IS EXCHANGE RATE PASS-THROUGH SYMMETRIC? EVIDENCE FROM U.S. IMPORTS

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Abstract: This paper addresses the question of whether exchange rate pass-through into the import price is symmetric between appreciation and depreciation of the home currency. The dramatic increase of the dollar in the early 1980s and the subsequent decline provided a necessary setting for testing whether there was a structural change in the exchange rate pass-through. Examining import price data for 98 disaggregated SIC industries in the U.S. manufacturing sector and the U.S. import price for all commodities, I find mixed evidence regarding the stability of exchange rate pass-through.

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1. Introduction

It has been observed that changes in the value of the dollar since the early 1980s did not fully pass through to U.S. import prices. One indication of such a phenomenon is that foreign exporters price to market in the U.S. Recent studies of the subject have drawn heavily on models of industrial organization and focused on the impact of market structure on the foreign firm's pricing behavior. These studies have emphasized varying demand elasticity in explaining price adjustments following exchange rate changes. For instance, partial pass-through will occur if demand becomes more elastic as price increases. The literature also suggests that the degree of pass-through varies across industries, and that the variation relates to industry characteristics such as the degree of competition, product substitutability, and the relative domestic and foreign shares in the market. For example, Dornbusch (1987) predicts that in a Cournot model the pass-through is larger the more competitive the industry (the smaller the markup of price over marginal cost) and the larger the share of imports in total sales. Current empirical studies of the impact of exchange movements on import or export prices are conducted either at a highly aggregated level (Krugman and Baldwin, 1987), or for particular products (Knetter 1989, Gagnon and Knetter 1990, and Marston 1990).

Theoretical studies and empirical work in this field have gone through basically three stages since 1980s. The first generation of models was represented by Dornbusch (1987), Krugman (1987), and Feinberg (1989) that focused on the target market price "stabilizing" behavior of exporting firms. These were followed by studies that emphasized cross-industry variation in exchange rate pass-through (see Cumby and Huizinga 1990, Knetter 1993, and Yang 1997). More recently, numerous studies have investigated whether exchange rate pass-through is stable over time. Taylor (2000) examined whether decline in inflation in the developed world had led to a decline in exchange rate pass-through. Campa and Goldberg (2002) tested the stability of exchange rate pass-through in OECD countries and found partial evidence of declining pass-through for some OECD countries. Gagnon and Ihrig (2002) found that there has been a decline in pass-through at the macroeconomic level for industrial countries since the 1980s.

A question that has been largely left unanswered in the literature is: Is the foreign exporting firms' stabilizing behavior symmetric? That is, do foreign exporters behave the same way when the dollar is down as compared with their behavior when the dollar is up? People claim that when the dollar is down (or the Japanese yen is up), foreign exporters will not raise their dollar prices proportionally so as to **keep** their market share. But when the dollar is up (or the yen is down), they lower the dollar prices of their exports to a greater extent so as to **increase** their market share. However, there have been few formal studies of this critical issue in international trade.[1]

The answer to the question of whether foreign exporting firms react to appreciation of the dollar in the same way as they do depreciation of the dollar depends on the convexity of the exchange rate pass-through. While exchange rate pass-through

[1] A noticeable exception is Coughlin and Pollard (2000) who addressed this issue along with exchange rate index choice. See Mahdavi (2002) for some evidence of opposite "opportunistic" pricing behavior for exporters in the U.S. furniture industry.

is the first derivative of the import price (in logarithm) with respect to the exchange rate (in logarithm), the convexity of the exchange rate pass-through is the second derivative. This study will bridge this gap in the literature by describing a simple model to explain the convexity of exchange rate pass-through and by conducting an empirical investigation using both disaggregated U.S. industry data and aggregate data for all commodity imports into the United States. The result of such an investigation will document new evidence of exporting firms' pricing behavior.

The remaining part of this paper is organized as follows. Section 2 provides a theoretical framework where an exporting firm's pricing behavior and exchange rate pass-through can be described. Section 3 conducts an empirical analysis of U.S. import price adjustments in reaction to dollar depreciation and dollar appreciations. The final section concludes.

2. Theoretical Framework

Without loss of generality, the following identity holds for a Japanese firm exporting to the United States: $P_{¥}/e_{¥/\$} = P_{\$}$, where $P_{¥}$ is the export price measured in the exporter's currency, the Japanese yen; $P_{\$}$, the price charged in the U.S. in the importer's currency, the U.S. dollar; and $e_{¥/\$}$, the nominal exchange rate quoted in units of the exporter's currency per unit of the importer's currency, yens per dollar.[2] When the exchange rate changes, either $P_{¥}$ or $P_{\$}$ or both may adjust. To illustrate, suppose the

[2] It is assumed that there is no tariff or transaction cost. Relaxing these assumptions will not qualitatively change the results of the model.

Japanese yen appreciates against the dollar (so that $e_{¥/\$}$ decreases), the Japanese exporter will make a pricing decision out of four possible scenarios: (1) keep the yen price constant, then $P_{\$}$, the dollar price that the U.S. importer pays, will be proportionally higher; (2) keep the dollar price, $P_{\$}$, unchanged, then the yen price, $P_{¥}$, will have to be proportionally lower; (3) lower the yen price, $P_{¥}$, but less than proportionally, then the dollar price will rise but, again, less than proportionally; or (4) raise the yen price, $P_{¥}$, then the dollar price, $P_{\$}$, will become more than proportionally higher.

