The Relationship Between Import Prices and Inflation in the United States

Thomas D. Corrigan
Sacred Heart University

Inflation has been a non-issue in the United States in recent years despite strong economic growth, on balance, and falling unemployment. Some analysts believe that "new economy" dynamics are responsible for this favorable outcome and further claim that the traditional Phillips curve tradeoff between growth and inflation is no longer a valid assumption underlying economic policy decisions. Others believe that the Phillips curve is indeed alive and well but that favorable "supply shocks" have masked the still relevant tradeoff between growth and price stability. One potential "supply shock" candidate is a declining trend in the cost of imports into the United States. This study differs from earlier studies of the relationship between import prices and overall inflation in that it analyzes the impact of both non-petroleum import prices and petroleum-related import prices, and, in addition, extends the analysis into a time period when petroleum prices rose to historic, nominal highs. Overall, the study supports the view that import prices have played a significant role in explaining inflation patterns in recent years.

INTRODUCTION

"Where has all the inflation gone for what is getting to be a long time passing?" So asks Geoffrey Tootell (1998) in an article entitled "Globalization and U.S. Inflation" published in the New England Economic Review. While this question was asked more than seven years ago, it could as easily be asked today given the persistence of low inflation in the face of fairly strong economic growth. The responses relevant to Tootell's 1998 question have also stood the test of time. Back then, some researchers believed that the long-standing relationship between inflation and economic growth ended. That is, they believed that the Phillips curve was no longer relevant in regard to an understanding of how the economy works and also as an influence on economic policy. Some researchers continue to believe the same today. Others cite favorable trends in health-care costs and energy prices as responsible for the low inflation in the late 1990s. This latter group is now equally concerned about the inflationary consequences of a rebound in health-care costs and the recent acceleration in energy prices.

Perhaps the most accepted explanation of the low inflation in the United States in recent years centers on the impact of foreign competition in U.S. domestic markets as well as markets in which U.S. companies compete abroad. This argument states that "globalization" has made it

virtually impossible for domestic companies to raise domestic or export prices regardless of the cost pressures to do so. In effect, these companies must focus their efforts on cost reduction if they hope to maintain or expand their profit margins. For some, "globalization" has replaced new-economy metrics as the driving force in the determination of inflation. As explained by Tootell (1998) and others, the "globalization" pressure on pricing and inflation in general can be either direct or indirect. The direct impact refers to the fact that the Consumer Price Index (CPI), the most widely quoted measure of domestic inflation, includes the prices of U.S. imports. Clearly, a decline in import prices will have a muting effect on the overall CPI. The indirect pressure comes from foreign companies competing against U.S. companies in domestic markets. Another indirect effect in transmitted through the cost channel. To the extent that foreign components are used to manufacture domestic goods, price changes for these components could spill over into price adjustments for the finished goods, subject to market conditions.

While Tootell argues against any direct or indirect link between CPI inflation in the U.S. and import prices, others are convinced that such links exist. Robert Rich and Donald Rissmiller (2000) of the Federal Reserve Bank of New York believe that import prices play a key role in the inflationary process, writing, "…a large and protracted decline in import prices has proved especially important in curbing inflation over the past several years."   More recently, commentators and analysts have expressed concern about a strengthening in import prices. For example, Paul Kasriel of The Northern Trust Company (2004) wrote: "Given the renewed drop in the dollar and our expected continued downward trend in the greenback's foreign exchange value, we would expect the prices of imported goods to rise at a faster rate going forward. In the event, we would also, then, expect core consumer inflation to remain on a rising trend."

THE DEBATE

It is no secret that many economists have been surprised by the behavior of inflation in recent years. The record-setting expansion of the 1990s and its associated low unemployment rates are consistent with an increase in price pressures rather than a diminution in such pressures. Some economists have found the answer to this puzzle in favorable "supply shocks," including periodic slides in energy prices, generally weak commodity prices, unsustainable advances in labor productivity growth and a moderation in medical costs. Many of these trends have now reversed, prompting numerous forecasts of a quickening in overall inflationary pressures in the U.S. in the years immediately ahead.

