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## Have U.S. Import Prices Become Less Responsive to Changes in the Dollar?

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*The failure of the dollar's depreciation to narrow the U.S. trade deficit has driven recent research showing that the transmission of exchange rate changes to import prices has declined sharply in industrial countries. Estimates presented in this study, however, suggest that "pass-through" to U.S. import prices has fallen only modestly, if at all, in the last decade. The authors argue that methodological changes in the collection of import data and the inclusion of commodity prices in pass-through models may have contributed to earlier findings of low pass-through rates.*

Over the past few years, the dollar has depreciated against a number of currencies. In principle, the dollar's fall should help to correct the U.S. trade deficit by altering the relative prices of U.S. and foreign goods. Specifically, the depreciation should prompt foreign producers to protect their profits by raising the dollar price of their exports to the United States. As the cost of foreign goods rises, U.S. demand should weaken, leading to a decrease in the quantity of goods that the United States imports.<sup>1</sup> Although this scenario is quite plausible, the dollar's recent slide has produced neither a substantial fall in imports nor a sizable shrinking of the trade imbalance.

One possible explanation for the U.S. experience of the past few years is that the rate of exchange rate "pass-through"—the degree to which a change in the value of a country's currency induces a change in the price of the country's imports and exports—has fallen relative to historical values. Indeed, while pass-through is almost always "incomplete" (for example, a 10 percent depreciation of a country's currency will lead to an increase of less

than 10 percent in the price of the country's imports), some recent research suggests that import prices in a number of industrial nations may have become progressively less responsive to changes in exchange rates over the past decade or so.

A potential decline in exchange rate pass-through has important implications for the U.S. economy. First, it has significant bearing on U.S. efforts to correct the country's trade imbalance. If import prices have become much less responsive to changes in currency values, a larger devaluation of the dollar will be needed to narrow the imbalance. Second, pass-through has implications for the stability of domestic prices. Low import prices are believed to contribute to low rates of inflation—in part by constraining domestic producers to keep their prices competitive. By boosting import prices, a dollar depreciation could create inflationary pressures in the U.S. economy, holding all else equal. However, if pass-through has in fact declined, import prices would not rise as much as expected, and the inflationary impact of the dollar's fall would be more muted.

In this edition of *Current Issues*, we take a fresh look at the relationship between exchange rates and U.S. import prices to determine whether a decline in pass-through has indeed occurred. We present new estimates of pass-through for U.S. imported goods both for the 1985-2005:2 period as a whole and for two subperiods, 1985-94 and 1995-2005:2. We also raise two methodological issues that may help explain the recent findings of low pass-through rates.

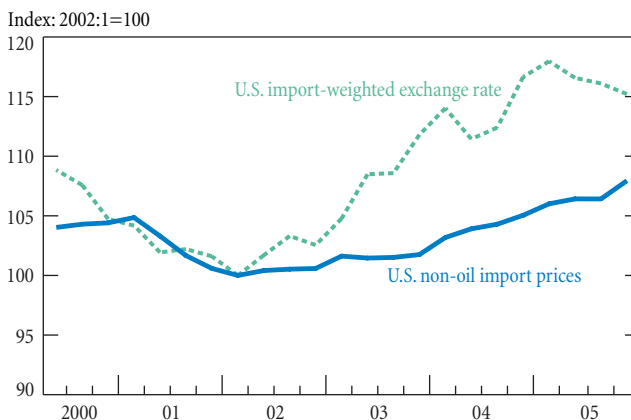
Overall, we find no conclusive evidence that pass-through has declined significantly from historical levels. Our analysis yields an estimate of a 10 percentage point decrease in pass-through—a considerably smaller decrease than that found by other researchers. Moreover, even this small decline may be more apparent than real. Our estimate is not what economists consider to be statistically significant—that is, it may reflect mere chance rather than evidence of a genuine decline that could be expected to persist over time. In addition, we find that changes in the sampling methods used by the Bureau of Labor Statistics (BLS) to produce import price data may create a downward bias in estimates of pass-through for the post-1998 period—including our own estimate. Finally, we show that the inclusion of commodity prices in some estimates may be contributing to findings of a substantial decline in pass-through.

### The Dollar's Decline and Exchange Rate Pass-Through

From 2002 to 2005, the dollar depreciated by about 15 percent against an import-weighted index of currencies while U.S. import prices, measured in dollars, rose by approximately 8 percent (Chart 1). Absent any other change in global conditions, these patterns suggest that about 50 percent of the cumulative change in the dollar has been transmitted to U.S. import prices in recent years.

