange rate pass-through, but that mechanism alone cannot explain the strong asymmetries found.

Chart 5

**Frequency of Depreciations and Appreciations in U.S. Exchange Rates Roughly Symmetric**



NOTE: Exchange rate is quoted as U.S. dollar/foreign currency.

SOURCES: International Monetary Fund International Financial Statistics; Bureau of Labor Statistics; author's calculations.

## Extent of Pass-Through

The academic literature has made great strides in understanding how exchange rate movements affect inflation. There is little disagreement that exchange rate pass-through is incomplete, and economists have some understanding of why that might be occurring.

There is less agreement on the extent of pass-through. It seems to vary across time and across industries. It also seems to vary depending on the direction of the exchange rate shock and sometimes the magnitude of the exchange rate shock. Unfortunately, economists have little understanding as to why exchange rate pass-through varies along these different dimensions. As a result, there has been little success predicting how exchange rate changes will affect inflation.

More recent studies, such as Forbes et al. (2015), Bussiere et al. (2015) and this author's work, suggest that the mechanisms behind the exchange rate change could matter. The degree of exchange rate pass-through could depend on whether a supply, demand or nominal shock drives the exchange rate fluctuation, for example. Further investigation can help policymakers effectively respond to exchange rate movements.

## Notes

<sup>1</sup>See Eichengreen and O'Rourke (2010) for more details about the global financial crisis and a comparison to the Great Depression.

<sup>2</sup>See Burstein and Gopinath (2014) for a more extensive review of the academic literature on exchange rate pass-through.

<sup>3</sup>See, for example, the figures in Marazzi et al. (2005) for an illustration of the decline in exchange rate pass-through into U.S. import prices.

<sup>4</sup>Other possible mechanisms are described in Gopinath (2015).

<sup>5</sup>According to Forbes et al. (2015), the "rule of thumb" commonly used for the U.S. is a pass-through rate of 5 percent into domestic prices.

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