Others are convinced that "new economy" dynamics were responsible for the subdued inflation in the 1990s. They believe that increased global competition in many markets was forcing companies to find non-price ways to protect and/or expand profit margins. This explanation suggests that inflation will remain low for as long as global demand and supply forces dominate domestic pricing decisions.

Most of the literature on import prices in recent years has focused on the relationship between import prices and exchange rates. Obstfeld (2002) believes that most researchers in recent years have concentrated on developing "models of pricing to market and destination-currency pricing of exports." Along these lines, Taylor (2000), supported by Campa and Goldberg (2002), argues that there has been a significant weakening in the desire or ability of firms to "pass through" price increases associated with unfavorable movements in exchange rates. Taylor (2000) attributes this lack of pricing power mainly to the low inflation environment achieved in many countries. He concludes that this weakening has important implications for monetary policy

because it impacts on forecasts of inflation and also on the relationship between changes in monetary policy and overall inflation. Olivei (2002), however, finds little evidence of a relationship between pass-through percentages and a country's overall inflation experience.

In the same paper, Olivei states that understanding the extent to which changes in exchange rates are passed through to domestic prices holds implications for a nation's balance of payments and its inflation performance. Olivei estimates that for a large sample of U.S. industries, the pass-through percentage averaged 50% in the 1980s, meaning that a 10% change in exchange rates led to a 5% adjustment in prices expressed in the importing country's currency. He also found that this ability to pass through changes in exchange rates fell to only 25% in the 1990s. One possible reason for the reduction in the pass-through percentage is that an increasing number of imports are related to intra-company trade and that transfer prices are inherently less sensitive to exchange-rate movements than trade based on arm's length transactions. Rangan and Lawrence (1999) report that 35% of total U.S. exports and 43% of U.S. imports in 1994 were the result of intra-company transfers for U.S.-based and foreign-based multinational companies.

THE PRICING OF IMPORTS

The transmission of exchange rate movements into import prices and eventually into overall inflation in the importing country partially depends on how imports are priced in the first place. Obstfeld and Rogoff (2000) assume that nominal prices are typically fixed in the exporter's currency, a view which leads to the inevitable conclusion that the prices of imports to consumers change one-for-one with changes in the value of the exporter's currency. Engel (2002), in describing the Obstfeld/Rogoff models, calls this pricing scheme "producer-currency pricing" or PCP. An alternative model presented by Betts and Devereux (2000) assumes that exporters fix their prices in the currency of the importing consumers, an interpretation which alternatively to PCP, suggests that there is no reason for exporters to change their prices in the face of exchange rates. Engel calls this pricing scheme "local-currency pricing" or LCP. Building on the Betts/Devereau study, Engel concludes that consumer prices are not very responsive to changes in exchange rates, especially in the short run. In discussing their finding that there is a lack of evidence supporting the law of one price in currency value determinations, Devereux and Engel (2001) argue that, in general, nominal exchange rate changes are not passed through to consumer prices, and that LCP behavior is widespread if not dominant in import-export markets. In a study of Japanese exporters to the U.S., Klitgaard (1999) found that Japanese exporters in the late 1990s tended to allow their profit margins to shrink, holding their dollar prices even in the face of a rising yen.

In the same vein, Dornbusch (1987) postulated that some exporters might find it to their advantage to maintain prices in the consumer's currency even if the exporter's currency is appreciating against the importer's currency. This thesis is based on the presumption of segmented markets and little or no arbitrage between markets. According to this view, exporters practice third-degree price discrimination, charging different prices in different markets. Dornbush called this pricing-to-market (PTM), a variant of the LCP pricing model. Later, Goldberg and Knetter (1997) and Warmedinger (2004) argued that PTM pricing was prevalent among manufacturers in the OECD countries. Obstfeld (2002) questions this conclusion, however, noting that LCP pricing, while prevalent for the United States, was much less evident in Japan and many European countries.