This figure, based on a casual impression from the chart, accords well with traditional estimates of a one-year pass-through rate of roughly 50 percent.<sup>2</sup> However, it contrasts with recent estimates that put pass-through to U.S. import prices at only 10 or 20 percent.<sup>3</sup> According to these estimates, import prices in the United States and other industrial countries have become significantly less responsive to exchange rate changes since the 1990s. The pass-through rate for the United States is estimated to have fallen 30 per-

Chart 1  
The Response of U.S. Import Prices to the Exchange Rate



Sources: U.S. Department of Commerce, Bureau of Economic Analysis; authors' calculations.

centage points, largely in the past decade.<sup>4</sup> Estimates of the drop in pass-through for other countries range as high as 40 percentage points, for Japan, and more than 80 percentage points, for France.<sup>5</sup>

To explore whether pass-through to U.S. import prices has in fact fallen in recent years, we employ an empirical model that estimates firms' exchange rate pass-through over the period extending from 1985 to the second quarter of 2005 (Box 1 describes our model). In addition, to test the notion that pass-through to U.S. prices has fallen most dramatically in the past decade, we estimate pass-through rates separately for two subperiods, 1985-94 and 1995-2005:2. We use both aggregate- and industry-level data.

We note at the outset that estimating exchange rate pass-through is not a straightforward exercise. The sensitivity of import prices to changes in the dollar's value may differ from a simple correlation between prices and dollar movements because of independent activity in the production or demand sectors. Thus, models used to estimate pass-through must control for other forces that affect firms' choices of import prices, such as demand conditions in the importing country and cost changes in the exporting country that should not be attributed to exchange rate movements.

<sup>1</sup>By the same logic, the dollar's depreciation should strengthen U.S. export flows, because overseas demand for U.S. goods will increase as those goods become less costly abroad.

<sup>2</sup>See Goldberg and Knetter (1997) and Campa and Goldberg (2005).

<sup>3</sup>See, for instance, Marazzi et al. (2005) and Sekine (2006).

<sup>4</sup>According to Marazzi et al. (2005), pass-through to U.S. import prices declined from more than 0.5 during the 1980s to roughly 0.2 in the past decade; Sekine (2006) sees a decrease from 0.4 in the 1970s to 0.1 in recent periods, with the sharpest fall occurring in the 1990s. Ihrig, Marazzi, and Rothenberg (2006) examine whether pass-through has declined for the Group of Seven countries since the late 1970s and 1980s.

<sup>5</sup>See Sekine (2006).

Box 1

**Exchange Rate Pass-Through Model**

For aggregate import price data, our pricing equation is:

$$\dot{p}_t = \alpha + \sum_{i=0}^4 a_i e_{t-i} + \sum_{j=0}^4 b_j w_{t-j} + c_t(Y_t) + \varepsilon_t,$$

where  $\dot{p}_t$  is an index of U.S. import prices at time  $t$ ,  $\alpha$  is a constant,  $e_{t-i}$  is the import-weighted nominal exchange rate at time  $t$  minus  $i$ ,  $w_{t-j}$  is a control for supply shocks that may affect import prices independently of the exchange rate at time  $t$  minus  $j$ ,  $Y_t$  is a control for demand shifts that may affect import prices independently of the exchange rate at time  $t$ , and  $\varepsilon_t$  is an econometric error term. Each of the variables is in percentage-change terms.

Exchange rate pass-through is the sum of the  $a_i$  coefficients on the nominal import-weighted exchange rate  $e$  at time  $t$  plus four lagged periods. U.S. domestic demand, defined as GDP minus exports plus imports, serves as a proxy for domestic demand shifts. Foreign production costs proxy for supply shocks that may affect import prices independently of the exchange rate. An import-weighted foreign consumer price index (CPI) proxies for foreign production costs  $w$ . Those specifications that have commodity prices as controls use four lags plus the contemporaneous term. Regressions are also run at the industry level with industry-specific import price, nominal import-weighted exchange rate, and import-weighted CPI indexes.<sup>3</sup>

<sup>3</sup>All regressions use ordinary least squares. The nominal import-weighted exchange rates are constructed from the bilateral exchange rates of thirty-four currencies with the dollar, each weighted by its annual share in U.S. (or for the industry-level regressions, the industry's) imports. The import price indexes exclude petroleum imports and are from the U.S. National Income and Product Accounts; the import volume data are from the U.S. International Trade Commission; the domestic demand data are from the U.S. Commerce Department's Bureau of Economic Analysis.