How does the exporting firm make its pricing decision in response to exchange rate change? The current literature emphasizes the importance of variable demand elasticity in modeling export pricing behavior (see Krugman 1987 and Marston 1990). When an exporting firm enjoys some market power, its pricing behavior depends crucially on the shape of the demand curve -- or more accurately, on its perception of the shape of the demand curve. Suppose that a Japanese exporter sets its price in U.S. dollars for its exports to the U.S. market. Assuming constant marginal cost, the profit-maximizing condition of the exporting firm is

$$P_{\$}\left(1+\frac{1}{\xi_{\$}}\right)=\frac{c_{¥}}{e_{¥/\$}}, \qquad \textbf{(1)}$$

where $P_{\$}$ and $e_{¥/\$}$ are as defined earlier; $\xi_{\$}$, the perceived demand elasticity facing the Japanese exporter in the U.S. market; and $c_{¥}$, the constant marginal cost in Japanese yen. The elasticity of the import price with respect to exchange rate, known as the degree of exchange rate pass-through, is then

$$\tau_{\$} = \frac{d \ln P_{\$}}{d \ln e_{¥/\$}} = - \left[1 - \frac{d\,\xi_{\$}}{dP_{\$}} \frac{P_{\$}}{\xi_{\$}} \frac{1}{\xi_{\$} + 1} \right]^{-1} . \qquad \textbf{(2)}$$

It is clear that the exchange rate pass-through depends on how price affects the demand elasticity. When the perceived demand elasticity is constant (i.e., $d\xi_{\$}/dP_{\$} = 0$), pass-through of the exchange rate change to the import price is -1 (that is, when the dollar depreciates by 1% against the yen, the dollar price of Japanese import will increase by 1 percent -- complete pass-through). In such a case, there is no pricing to market. So long as the perceived demand elasticity varies with price, then pass-through will deviate from one in absolute terms. If the demand curve becomes more elastic as prices rises ($d\xi_{\$}/dP_{\$} < 0$), pass-through will be less than one; this is true for a linear demand curve, in which case the percentage fall in the U.S. import price will always be less than half of the percentage rise in the dollar (see Krugman 1987). If the demand curve becomes less elastic ($d\xi_{\$}/dP_{\$} > 0$), pass-through will be greater than one -- Scenario (4) as discussed earlier. Therefore, the exchange rate pass-through depends crucially on the curvature of the demand curve.

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Insert Figure 1 about here
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While the exchange rate pass-through involves the first derivative of the import price (in logarithm) with respect to the exchange rate (in logarithm), the convexity of the exchange rate pass-through refers to the second derivative. Figure 1 depicts the relationship between the import price and the exchange rate and the convexity of the pass-through. Three situations are illustrated in the exhibit. Schedule A, a straight line, represents constant exchange rate pass-through. If the slope of Schedule A is less than one in absolute terms, the pass-through is considered incomplete, which has been evidenced in recent studies. However, with variable demand elasticity, exchange rate pass-through is not expected to be constant. Schedule B in Figure 1 represents decreasing exchange rate pass-through as the home currency (the dollar) appreciates. The situation is warranted when a foreign exporter has some monopolistic market power in the home market. When the dollar appreciates, the foreign exporter maintains its dollar price and increases its profit margin. When the dollar depreciates, the foreign exporter increasingly passes the exchange rate changes into the dollar price. Both Schedule A and Schedule B support the traditional view that depreciation of the home currency leads to inflation in the domestic market. On the other hand, Schedule C represents increasing exchange rate pass-though as the dollar appreciates. This situation is justified when a foreign exporter faces more competition in the target market (the United States). When the dollar appreciates, the foreign exporter is able to lower its dollar price to gain market share without jeopardizing its profit margin. But when the dollar depreciates, the foreign exporter has to price to market, absorbing much of the exchange rate change into its profit margin.

The exchange rate pass-through behavior depicted in Figure 1 may also have a macro economic interpretation. In the 1990s, several industrial countries, such as Sweden and the United Kingdom in 1992, experienced episodes of large exchange rate depreciations that did not lead to significant increases in domestic inflation. Gagnon and Ihrig (2002) provide a theoretical model to explain the decline in measured exchange rate pass-through at the macroeconomic level for industrial countries since the 1980s. When firm expect eth monetary authority to act strongly to stabilize the domestic inflation rate, they are less inclined to change prices in response to a given exchange rate shock. Such exchange rate pass-through behavior can be illustrated as Schedule C of Figure 1. Similarly, Taylor (2000) hypothesizes that the decline in average inflation rates in the developed world has also resulted in a decline in the degree in which firms pass through changes in costs, such as changes in exchange rates, into prices for their final goods. Campa and Goldberg (2002) investigate the stability of exchange rate pass-through in OECD countries and the link between macroeconomic variables and pass-through. In addition to inflation, they propose that invoicing currency choice and country sizes are other factors that determine the stability and level of exchange rate pass-through.

3. Data and Empirical Analysis

The value of the U.S. dollar, measured as an index (effective exchange rate) against major currencies, increased from 94.6 in January 1980 to 140.35 in March 1985, then decreased steadily 77.68 in April 1995 (see Figure 2). Such dramatic changes in the value of the dollar provide necessary data for testing the stability of exchange rate pass-through, or whether there are symmetric responses in U.S. import prices between dollar appreciation and dollar depreciation. I will perform this test using two separate samples: one with disaggregated industry data and another with aggregate data for all commodities.