In a study of 25 OECD countries, Campa and Goldberg (2002) estimated an average exchange rate pass-through rate of 60% within three months of a change in exchange rates and a 75% pass-through percentage within six months. They also estimate that the pass-through rate for the United States is much lower: 25% over one month and 40% over two months. They also found that countries with highly volatile exchange rates exhibit relatively high pass-through rates, but also that there appears to be no relationship between percentage pass-through and inflation rates, money supply growth, or country size. What proved to be important was the composition of industries that make up a particular economy. Commodity producers tend to exhibit high pass-through rates while economies dominated by manufacturing tend to have low pass-through rates. For the U.S., the aggregate pass-through rate is estimated to have declined from 37% to 25% between 1980 and 1998 solely due to the change in the composition of imports in favor of manufactured products at the expense of energy products and other raw materials.

McCarthy (2000) analyzed data for nine developed countries through a VAR model and concluded that exchange rate pass-through seems to be larger in countries with a high import component to domestic demand, and that in large countries, the inflationary effect of currency depreciation on domestic prices is counteracted by a decline in world prices, reducing the measured pass-through percentage. He further concludes: "Despite the appreciation of the U.S. dollar and the decline in import prices, these factors had little effect on the U.S. disinflation, once the oil price decline is taken into account." He ascribes much of the recent decline in inflation in the U.S. to more permanent factors, such as the success of the Federal Reserve in reducing inflationary expectations.

Tootell (1998) examined the relationship between U.S. inflation and capacity utilization rates among our major trading partners. He dealt with a commonly held belief at the time that the U.S. economy was becoming increasingly influenced by economic conditions abroad. His study focused on whether or not domestic CPI inflation depended on foreign, rather than domestic, capacity conditions. He started with the premise that foreign capacity should impact on import prices, which, in turn, would impact on domestic prices. The study found no evidence of such a relationship. To the contrary, the analysis suggests that foreign producers are likely to change their prices only in response to price changes by domestic producers. To the extent that domestic producers alter their prices as their capacity utilization rates change, it can be argued that foreign producers are more influenced in their pricing behavior by capacity conditions in the U.S. rather than those in their home countries. Moreover, Tootell concluded that there was no relationship between import prices and domestic prices, when oil prices are taken out of the equation.

THE TRIANGLE MODEL

The Rich/Rismiller analysis centers on a variation of the Phillips curve concept as developed by Robert Gordon (1997). Also known as the "triangle model," the Gordon- Phillips curve construction relates the inflation rate to three forces: demand, supply, and inertia. The demand factor is measured by a relationship between the demand for goods and services and the capacity of the economy to meet those demands. When demand exceeds the trend level of output, demand shortages produce inflationary pressures. On the other hand, slack demand produces idle capacity and a lessening in inflationary pressures. Unemployment rates and capacity utilization rates can be employed to measure the demand variable, as can a measure of the GDP gap. Supply factors center on the costs of production. Such factors may include food and energy prices, wage rates, and import prices, among others. Inertia refers to the measured phenomenon

that price trends tend to persist over time. That is, inflation generally responds slowly but steadily to shocks to the economic system. This slow response to shocks relates to the muting effect of wage and price contracts prevalent in many goods and labor markets. The inertia effect is built into the Phillips curve model by using past inflation to help determine current inflation.

Andersen and Wascher (2000) looked at the coexistence of low inflation and strong economic performance from a different perspective. They were interested in finding out why the OECD has persistently overestimated inflation in eight OECD countries. They were concerned that the over-predictions resulted from not taking into account supply shocks and that policymakers would ascribe the over-predictions to permanent structural changes in the growth-inflation tradeoff. Such a misconception could lead policymakers to mistakenly hold to an easy monetary policy when restraint was called for. After much analysis, they concluded, "We are unable to distinguish between one-time shock effects and permanent changes in the inflation process." However, Anderson and Wascher also stated that if external shocks were important in bringing down inflation in the U.S. in the 1990s, they were more related to productivity shocks than to import prices.

In their July 2000 study, Rich and Rissmiller expressed no such doubts. They too examined the inflation/economic growth tradeoff from two perspectives. They reasoned that the low inflation of the 1990s was the outcome of either (1) positive supply shocks, such as declining import prices, or (2) a permanent change in the growth/inflation tradeoff brought on by the ratcheting up in labor productivity growth associated with "new economy" dynamics. Focusing on a Phillips curve model, the authors conclude that "Conventional economic forces, comparable to those that have shaped inflation behavior in the past can account for the restraint that has characterized U.S. inflation … Of these forces, a large and persistent decline in import prices has proved especially influential in recent years." In short, Rich and Rissmiller concluded that the Phillips curve is alive and well and that the "new economy" has very little to do with the favorable inflation experience of the U.S. in recent years. This finding is reinforced by Bhattacharya and Thomakos (2004) who contend that "Special factors, i.e., import prices and exchange rates, can provide significant policy guidance for domestic monetary authorities."