Most pass-through models also recognize that import price responses to exchange rate movements can be delayed, with adjustments often taking up to a year or longer.

Our pass-through model controls for foreign cost shocks other than exchange rate fluctuations by using an import-weighted foreign consumer price index. Although foreign producer prices are a better measure of foreign cost shocks, consumer prices usually track changes in producer price indexes—and they are available for more countries and over more years. In addition, our model controls for changes in the demand for imports that reflect variation in consumer tastes or income, rather than in the dollar's value, by includ-

Table 1

**Aggregate-Level Exchange Rate Pass-Through to U.S. Import Prices**

Percent

	1985-94	1995-2005:2	1985-2005:2
Standard regression	56* (.090)	46* (.098)	51* (.056)
Standard regression plus commodities	53* (.093)	13 (.134)	36* (.057)

Source: Authors' calculations.

Notes: Figures are long-run estimates. Standard errors are in parentheses.

\*Statistically significant at the 5 percent level.

ing U.S. domestic demand. U.S. domestic demand is defined as total U.S. GDP minus exports (demand from outside the United States) plus imports (U.S. demand not satisfied by domestic output). Import prices are measured by an index of goods prices upon entry into the United States.<sup>6</sup>

At the aggregate level, we find that over the course of one year, firms pass through 51 percent of an exchange rate change to import prices for the 1985-2005:2 period (Table 1). That is, import prices generally rise by about ½ percentage point following a 1 percent dollar depreciation. Firms pass through less than 10 percent of an exchange rate change to overall consumer prices in the United States over the same period. Dividing the sample into two ten-year subperiods, we find pass-through to be 56 percent for 1985-94 and 46 percent for 1995-2005:2.

Thus, our estimates suggest that pass-through may have declined by 10 percentage points from the first subperiod to the second. Note, however, that in our estimates, the difference in the coefficients between the two subperiods is not statistically significant. That is, the estimated drop in pass-through may be a product of random noise in the data rather than evidence of a genuine decline that could be expected to persist over time.

A more detailed picture of exchange rate pass-through patterns emerges at the industry level (Box 2). Three industries with significant shares of U.S. manufacturing imports—road vehicles, computers and telecommunications equipment, and chemicals—have each exhibited a substantial decrease in pass-through (Table 2, on page 5). By contrast, other industries—such as primary metals, other metal manufactures, food manufacturing, leather, and rubber and plastic—have each shown a marked rise in pass-through. The average trade-weighted change in pass-through

<sup>6</sup>This index excludes the prices of petroleum products.

## Box 2

**Exchange Rate Pass-Through and Market Power**

Pass-through can vary across industries because foreign firms may have different levels of market power relative to domestic firms. If a foreign firm exports goods in an industry in which domestic firms have considerable market power, the foreign firm may be more reluctant to raise prices than it otherwise would when the domestic currency depreciates. As a result, the foreign firm will adjust its markup downward to maintain market share, and exchange rate pass-through will be lower. By contrast, if a foreign firm exports goods in an industry in which domestic firms have less market power than their foreign counterparts, it may have less incentive to keep prices low; in that case, pass-through rates may well be higher.

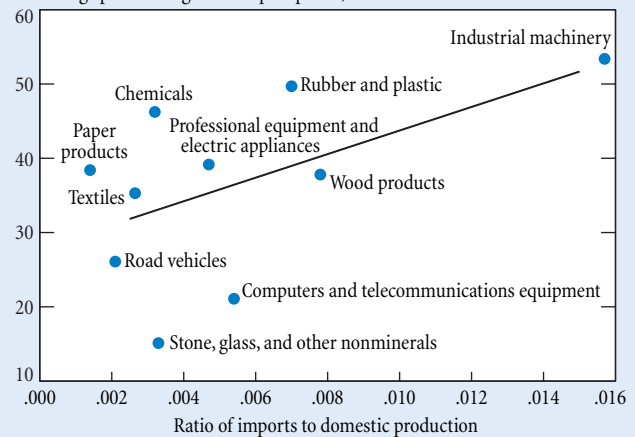
To test these relationships, we compare pass-through rates across industries using a measure of foreign market power relative to domestic market power, calculated as the ratio of the value of imported goods to the value of domestic production. To provide a more complete picture of the competitive pressures in each industry, we weight domestic production by a measure of market concentration known as a Herfindahl-Hirschman Index (HHI). Market concentration is often positively associated with market power. A foreign firm may have more difficulty competing in an industry with a highly concentrated domestic market dominated by a few firms, which in turn may affect its pass-through patterns. The HHI is calculated by squaring the market share of a number of firms within an industry and summing the resulting shares. We use HHIs calculated by the U.S. Census Bureau employing data on the fifty largest firms in each industry in 1997.