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Insert Figure 2 about here
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In a study of exchange rate pass-though in U.S. manufacturing industries, Yang

(1997) compiled a dataset containing quarterly data of import prices and corresponding producer's prices (or wholesale prices) for selected two-, three-, and four-digit SIC industries in the manufacturing sector. I use the same dataset for the disaggregated industry sample. The original data for import prices and producer (wholesale) prices were from the U.S. Bureau of Labor Statistics (BLS). The exchange rate was obtained from Morgan Guaranty's nominal effective exchange rate of the U.S. dollar against 15 other industrial-country currencies. 17 two-digit industries, 47 three-digit industries, and 34 four-digit industries are included in the sample. Due to the available time span of the import prices, the longest series cover a period from December 1980 through December 1991.[3]

It has become increasingly known that many time series are not stationary in their levels; that is, they contain unit roots. Using the Fuller and the Dickey-Fuller tests for unit roots, Yang (1997) found that, with very few exceptions, the import price index series, the U.S. producer price index series, and the exchange rate series involved do contain unit roots. As a result, log differences of the time series variables are used in the estimation, which is specified as follows:

$$\Delta \ln MP_{k,t} = \beta_{1,k} \Delta \ln EXR_t + \beta_{2,k} \Delta EXRDUM_t + \beta_{3,k} \Delta \ln PP_{k,t} + \beta_{4,k} \Delta \ln MP_{k,t-1} + \nu_{k,t} \,, \quad \textbf{(3)}$$

where $MP_{k,t}$ is the import price index for industry $\boldsymbol{k}$, EXR_t the nominal effective exchange rate index for the U.S. dollar, and $PP_{k,t}$, the corresponding domestic price index for industry $\boldsymbol{k}$. $EXRDUM_t$ is the product of EXR_t and a dummy variable DUM taking on the value of 1 for time after March 1985, when the dollar reached its peak and started to

[3] The SIC-based import price series end in 1992 as the BLS stopped publishing these series.

depreciate, and 0 for time up to March 1985, when the dollar followed a rising trend. $\beta_{1,k}$ is the elasticity of exchange rate pass-through, which is expected to be negative and smaller than 1 in absolute value. The coefficients for the domestic price and the lagged dependent variable are expected to be positive, showing the impact of domestic price on import price and persistence in the import price. The values and statistical significance of $\beta_{2,k}$ should provide evidence of whether exchange rate pass-though has a structural change for a time period during which the dollar depreciated.

The ordinary least squares (OLS) method is applied. The estimation results for the two-, three-, and four-digit industries are presented in Tables 1 to 3 respectively. The estimates for exchange rate pass-though elasticity are negative for all two-digit SIC industries and statistically significant at 10% or lower for about half of them. The magnitude of the estimates is constantly lower than 0.5 (in absolute value), indicating incomplete exchange rate pass-through. The coefficients for $EXRDUM_t$, with 7 negative and 10 positive, are not statistically significant except for SIC 30 (Rubber and miscellaneous plastic products). This finding shows that in general there has been no change in the pass-through behavior after 1985 when the dollar started to depreciate. The exception for SIC 30 does indicate, however, there was a higher degree of pass-through after 1985 for this specific industry, warranting an investigation into the industry specific factors that affect the import pricing behavior.

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Insert Tables 1 to 3 about here
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For the three-digit SIC industries, the estimates for the pass-through elasticity are mostly negative and statistically significant at the 10% lever or better. There is a greater variation in the estimates, however. The pass-through for SIC 206 (sugar and confectionery products) was -0.98, representing almost complete pass-through. A few other industries (SIC 326 - pottery and related products, SIC 355 - special industry machinery, except metalworking, and SIC 396 - costume jewelry, costume novelties, buttons, and miscellaneous notions, except precious metal) have also demonstrated exchange rate pass-through as high as well over 0.60 in absolute value. The estimated coefficients for $EXRDUM_t$ are not statistically significant for most industries, although there are relatively more negative estimates than positive ones. A few industries (SIC 307 - miscellaneous plastic products, SIC 353 - construction, mining, and materials handling, and SIC 365 - household audio and video equipment, and audio recordings) do show increasing exchange rate pass-through as the dollar depreciated, while a few other industries (SIC 261 - pulp mills, SIC 333 - primary smelting and refining of nonferrous metals, and SIC 367 - electronic components and accessories) demonstrate decreasing exchange rate pass-through as the dollar depreciated.

The results for the four-digit SIC industries are very similar to those of the three-digit SIC industries, with a few industries (SIC 2084 - wines, brandy, and brandy spirits, SIC 3331 -primary copper, SIC 3531, construction machinery, SIC 3552 textile machinery, SIC 3574 calculating machines, and SIC 3662 ratio and TV communication equipment) registering statistically significant changes in exchange rate pass-through after 1985. It is interesting to note the dramatic changes in pass-through for SIC 3331 and SIC 3574, from no pass-though or even a positive pass-though before 1985 to a complete reverse after 1985.

While most industries in the disaggregated industry sample show no significant change in the exchange rate pass-through between appreciation and depreciation periods for the dollar, differences across industries do exist. Further investigation into specific industries is required to explain these differences. To study the pass-through behavior at the aggregate level, I employ a different sample containing U.S. import price for all commodities. The data is obtained from End Use Import Indexes compiled by the U.S. Bureau of Economic Analysis (BEA). The time series covers a period starting in September 1982 till September 2002 (the most recent quarter with data available). The major currencies index of the dollar published by the U.S. Federal Reserve Board is used for the exchange rate variable. The corresponding producer price index for all commodities (from the BLS) is used to control for U.S. domestic market conditions. The three time series (import price, producer price, and the exchange rate) are depicted in Figure 3.

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Insert Figure 3 about here

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The OLS method is used to estimate the exchange rate pass-through and its stability for the aggregate U.S. import price. Various different model specifications are employed to test the robustness of the results. Since the time series spans a much longer time period than the previous disaggregated industries, the dummy variable is now defined somewhat differently: It takes on a value of 1 for a period between the third quarter of 1985 and the first quarter of 1990, when the dollar flowed a steady decline trend.

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Insert Table 4 about here
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Table 4 presents the results of estimation at the absolute level, log level, and log difference both with and without the exchange rate dummy variable. The estimation for the pass-through elasticity is consistently negative and statistically significant at the 1% level or lower throughout model specifications. The degree of pass-through ranges from -0.26 to -0.32 for estimation with levels and from -0.14 to -0.18 with log difference. There are indications of a relatively low exchange rate pass-through into U.S. aggregate import prices. The test for a possible structural change in the exchange rate pass-through has shown mixed results. While the estimated coefficients for exchange rate dummy are consistently negative across specifications, only those with level estimates are statistically significant at around the 1% level.