THE MODEL

Three different price series were examined using a variant of the Rich-Rissmiller and Gordon formulations. The data series for all three extends from the first quarter of 1986 through the fourth quarter of 2004. The first, the Producer Price Index, plotted against an index of Import Prices (less oil) in Chart 1, proved to be the most responsive to import prices. The second, the Consumer Price Index, exhibited a less strong association as did the third price series, the Personal Consumption Expenditures deflator.

Adapting the "triangle model," the analysis tested the relationship between a measure of economy-wide inflation to (1) import prices, (2) a measure of demand excesses in the economy, and (3) an inertia variable. Three different excess demand series were tested: the ratio of Real GDP to Real Potential GDP (GAP); an index of capacity utilization (CAP); and the unemployment rate (UN). Ball and Mankiw (2002) argue that the unemployment rate less the NAIRU, or the natural rate of unemployment, should be used as the excess demand variable. However, Hogan (2000) points out that standard statistical tests show that NAIRU estimates can vary as much as 2 percentage points on a common set of data. That is, according to Hogan, analysis cannot distinguish between a NAIRU of 4% and one of 6%. Following Tootell's (1998)

suggestion, two separate GAP variables were tested: Real GDP to Potential Real GDP and Real GDP to the trend in Real GDP. In addition, two import prices were tested: an index of all import prices excluding petroleum (LOIL) and an index of petroleum and petroleum products import prices (OIL). The inertia factor is a one-quarter lagged value of the dependent variable. The expected relationship between inflation and both import price series and the inertia variable is positive, as is the expected relationship between inflation and two of the excess demand variables, GAP and CAP. The relationship between inflation and UN is expected to be negative.

THE PRODUCER PRICE INDEX

Several different model specifications using ordinary least squares were examined. Using a modified version of the Andersen and Wascher (2000) specification, the basic model follows the form of:

$$\Delta pc_t = \mu + \beta \Delta ED_t + \sigma \Delta pc_{t-1} + \lambda \Delta Z_t + \varepsilon$$

Where Δpc denotes price inflation, ED represents the excess demand variable (candidates include GAP, CAP and UN), and Z represents a supply-side variable, in this case import prices. This also closely follows the construction used by Rich-Rissmiller.

As indicated, various lags for the independent variable were examined, but the best results indicate that the relationship between PPI inflation, both import price series, and the ED variable is contemporaneous. Following a suggestion by McCarthy (1999), the ratio of real imports to real GDP was also tested, based on the belief that the rising share of imports into the U.S. should be having a dampening influence on overall inflation. In effect, this variable would be measuring the impact of globalization on domestic pricing behavior. Several variations of the "globalization" variable were tested, but all suggested a positive relationship between globalization and inflation, contrary to expectations. All data were smoothed using a four-quarter moving average. The PPI equation was estimated using (1) Q-Q first differences in logs and (2) Q-Q percent changes at annual rates. The results for each formulation were virtually the same. Chart 2 shows actual Q-Q percent changes in the PPI and equation estimates from the percent change equation.

A specification substituting unit labor costs for import prices resulted in a lower R^2 and a coefficient for unit labor costs that was statistically insignificant at the 95% confidence level. Similar inferior results were obtained when an index of labor productivity was substituted for import prices. Hogan (2000) similarly concluded that neither changes in labor costs nor productivity were important in explaining inflation in the U.S. over a thirty-year period ending in the early 1990s. To test for parameter stability, the data sample was shortened to end in 2000.4 and also in 1998.4. The second set of results shown in the table below refers to the 2000.4 sample set, and the third set of results refers to the 1998.4 sample set. As can be seen, the coefficients for the independent variables differ only slightly among the sample sets with all variables significant at the 5% probability level.