The chart shows that industries with high foreign market power relative to domestic market power do indeed

exhibit high pass-through rates. We qualify this finding, however, by noting that pass-through may differ across industries for other reasons. The degree to which imported goods are substitutable for domestic goods may vary by industry. In addition, industries may face diverse trade restrictions, such as import quotas and tariffs.

**Exchange Rate Pass-Through and Market Power**

Percentage pass-through into import prices, 1988-2004



Sources: U.S. Department of Commerce, Bureau of Economic Analysis and Bureau of the Census; authors' calculations.

Notes: The industries shown in the chart account for roughly 70 percent of U.S. manufacturing. Those industries for which import and domestic data groupings were not similar (food manufacturing, beverages and tobacco, leather, and apparel) have been dropped. Primary metals, metal manufactures, and miscellaneous products have also been dropped because these industries are outliers.

over all industries is -9 percentage points, a figure that is basically identical to the results obtained in our aggregate regressions.

Overall, changes in exchange rate pass-through at the industry level point to the same conclusion as our aggregate results: though some decline in pass-through may have occurred, our estimated decrease of 9 to 10 percentage points is considerably lower than the 30 percentage point decline identified in other studies. Moreover, as we argue in the next section, even the small decline in pass-through that we find may stem from a methodological change: Recent revisions to the import data used in pass-through calculations may contribute to estimates that are biased toward zero.

**Changes in BLS Sampling Methods and Estimates of Exchange Rate Pass-Through**

One factor that may have contributed to lower estimates of pass-through in recent years is a change in the sampling methodology used by the Bureau of Labor Statistics to collect import price data. In 1998, the BLS altered its methods in order to obtain more information on intrafirm transactions—that is, transactions between domestic and foreign subsidiaries of the same multinational firm. Approximately 40 percent of U.S. imports involve a U.S. subsidiary of a multinational firm importing from a foreign subsidiary. Recognizing that such transactions were underrepresented in the data, the BLS roughly doubled the number of intrafirm prices in its sample, raising the overall number of prices by about 25 percent.

Table 2  
**Industry-Level Exchange Rate Pass-Through to U.S. Import Prices**  
 Percent

Industry	1985-94	1995-2005:2
Road vehicles (23.2)	48*	14*
Computers and telecommunications equipment (19.5)	83*	51
Industrial machinery (12.4)	52*	53*
Chemicals (6.5)	47*	31
Toys and miscellaneous manufactures (5.3)	42*	38*
Clothing (4.9)	56*	7
Primary metals (4.6)	80*	186*
Professional equipment and electric appliances (4.3)	68*	64*
Metal manufactures (2.9)	41*	54*
Food manufacturing (2.7)	19*	49*
Leather (2.5)	-5	13*
Paper products (2.4)	18	67
Rubber and plastic (2.3)	15	76*
Wood products (1.8)	20	42
Stone, glass, other nonminerals (1.5)	80*	36*
Furniture (1.4)	51*	35*
Textiles (1.4)	53*	50*
Beverages and tobacco (0.4)	32	5

Source: Authors' calculations.

Notes: Figures are long-run estimates. Import shares, in parentheses, are the average from 1985 to 2005.

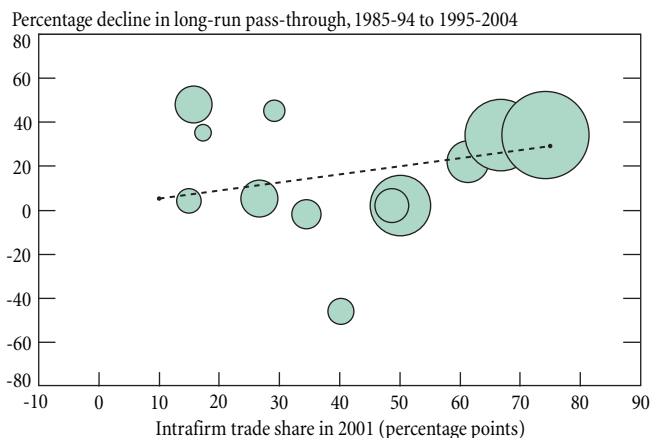
\*Statistically significant at the 5 percent level.