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Insert Table 5 about here
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The estimates with a lagged dependent variable are presented in Table 5. The estimates for pass-through elasticity are again all statistically significant and fall within a very narrow range – from -0.16 to-0.18 – for different model specifications. The results for the exchange rate dummy are very similar to those with log difference estimates presented in Table 4, negative but statistically insignificant.

4. Conclusion

This paper addresses the question of whether exchange rate pass-through into the import price is symmetric between appreciation and depreciation of the home currency. I describe a simple model of pass-through convexity to explain the relationship between import price and exchange rate. Depending on the convexity of the demand elasticity, the exchange rate pass-through can be constant, decreasing, or increasing as the home currency appreciates. The dramatic increase of the dollar in the early 1980s and the subsequent decline provided a necessary setting for testing whether there was a structural change in the exchange rate pass-through. Examining import price data for 98 disaggregated SIC industries in the U.S. manufacturing sector and the U.S. import price for all commodities, I find mixed evidence regarding the stability of exchange rate pass-through. The majority of the industries experienced no significant change in their pass-through elasticity over the periods of dollar appreciation and depreciation in the 1980s. A few industries, however, did show increasing exchange rate pass-through as the dollar depreciated, while a few other industries demonstrated decreasing exchange rate pass-through as the dollar depreciated. These cross-industry differences warrant further microeconomic investigations. There is some evidence that the exchange rate pass-through for U.S. import price for all commodities increased when the dollar depreciated during the latter part of the 1980s, but the evidence is not robust. The significance of this finding is that there has been no decline in exchange rate pass-through at the aggregate level of U.S. import price, contrary to what has been evidenced in most other industrial countries (Gagnon and Ihrig 2002).

Low variability in import prices or incomplete exchange rate pass-through seem to be a common phenomenon in industrial countries, as evidenced by current studies on the topic. It will be interesting to investigate how import prices and overall domestic prices react to exchange rate changes in developing countries, particularly in the wake of currency crises as experienced by many countries in the 1990s. While the monetary authorities in industrial countries may have the wherewithal to reduce the pass-through and inflation variability, the majority of developing countries are more prone to bear the brunt of exchange rate fluctuations.

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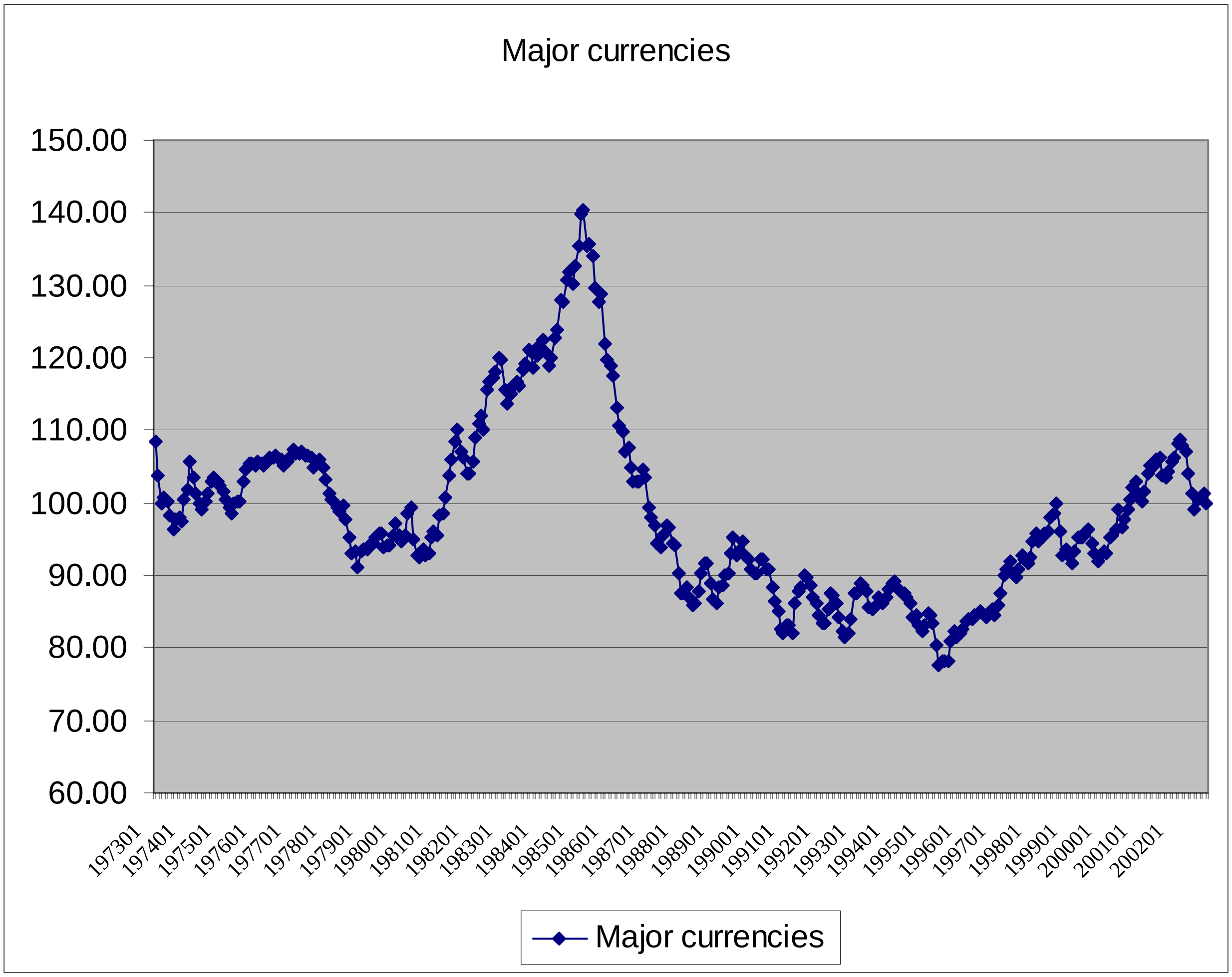
Figure 1: The Value of U.S. Dollar Against Major Currencies (197303 = 100)
(1973-2002)



Sources: U.S. Federal Reserve Board.