CHART 1

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PRODUCER PRICE INDEX VS. IMPORT PRICE INDEX LESS OIL

Percent change
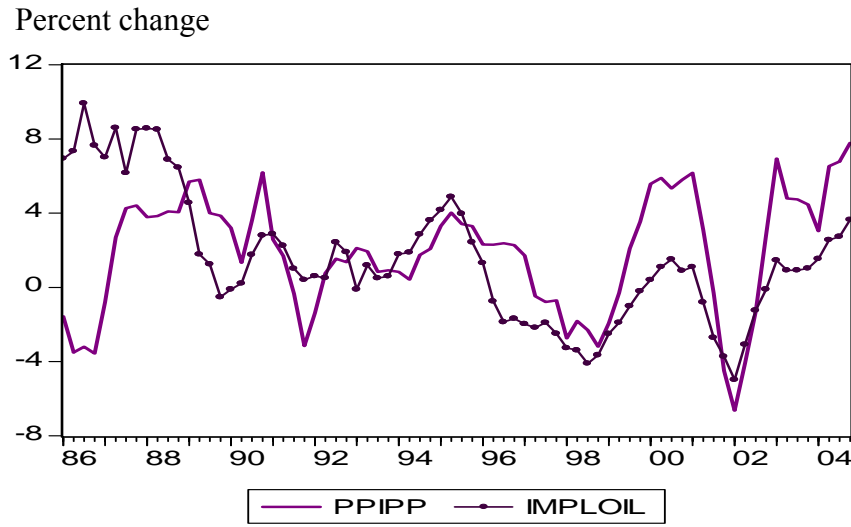
For the PPI, the best results were obtained using CAP as the excess demand variable, although regression results using a measure of the GDP gap produced very similar results as did a specification which used the unemployment rate as the excess demand variable. Specifically, the regression equation that was selected for analysis using OLS is:

TABLE 1

	C	LOIL	OIL	CAP	PPI(-1)	R^2	F-test
Sample: '86.1 – '04.4	.0013	.1081	.0425	.1635	.6167	.916	194.58
T-statistic	3.993	2.860	10.192	3.646	14.854		
No. of obs.	75						
Sample: '86.1 - '00.4	.0012	.0970	.0384	.1379	.5917	.923	163.72
T-statistic	3.809	3.006	10.007	3.005	12.651		
No. of obs.	60						
Sample: '86.1 – '98.4	.0013	1.003	.042	.147	.575		
T-statistic	3.367	3.063	8.573	3.133	10.583	.916	128.59
No. of obs.	52						

Where:
PPI = First difference in logs in the Producer Price Index, 4-quarter moving average, annual rate.
LOIL = First difference in logs in an index of import prices, excluding petroleum, 4-quarter moving average, annual rate.
OIL = First difference in logs in an index of petroleum and petroleum import prices, 4-quarter moving average, annual rate.
CAP = First difference in logs in The Index of Capacity Utilization, 4-quarter moving average, annual rate.

Based on the Q-statistic, the equations presented above exhibit some degree of serial correlation of the residuals, although calculated Durbin-Watson statistics for the two equations

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were in the 1.4 to 1.5 range. In addition, the residuals from the estimated equations meet the Augmented Dickey-Fuller test for stationary.

OTHER PRICE INDICES

Statistical results for equations using (1) the Consumer Price Index (CPI) and (2) the Personal Consumption Deflator (PCED) failed to match those shown above with the Producer Price Index as the dependent variable. For both the CPI and PCED, lagged values of the dependent variable dominated the results for each specification. On balance, the basic Phillips curve construction did not materialize regardless of the excess demand variable used in the estimating equation. In this regard, the best results were obtained with the CAP variable; less robust results were obtained with a measure of unemployment and also with a measure of the GDP gap. However, the coefficient on various measures of import prices proved to be statistically significant. For the CPI, the t-statistic on LOIL was 2.06 while that on OIL was 6.42. Similar statistics were generated when PCED replaced the CPI as the dependent variable. The more meaningful finding was that both the CPI and PCED are materially less sensitive to changes in either LOIL or OIL compared to the PPI. The same results were realized when the core CPI was substituted as the dependent variable. These findings follow Tootell's (1998) conclusion that since the CPI measures prices paid by consumers while import prices are the prices paid by importers, there can be a substantial amount of slippage between a change in import prices and a change in consumer prices. Brinner (1999) believes that "Finished Goods Wholesale Prices" rather than the CPI is the best measure of inflation because it is not subject to periodic revisions and excludes hard-to-measure services prices. Brinner's hypothesis was tested but produced poor results. Obstfeld (2000) similarly believes that due to non-tradable marketing costs and other imperfectly competitive practices, the pass-through of import prices to consumer prices is incomplete at best.