This change in methodology could affect the calculation of exchange rate pass-through because intrafirm prices, set through administrative procedures rather than actual market transactions, may be less sensitive to exchange rate changes than non-intrafirm prices.<sup>7</sup> Clausing (2001, p. 20), for example, finds that “intrafirm imports are less likely to experience a monthly price change in response to changes in the exchange rate than non-intrafirm imports.”<sup>8</sup> Moreover, roughly half of the intrafirm prices included in the BLS's expanded sample are cost-based rather than market-based: that is, they are not set with reference to market trends but

<sup>7</sup>Rangan and Lawrence (1999) argue that intrafirm trade may respond differently to exchange rate changes than does trade between firms.

<sup>8</sup>Commenting on Japanese imports to the United States, Clausing notes that “for imports, intrafirm prices clearly respond to a lesser degree to exchange rate changes than do non-intrafirm prices” (p. 21). The study's overall findings on intrafirm import prices are mixed, however. Clausing finds in regressions that intrafirm import prices respond somewhat more to exchange rate changes than do non-intrafirm import prices. Nevertheless, these regressions omit most of the control variables used in pass-through studies, such as foreign cost and domestic demand variables, so the coefficient on the exchange rate variable is difficult to interpret.

Chart 2  
**The Relationship between Higher Intrafirm Trade and Industry-Level Pass-Through**



Sources: U.S. Department of Labor, Bureau of Labor Statistics; authors' calculations.

Notes: Each bubble represents an industry, with more than 80 percent of U.S. manufacturing trade accounted for. The size of each bubble corresponds to the industry's share of total U.S. manufacturing imports. The dashed line is a trend line.

instead are constructed as a markup over the exporting subsidiary's observable costs. A study by Alterman (1997a) finds that, for particular industries, cost-based prices change less frequently than market-based prices and, in particular, fluctuate less than market-based prices following macroeconomic shocks such as exchange rate changes.

If intrafirm prices are indeed less responsive to exchange rate shifts, then the increased representation of these prices in the BLS import data after 1998 could have introduced a downward bias in measurements of exchange rate pass-through to import prices.<sup>9</sup> This interpretation finds support in Chart 2, which depicts a positive relationship between the share of intrafirm transactions in an industry's total imports and the decrease in annual pass-through elasticities over the past two decades.

Thus, the change in BLS methodology could well have contributed to the perceived decline in exchange rate pass-through in recent years. Estimates of pass-through that use BLS data compiled after the 1998 revision would logically exhibit a lower rate of pass-through than those using pre-1998 data—even though firms' pass-through behavior was unchanged and the underlying relationship between exchange rates and import prices remained the same.

<sup>9</sup>Ideally, one could correct estimates of exchange rate pass-through or quantify the impact of the methodological change on pass-through estimates. However, this process would require access to a substantial amount of microeconomic data on the pricing methods of firms in the BLS sample.

### The Inclusion of Commodity Prices in Pass-Through Estimates

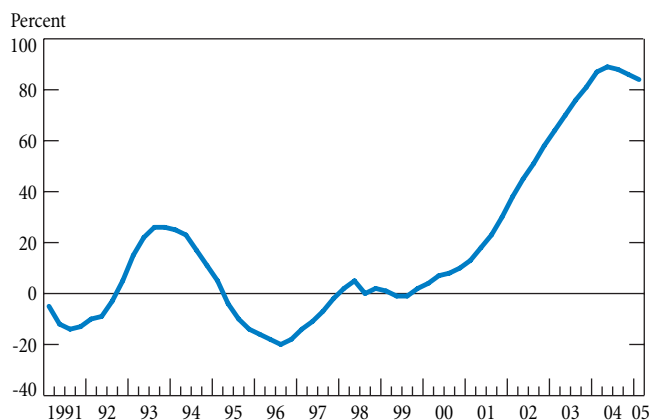
A second factor that may have contributed to findings of a pass-through decline is the inclusion of commodity prices (such as those for metals or agricultural raw materials) in economic models of pass-through. Most pass-through models do not control separately for changes in commodity prices, largely because such changes are viewed as a subset of other production cost shocks borne by exporting firms. However, because commodity prices have historically been set in U.S. dollars and may be expected to rise in response to dollar declines, it has been argued that including commodity prices in pass-through models may control for an indirect channel through which exchange rates affect U.S. import prices (Marazzi et al. 2005; Mann 1986).