Figure 2: Convexity of Exchange Rate Pass-Through

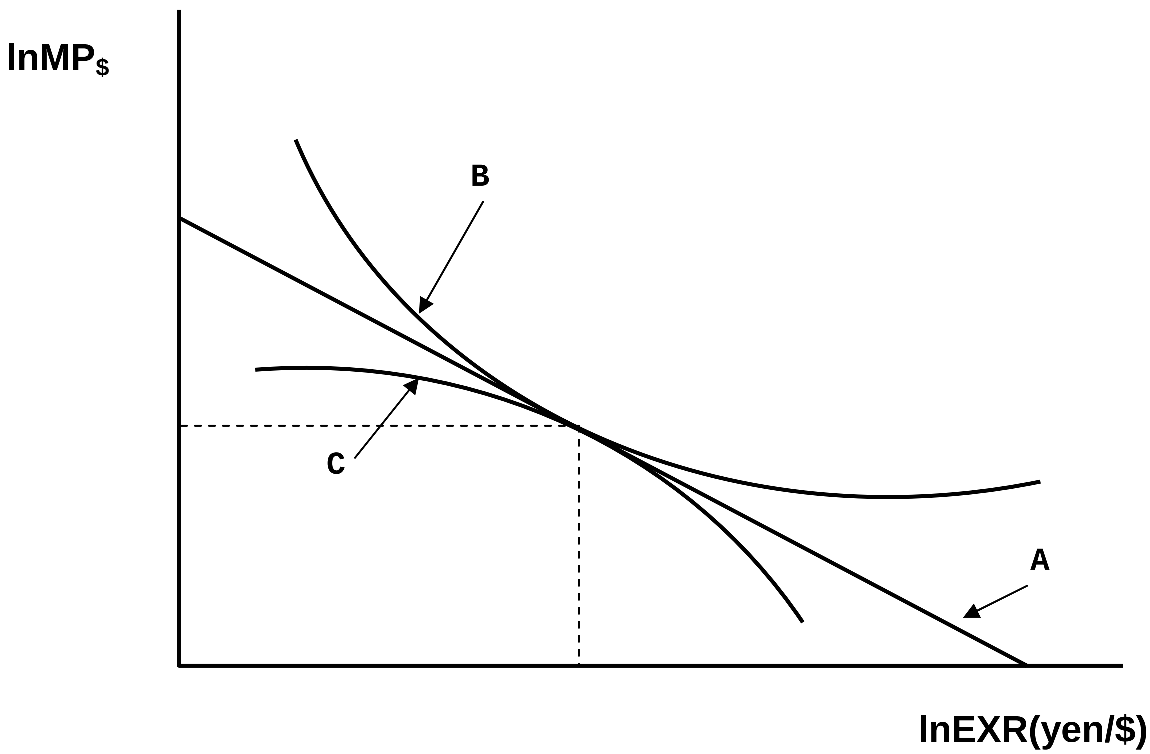
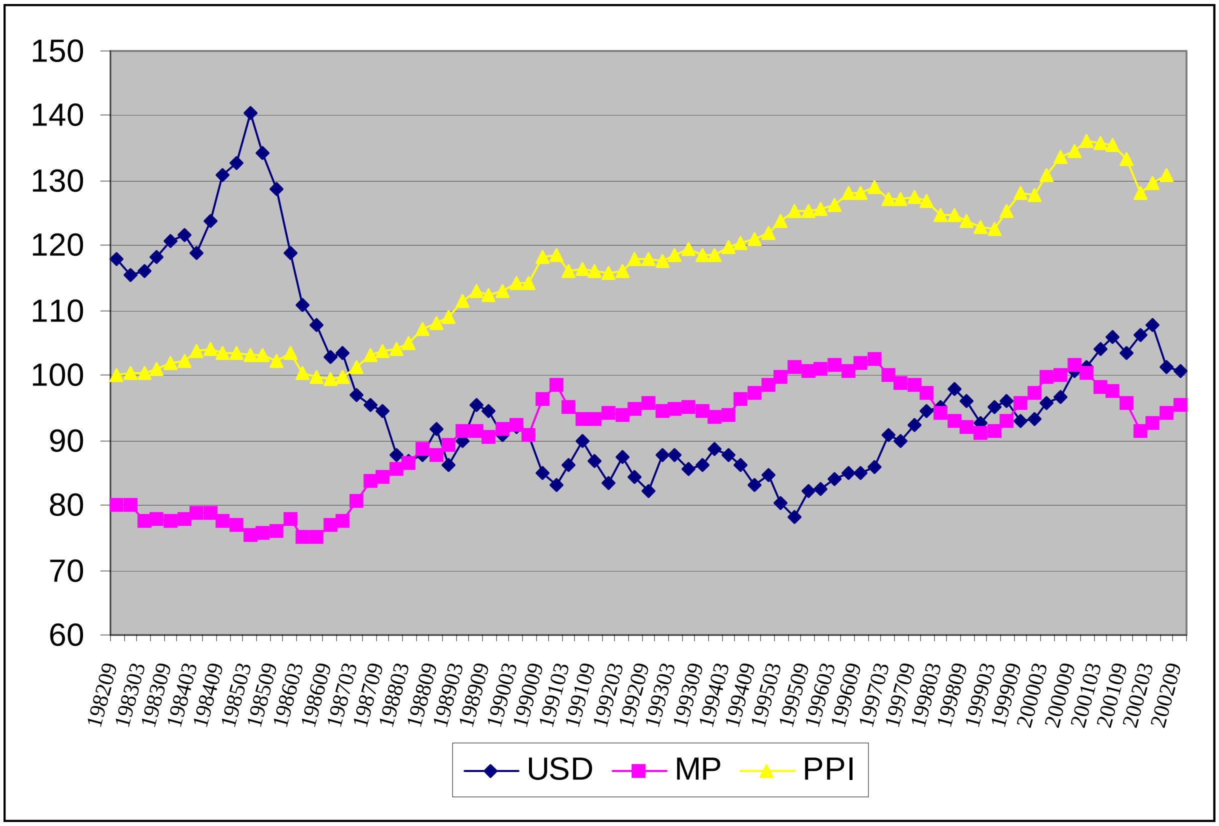


