U. S. IMPORT SUPPLY BEHAVIOR: EVIDENCE FROM THE 1980s

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INTRODUCTION

Import supply has received insufficient attention in previous empirical studies of trade behavior. While the literature on the demand for imports is exhaustive, import supply studies are virtually nonexistent [Stern, Francis and Schumacher, 1976; Magee, 1975; Goldstein and Khan, 1985; and Marquez, 1991]. In fact, so little is known about the import supply curve that it is often regarded as inconsequential. Under the simple assumption of an infinite supply elasticity, single equation demand curves can be estimated without regard to supply-side effects. This study provides evidence that import supply curves may not be infinitely elastic. Furthermore, this study utilizes information from the supply side to estimate a simultaneous equations model of import behavior.

If import supply is infinitely elastic in the short run, the United States can increase its imports from the rest of the world without inducing any increases in foreign currency prices. For this to be the case, however, the world must have ample unemployed resources. This would insure that a depreciation of the U. S. currency would lead to an improvement in a trade imbalance (given the Marshall-Lerner condition)[1] since U. S. import prices would rise by the amount of the depreciation (i.e., the pass-through would be 100 percent). Many recent studies have found that pass-through of the exchange rate to the U. S. price is not 100 percent [Hooper and Mann, 1989; Fisher, 1989; Dornbusch, 1987; Baldwin, 1988]. This means that depreciation of the dollar is at least partially offset by decreases in foreign currency prices, so that the foreign supply price elasticities are less than infinite.

A major problem with many prior studies of import and export supply is the estimation of the supply curve. In particular, should the supply curve be estimated using a single equation or simultaneous equations method? It is fairly easy to obtain a single equation estimate, but the price estimate is likely to include significant specification bias.[2] Several recent studies[3] acknowledge bias in the single equation estimation approach and, instead, use simultaneous equations. Wahl and Hayes [1990] and Goldstein and Khan [1978] compare single equation with simultaneous equations methods of estimating demand. They find that simultaneous equations estimates of demand price elasticities are larger than with single equation methods. This result, in and of itself, implies supply elasticities that are less than infinite. The analysis in this paper applies the Goldstein and Khan methodology to U. S. imports.

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Unlike models examining domestic or export behavior, the estimation of a simultaneous import supply/demand model confronts the problem of choosing the relevant price variable. Foreign supply behavior depends on the foreign price, whereas U. S. demand behavior depends on the U. S. price. Since the exchange rate is needed to convert the foreign price to the U.S. price, these prices are clearly not the same. The obvious solution to this problem has been to use the single equation approach to estimate import demand, even though it is virtually undisputed that price and quantity are simultaneously determined. This study uses the U. S. dollar import price[4] when estimating U. S. import supply since this is the price relevant to U. S. policy making, and it is in response to changes in this price that the U. S. experiences changes in import supply.

Aggregate data poses another specification problem in estimating trade models. Until recently, many studies of trade behavior used only aggregate data.[5] This is appropriate only when the effects of the independent variables for the disaggregated, or in the case of this study, industry level data are the same as for the aggregate data [Maddala, 1977]. In most instances, we would not expect this to be the case for trade data. Some studies have divided aggregate data into groups of industries and studied the groups individually. Hirsch [1974] shows that trade cannot be explained with one all-embracing aggregate trade model. He explains that industries can be divided according to the trade theories to which they most closely correspond. If this is true, then the data should be disaggregated to correspond to the differing theories, since the determining variables in each theory play different roles. This study uses industry-specific data. The industries are then "grouped", but the specific industry effects are still taken into account.

TRADE THEORY

Hirsch [1974] defines three main industry groups for which alternative theories explain the direction of trade: Ricardo goods industries, Heckscher-Ohlin goods industries, and product-cycle goods industries. Hufbauer and Chiles [1974] have divided U. S. manufacturing industries at the three-digit SIC level into three corresponding groups. Since these classifications are organized by their implications for import supply, I adopt their classification of industries in the empirical analysis that follows. I assume importers within each group behave alike; however, supply behavior across groups should differ significantly.

The Hufbauer/Chiles groups differ in terms of their sources of comparative advantage. Comparative advantage for Ricardo goods producers lies in endowments of domestic natural resources and low pre-trade prices. Industries chosen for this category have a high natural resource content. For Heckscher-Ohlin goods producers, comparative advantage lies in capital-to-labor ratios and relative factor costs. These industries possess standardized technology that is universally available. Product-cycle goods are newly developed goods for which technology is not standardized and is often owned by the creators of the new products. Comparative advantage in this group depends largely on the creation of new products. These industries often require skilled labor due to complex or sophisticated production processes and product development.

TABLE 1
Semi/Unskilled to Skilled Labor Ratios
By Trade Group for the U. S. in 1980

Industry Group	Ratio of skilled labor to total employment	Ratio of semi/unskilled labor to total employment	Ratio of semi/unskilled to skilled labor
Ricardo Goods	10.16	51.55	5.07
Heckscher-Ohlin Goods	11.61	52.47	4.50
Product Cycle Goods	23.02	30.11	1.30

To test the validity of the Haufbauer/Chiles division of industries, particularly the product cycle/Heckscher-Ohlin division, I collected data on the ratios of skilled and semi/unskilled labor to all employees from the *U. S. 1980 Census of Population: Subject Reports Occupation by Industry.* To proxy skilled labor, I use data on all employees in managerial and professional specialty occupations. This category includes all managers, engineers, scientists, lawyers, etc. To proxy semi/unskilled labor, I use all employees who are operators, fabricators and laborers. Table 1 contains the weighted averages of the ratios of semi/unskilled labor to skilled labor by industry group, where the weights are based on the industry's share of production in the sample in 1980. Not surprisingly, the ratio of semi/unskilled to skilled workers is higher for both Ricardo and Heckscher-Ohlin goods industries than for product-cycle industries.