CHART 2
ACTUAL VS. FITTED

Percent Change
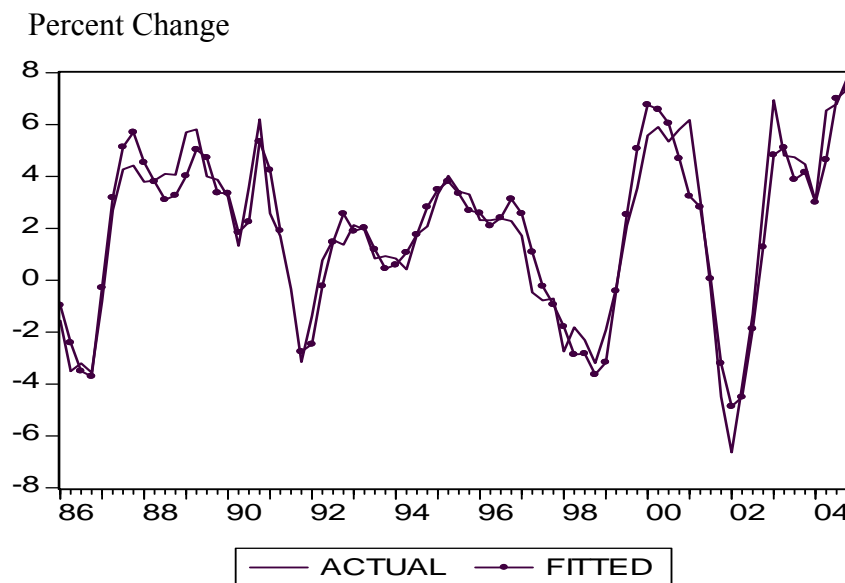
INTERPRETATION OF RESULTS

In all cases, import prices proved to be a significant variable in helping to explain inflation at various levels over the tested time periods. Several excess demand variables were tested, with CAP turning out to produce slightly better statistical results than GAP or UN. All coefficients exhibited the expected signs. The PPI price elasticity with respect to non-oil import prices ranged from .108 for the log-log equation to .099 for the percent change equation. The same measures with respect to petroleum prices were .042 and .041, respectively. Equation results proved to be stable for shorter time periods, although there is evidence that the impact of both non-oil import prices and oil-import prices on PPI inflation has been increasing over time. The equations on the CPI showed reduced sensitivity to import prices, although statistically all measures of import prices proved to be significant. The CPI price elasticity with respect to import prices was in the .03 range, a reading that supports the findings of Tootell (1998).

CONCLUSION

An examination of the data strongly suggests that the "headline" pronouncements of a link between overall U.S. inflation and import prices have some merit. The analysis presented above indicates that, on balance, a 10% change in non-oil import prices has resulted in fairly rapid one-percent change in the PPI.   For consumer prices, we find the response to be only one-third as strong.

In its June 12, 2002 newsletter, the Economics Group – International of Wachovia Securities wrote: "Further dollar weakness going forward would put upward pressure on import prices." The significance of this statement in relation to U.S. inflation, interest rates, and monetary policy depends on whether PCP or LCP pricing is prevalent in the current economic environment and also on the sensitivity of overall inflation to changes in import prices. If this is a fair representation of the current pricing environment, then all the work done on exchange-rate pass-through will have relevancy in trying to predict future Fed actions. Similarly, studies relating import prices to inflation directly will add to the discussion. The results here suggest that economic policymakers must be aware of import pricing trends and explicitly take into account the implications of further declines in the external exchange value of the U.S. dollar.

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