Figure 3: Import Price for All Commodities, Value of Dollar, and Producer Price (1982-2002)



Sources: USD: U.S. Federal Reserve Board

MP and PPI: Bureau of Labor Statistics, U.S. Department of Labor

Table 1: Parameter Estimates for Two-Digit SIC Industries

SIC	EXR	DUMEXR	PP	LMP
20	-0.2331	0.1235	0.2795	0.1824
	0.1189	*0.4892*	*0.0844*	*0.2031*
22	-0.1090	-0.0871	1.7220	0.0894
	0.5096	*0.6501*	*0.0153*	*0.6087*
23	-0.0856	0.0360	0.5907	0.2574
	0.3950	*0.7811*	*0.0543*	*0.1303*
24	-0.1273	0.0614	1.1949	-0.0065
	0.3708	*0.7330*	*0.0001*	*0.9471*
25	-0.4373	0.2065	0.9536	0.2052
	0.0002	*0.1326*	*0.0091*	*0.1106*
26	-0.0898	0.1569	0.7031	0.4329
	0.4509	*0.3030*	*0.0057*	*0.0022*
28	-0.1979	-0.0365	0.5376	0.2855
	0.1786	*0.8318*	*0.0271*	*0.0865*
30	-0.0880	-0.1799	0.2354	0.1845
	0.1660	*0.0290*	*0.2542*	*0.1578*
31	-0.2749	0.0219	0.6931	0.0319
	0.0052	*0.8497*	*0.0019*	*0.8204*
32	-0.3696	0.0483	0.4106	0.3717
	0.0016	*0.7317*	*0.1302*	*0.0018*
33	-0.3862	0.3359	1.5968	0.0615
	0.0319	*0.1245*	*0.0001*	*0.6388*
34	-0.3280	0.1039	1.1431	0.2827
	0.1083	*0.6169*	*0.0102*	*0.0701*
35	-0.3606	-0.0984	0.3808	0.3487
	0.0001	*0.3345*	*0.0842*	*0.0002*
36	-0.1244	-0.0976	0.2571	0.3469
	0.3667	*0.5119*	*0.1461*	*0.0312*
37	-0.1826	-0.0524	0.4856	0.4377
	0.0285	*0.5953*	*0.0001*	*0.0001*
38	-0.3976	-0.1835	-0.1838	0.2734
	0.0013	*0.2134*	*0.5143*	*0.0085*
39	-0.3855	0.2146	0.4736	0.2692
	0.0125	*0.2162*	*0.1455*	*0.1017*

Table 2: Parameter Estimates for Three-Digit SIC Industries

SIC	EXR	DUMEXR	PP	LMP
201	0.0092	-0.0119	-0.0273	-0.0850
	0.9785	*0.9779*	*0.8448*	*0.6486*
202	-0.1616	-0.1780	0.4739	0.5327
	0.4980	*0.5084*	*0.1976*	*0.0003*
203	-0.2584	0.0383	0.9752	-0.2209
	0.5689	*0.9457*	*0.1588*	*0.1506*
206	-0.9758	0.8021	0.4545	-0.2323
	0.0802	*0.2288*	*0.3055*	*0.1805*
207	-0.1165	1.1814	1.0481	0.1128
	0.9124	*0.3195*	*0.0012*	*0.4252*
208	0.0044	-0.1225	0.5307	0.5040
	0.9459	*0.1451*	*0.0001*	*0.0001*
209	-0.1499	-0.3395	0.1007	0.1116
	0.4519	*0.1443*	*0.7254*	*0.4524*
221	0.1240	-0.0755	1.1442	0.1287
	0.6766	*0.8169*	*0.0220*	*0.4890*
222	-0.2323	0.1439	0.1654	0.1072
	0.4678	*0.7244*	*0.8319*	*0.5307*
229	-0.1594	-0.1788	0.0635	0.3926
	0.2554	*0.3145*	*0.8797*	*0.0029*
231	-0.1930	-0.0324	1.2135	-0.2453
	0.0867	*0.8126*	*0.0001*	*0.1071*
232	-0.1758	0.1982	0.7916	0.4145
	0.1092	*0.1710*	*0.0181*	*0.0107*
238	-0.0927	0.0423	0.6763	0.0995
	0.5153	*0.8134*	*0.1621*	*0.5699*
242	-0.4806	0.3908	1.0141	-0.1978
	0.0470	*0.1256*	*0.0001*	*0.0365*
243	-0.1338	0.1635	0.3291	0.2049
	0.4261	*0.4545*	*0.0694*	*0.1888*
259	-0.4390	0.2081	0.9610	0.2103
	0.0001	*0.1252*	*0.0080*	*0.0992*

Table 2: Parameter Estimates for Three-Digit SIC Industries (Continued)