Significantly, the inclusion of commodity prices in pass-through models produces lower pass-through estimates. When we reestimate exchange rate pass-through to control for commodity prices, we find a 36 percent pass-through rate for the 1985-2005:2 period—a significant departure from the 51 percent found without commodity prices. The inclusion of commodity prices in our model has little effect on our pass-through estimate for 1985-94—which, at 53 percent, is just 3 percentage points below our original estimate of 56 percent. However, the inclusion produces a much lower 13 percent estimate for 1995-2005:2—a 33 percentage point fall from our original estimate of 46 percent.

Our results indicate that the pass-through rate declines dramatically precisely when commodity prices and exchange rates are highly correlated. Over the past five years, commodity prices have been much more strongly correlated with exchange rate movements than in the past (Chart 3). Until about 1998, the correlation fluctuated between plus and minus 20 percent. Since 1999, however, it has risen significantly, reaching 80 percent by the end of our sample period.

What accounts for the high correlation between commodity prices and dollar changes after 1995? One interpretation is that a fundamental change has occurred in the nature of the relationship between the dollar and commodity prices, as argued by Marazzi et al. (2005). If exchange rate changes continue to affect U.S. import prices through commodity prices as much as the recent data suggest, this channel may have to be recognized explicitly and, in a manner of speaking, cumulated to the estimated direct effect of exchange rate changes on import prices. If the post-1998 change in the commodity price-dollar relationship is permanent, the impact of dollar changes on import prices through commodity prices may have risen in importance as a pass-through channel since the 1980s and 1990s, as Marazzi et al. suggest.

Chart 3  
Ten-Year Rolling Correlations between Commodity Prices and the Dollar Exchange Rate



Sources: International Monetary Fund, International Financial Statistics; authors' calculations.

The lower pass-through estimates that include commodity prices may be more descriptive of conditions going forward given the existence of a new structural pattern in the data.

Even if such a structural change has occurred, however, both the direct (exchange rate) and indirect (commodity price) impact of dollar changes on U.S. import prices should be considered when assessing overall pass-through. That is, having isolated the independent effect of dollar changes operating through a commodity price channel, one must add it to the direct exchange rate effect in order to arrive at an accurate estimate of pass-through. If this is done, then one does not see a sharp drop in pass-through in the past decade.

A second interpretation is that the recent high correlation between dollar changes and commodity price changes is purely coincidental. One could argue that developments in fast-growing economies such as China and India over the past few years are having a sizable influence on commodity prices independent of dollar moves and the U.S. economy. That is, increased demand from these countries may be driving up commodity prices at the same time that developments in the U.S. current account are putting downward pressure on the dollar. If so, the reduction in estimated pass-through may reflect a spurious correlation rather than a structural change in the joint behavior of import prices and exchange rates. Accordingly, it may be more appropriate to exclude commodity prices from exchange rate pass-through models.

Although the first interpretation merits careful consideration, our view is that there is yet no firm evidence of a new and different structural relationship between the dollar and commodity prices. If so, the recent high correlation between the dollar and commodity prices may be coincidental—

reflecting the confluence of high demand by China and India and the depreciation of the dollar.

Clearly, the relationship between the value of the dollar and the price of commodities is a complex one, deserving of continued research. Still, whatever position one takes on the importance of commodity prices as a channel for the dollar's impact on the U.S. economy, our analysis suggests that estimates of overall pass-through should focus on the direct and indirect effects of dollar changes on U.S. import prices. There is only weak evidence that this overall rate of pass-through has fallen over the past two decades.

### Conclusion

The responsiveness of U.S. import prices, and by extension consumer prices, to exchange rate changes has important implications for the U.S. economy. Although a number of recent studies point to a substantial decline in exchange rate pass-through over the past decade, we find no conclusive evidence of such a trend. While we calculate a drop in pass-through of 10 percentage points from 1985-94 to 1995-2005:2, this estimate is markedly lower than those advanced in other studies and is, based on our empirical model, not significant statistically. We also find that methodological changes—a revision in the BLS procedures for collecting import price data and the inclusion of commodity prices in some pass-through models—may be skewing pass-through estimates in a way that gives the appearance of a decline over the past decade.

These findings lead us to conclude that it is not yet appropriate to treat U.S. import prices as substantially less sensitive to exchange rates. Future studies may show that foreign producers have changed their pricing behavior with regard to U.S. sales, but evidence that such a change has already occurred remains weak.

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