SIC	EXR	DUMEXR	PP	LMP
261	-0.5422	0.7534	2.2214	0.3201
	0.1442	*0.0805*	*0.0005*	*0.0303*
262	0.1887	-0.1798	0.9686	-0.0394
	0.0937	*0.2086*	*0.0001*	*0.7512*
281	-0.2224	-0.3631	0.0678	0.2379
	0.6950	*0.5732*	*0.9585*	*0.3134*
301	0.0193	0.0579	0.0282	0.3566
	0.7666	*0.4762*	*0.6206*	*0.0185*
307	-0.1237	-0.3959	0.1755	0.1642
	0.4329	*0.0334*	*0.6351*	*0.2101*
314	-0.1496	-0.1084	0.2259	-0.0316
	0.2467	*0.5049*	*0.2196*	*0.8450*
326	-0.6581	0.0585	0.3539	0.3022
	0.0009	*0.8044*	*0.4339*	*0.0102*
331	-0.0777	0.0618	0.5462	0.5032
	0.4591	*0.6393*	*0.0048*	*0.0001*
333	-0.6181	0.6348	0.9726	0.0231
	0.0583	*0.1009*	*0.0001*	*0.8502*
335	-0.0958	-0.1974	0.3672	0.3059
	0.5169	*0.2540*	*0.0004*	*0.0082*
345	-0.0807	-0.1462	0.4676	0.4453
	0.5097	*0.3506*	*0.0617*	*0.0019*
349	-0.2543	0.0532	1.2330	0.0886
	0.2268	*0.8137*	*0.0041*	*0.5949*
353	-0.2775	-0.2960	0.6995	0.3438
	0.0305	*0.0583*	*0.0303*	*0.0010*
354	-0.5707	-0.0048	0.9094	0.1926
	0.0001	*0.9750*	*0.0073*	*0.0539*
355	-0.6420	-0.1034	0.8613	0.2592
	0.0460	*0.7582*	*0.1843*	*0.0480*
356	-0.5667	-0.0801	0.6972	0.2382
	0.0002	*0.6470*	*0.0648*	*0.0220*

Table 2: Parameter Estimates for Three-Digit SIC Industries (Continued)

SIC	EXR	DUMEXR	PP	LMP
357	-0.3326	0.1620	-0.2074	0.2128
	0.4085	*0.6895*	*0.5505*	*0.3588*
363	-0.4627	0.2398	1.4144	0.3766
	0.0065	*0.1653*	*0.0092*	*0.0078*
364	-0.4704	-0.0710	0.5152	0.2837
	0.0122	*0.7414*	*0.1749*	*0.0165*
365	0.0676	-0.2396	0.3877	0.5330
	0.4373	*0.0388*	*0.0140*	*0.0001*
366	-0.0912	-0.1319	0.3486	0.0652
	0.5716	*0.4526*	*0.0976*	*0.6874*
367	-0.5577	0.4490	0.3729	0.1014
	0.0131	*0.0772*	*0.2753*	*0.5426*
369	-0.3785	-0.0607	0.2939	0.3211
	0.0063	*0.7135*	*0.4798*	*0.0069*
371	-0.1792	-0.0523	0.3894	0.3885
	0.0732	*0.6636*	*0.0001*	*0.0006*
382	-0.5763	-0.1180	-0.1331	0.2496
	0.0012	*0.5761*	*0.7433*	*0.0247*
383	-0.4329	-0.3454	-0.3527	0.2813
	0.0158	*0.1187*	*0.4036*	*0.0120*
386	-0.2411	-0.1176	-0.0808	0.3116
	0.0423	*0.4199*	*0.7734*	*0.0158*
387	-0.4416	-0.1987	-0.1324	0.0943
	0.0088	*0.3324*	*0.7358*	*0.4142*
391	-0.6060	0.5046	0.7938	0.1646
	0.0306	*0.1151*	*0.1494*	*0.3340*
394	-0.1096	-0.0394	0.2593	0.1550
	0.2857	*0.7644*	*0.2514*	*0.4177*
396	-0.6567	0.3882	0.4010	0.1675
	0.0130	*0.1571*	*0.2857*	*0.3195*

Table 3: Parameter Estimates for Three-Digit SIC Industries

SIC	EXR	DUMEXR	PP	LMP
2011	-0.2428	0.3174	0.4250	0.0797
	0.3974	*0.3793*	*0.0042*	*0.5878*
2033	-0.3181	0.5570	0.9477	-0.0633
	0.5092	*0.3518*	*0.1955*	*0.6873*
2062	-0.3584	0.2824	0.8953	-0.3878
	0.3087	*0.4529*	*0.0164*	*0.0218*
2066	0.1534	-0.4009	0.6457	-0.1728
	0.7409	*0.4239*	*0.0894*	*0.3547*
2076	-0.3819	1.3471	0.3125	0.2059
	0.7788	*0.3781*	*0.2786*	*0.2133*
2082	-0.1340	0.1271	0.4582	0.2613
	0.1090	*0.2097*	*0.0009*	*0.0571*
2084	-0.0161	-0.2081	0.6725	0.4573
	0.8560	*0.0591*	*0.0001*	*0.0001*
2085	-0.0197	-0.0379	0.7969	0.3026
	0.8175	*0.7117*	*0.0001*	*0.0058*
2321	-0.1590	0.1348	0.6903	0.3739
	0.1917	*0.3818*	*0.0550*	*0.0192*
2421	-0.2547	0.1083	1.1605	-0.0785
	0.1685	*0.6435*	*0.0001*	*0.3460*
2435	-0.0878	0.1043	0.3155	0.3188
	0.6097	*0.6416*	*0.0874*	*0.0392*
3143	-0.1979	-0.2074	0.3710	0.3205
	0.0923	*0.1588*	*0.1182*	*0.0121*
3144	-0.2540	-0.2318	1.5424	-0.4196
	0.1934	*0.3336*	*0.0004*	*0.0043*
3312	-0.0921	0.0584	0.5472	0.4604
	0.3785	*0.6525*	*0.0041*	*0.0003*
3313	-0.0577	0.1424	1.0703	0.5147
	0.8850	*0.7794*	*0.1150*	*0.0004*
3331	0.4702	-1.1389	2.2060	-0.1581
	0.3572	*0.0518*	*0.0001*	*0.0922*
3494	-0.1548	-0.2581	0.5430	0.3125
	0.5933	*0.4112*	*0.2142*	*0.0477*

Table 3: Parameter Estimates for Three-Digit SIC Industries (Continued)

SIC	EXR	DUMEXR	PP	LMP
3496	-0.1405	0.1260	0.2960	0.3092
	0.1647	*0.3389*	*0.1356*	*0.0477*
3499	-0.2870	0.0169	0.1924	0.1330
	0.0608	*0.9301*	*0.5064*	*0.3569*
3531	-0.1653	-0.3421	0.3204	0.3010
	0.2845	*0.0699*	*0.3972*	*0.0131*
3541	-0.8171	0.3018	0.3631	0.3347
	0.0004	*0.1742*	*0.2625*	*0.0033*
3552	-0.2856	-0.5781	0.0858	0.2284
	0.0721	*0.0049*	*0.8086*	*0.0360*
3555	-0.9273	0.2012	0.7901	0.3043
	0.0137	*0.6017*	*0.2929*	*0.0168*
3559	-0.5554	-0.0487	1.2089	0.1190
	0.1774	*0.9113*	*0.1480*	*0.4795*
3562	-0.3264	-0.2580	0.5281	0.3273
	0.0856	*0.2136*	*0.0197*	*0.0088*
3569	-0.6586	-0.1517	0.8075	0.1975
	0.0019	*0.5469*	*0.1304*	*0.0806*
3574	0.9886	-1.0597	-0.1323	-0.2976
	0.1000	*0.0784*	*0.7847*	*0.2587*
3579	-0.9214	0.2473	0.3650	0.3043
	0.0006	*0.3407*	*0.2425*	*0.0051*
3639	-0.3456	0.0755	0.2725	0.1485
	0.1150	*0.7448*	*0.3399*	*0.3967*
3643	-0.5820	-0.1055	0.6981	0.2786
	0.0250	*0.7257*	*0.1870*	*0.0220*
3651	0.0366	-0.1862	0.3144	0.5393
	0.6850	*0.1198*	*0.1661*	*0.0001*
3661	-0.2391	0.0920	0.4151	-0.0658
	0.2356	*0.7216*	*0.2310*	*0.6669*
3662	0.0001	-0.2713	0.2081	0.2818
	0.9996	*0.1026*	*0.2843*	*0.0660*
3679	-0.2521	0.0553	0.3077	0.3485
	0.0989	*0.7327*	*0.1153*	*0.0301*

Table 4: Exchange Rate Pass-Through for All Commodities (1982-2002)

Model	Variable	Estimates	Std Errors	*t*-Statistics	Significance	Adj. R-Sq
Level	Intercept	55.1785	3.4534	15.98	<.0001	0.9558
Without Dummy	USD	-0.2556	0.0159	-16.08	<.0001	
	PPI	0.5193	0.0206	25.16	<.0001	
Level	Intercept	62.6464	3.9387	15.91	<.0001	0.9609
With Dummy	USD	-0.2698	0.0155	-17.38	<.0001	
	USDDum	-0.0189	0.0057	-3.35	0.0013	
	PPI	0.4707	0.0242	19.43	<.0001	
Log Level	Intercept	2.6247	0.1635	16.05	<.0001	0.9669
Without Dummy	USD	-0.3023	0.0164	-18.46	<.0001	
	PPI	0.6859	0.0236	29.02	<.0001	
Log Level	Intercept	2.8919	0.1922	15.04	<.0001	0.969
With Dummy	USD	-0.3150	0.0167	-18.87	<.0001	
	USDDum	-0.0031	0.0013	-2.45	0.0164	
	PPI	0.6426	0.0289	22.23	<.0001	
Log Difference	Intercept	-0.0021	0.0011	-1.89	0.0631	0.7194
Without Dummy	USD	-0.1757	0.0310	-5.67	<.0001	
	PPI	1.1281	0.0926	12.19	<.0001	
Log Difference	Intercept	-0.0026	0.0012	-2.19	0.0313	0.7215
With Dummy	USD	-0.1411	0.0416	-3.39	0.0011	
	USDDum	-0.0844	0.0677	-1.25	0.2166	
	PPI	1.1654	0.0970	12.02	<.0001	
Log Difference	USD	-0.1597	0.0417	-3.83	0.0003	0.7075
With Dummy	USDDum	-0.0364	0.0657	-0.55	0.5813	
No Intercept	PPI	1.0919	0.0933	11.71	<.0001	

Table 5: Exchange Rate Pass-Through for All Commodities (1982-2002)
With Lagged Dependent Variable

Model	Variable	Estimates	Std Errors	t-Statistics	Significance	Adj. R-Sq
Log Level	Intercept	1.5669	0.1767	8.87	<.0001	0.9827
Without Dummy	USD	-0.1799	0.0198	-9.08	<.0001	
	PPI	0.3273	0.0491	6.66	<.0001	
	LMP	0.4894	0.0618	7.92	<.0001	
Log Level	Intercept	1.6327	0.2180	7.49	<.0001	0.9826
With Dummy	USD	-0.1844	0.0217	-8.49	<.0001	
	USDDum	-0.0005	0.0010	-0.52	0.6047	
	PPI	0.3270	0.0494	6.62	<.0001	
	LMP	0.4797	0.0648	7.4	<.0001	
Log Difference	USD	-0.1770	0.0314	-5.64	<.0001	0.7171
Without Dummy	PPI	1.0609	0.0917	11.57	<.0001	
	LMP	0.0812	0.0616	1.32	0.1915	
Log Difference	USD	-0.1620	0.0416	-3.89	0.0002	0.7144
With Dummy	USDDum	-0.0361	0.0654	-0.55	0.5831	
	PPI	1.0718	0.0943	11.37	<.0001	
	LMP	0.0824	0.0619	1.33	0.1874	