In the empirical model to be presented, I choose relative wages and the foreign investment to GDP ratio as the relevant supply variables.[6] Table 1 reveals that production workers make up much larger portions of total employment for the Ricardo and Heckscher-Ohlin industries. U. S. import-competing firms in those industries find themselves at a significant disadvantage when the domestic currency significantly appreciates since it lowers all relative foreign costs of production, particularly the cost of non-skilled labor. This allows the foreign firms to lower their prices, increasing the quantities they can sell in the United States. An appreciation makes less difference in product cycle industries, since these industries rely more heavily on skilled labor. Domestic competitors using skilled labor in developed countries such as the United States can maintain their comparative advantage for prolonged periods of time, often despite fluctuations in exchange rates.

Investment to GDP ratios are expected to exert greater impacts in Heckscher-Ohlin and product cycle goods industries. Klein [1978, 1] stresses that investment should be included as a supply determinant since the accumulation of capital contributes to the supply of goods by becoming a factor input. As foreign countries increase their investment, they become increasingly more competitive in the high technology product cycle goods industries. Foreign countries gain technology through investment of their own and through spillover effects from U. S. investment. Thus, an increase in investment by U. S. competitors leads to an increase in imports to the United States. For Heckscher-Ohlin goods industries, foreign investment may increase the foreign industry's capacity, potentially implying greater scale economies, which also leads to increases in exports to the United States. These effects provide alternative explanations to the recent hysteresis[7] literature explaining the failure of U. S. imports to decline following the large U. S. dollar depreciation in the latter half of the 1980s.

THE MODEL

Following Goldstein and Khan [1978], I use a dynamic simultaneous equations method to estimate import supply and demand. Import supply, Q^S_{it}, is a function of the import price, P^F_{it}, relative foreign wages, FW_t, and the foreign investment to GDP ratio, WI_t, in logs (as represented by the lowercase letters) and assuming a stochastic error term:

$$q^S_{it} = \beta_{0i} + \beta_1 p^F_{it} + \beta_2 fw_t + \beta_3 wi_t + \mu_{it}, \quad (1)$$

where $\beta_1 > 0$ and $\beta_2 < 0$ by the standard assumptions. Since foreign investment allows foreign firms to increase output by increasing technology and/or capacity, β_3 will be positive.

Import demand, Q^D_{it}, is a function of the import price, P^F_{it}, $U.\ S.\ GDP_t$, and the U.S. import competing price, P^D_{it}. Import demand has the following form (in logs):

$$q^D_{it} = a_{0i} + a_1 p^F_{it} + a_2 p^D_{it} + a_3 gdp_t + \mu_{it}, \quad (2)$$

where $a_1 < 0$ and a_2, $a_3 > 0$ by the standard assumptions. The assumption that a_3 is positive is common, though unnecessary. If imports are an inferior good to U. S. consumers, a_3 will be negative.

To allow for lags in the adjustments of q and p^D to their equilibrium values, imports are allowed to adjust to *excess supply*. Excess supply is defined as the change in U. S. import supply, q^S_{it}, from past imports, q_{it-1}:

$$\Delta q = \gamma[q^S_{it} - q_{it-1}] \quad (3)$$

where $\gamma > 0$. Substituting equation (1) into (3) and assuming a stochastic error term, the supply equation for estimation is:

$$q_{it} = b_{0i} + b_1 p^F_{it} + b_2 fw_t + b_3 wi_t + b_4 q_{it-1} + \epsilon_{it}, \quad (4)$$

where $b_0 = \gamma\beta_0$, $b_1 = \gamma\beta_1 > 0$, $b_2 = \gamma\beta_2 < 0$, $b_3 = \gamma\beta_3 > 0$, $b_4 = 1-\gamma > 0$.

Likewise, import prices adjust to *excess demand,* defined as the difference between current imports, q_{it}, and import demand, q^D_{it}:

$$\Delta p^F = \lambda[q^D_{it} - q_{it}] \quad (5)$$

where $\lambda > 0$. Substituting equation (2) into (5) and normalizing the import price, the demand equation for estimation is:

$$p^F_{it} = c_{0i} + c_1 q_{it} + c_2 p^D_{it} + c_3 gdp_t + c_4 p^F_{it-1}] + \epsilon_{it}, \quad (6)$$

where $c_0 = \lambda a_0/(1-\lambda a_1)$, $c_1 = -\lambda/(1-\lambda a_1) < 0$, $c_2 = \lambda a_2/(1-\lambda a_1) > 0$, $c_3 = \lambda a_3/(1-\lambda a_1) > 0$, $c_4 = 1/(1-\lambda a_1) > 0$.

ESTIMATION RESULTS

This study focuses on three- and four-digit SIC industries in the United States for the years 1981 to 1990. I chose only those industries for which both the import price indexes and matching producer price indexes are available for the entire period. Of the industries meeting this criterion, several were dropped because of missing data or significant changes in the industry definitions in the 1987 Census. The resulting sample included a total 37 industries (8 Ricardo goods industries, 19 Heckscher-Ohlin goods industries, and 10 product cycle goods industries). Imports for these industries accounted for 46 percent of total manufacturing exports to the United States in 1985. The industry divisions and data descriptions are found in the Appendix.

Since the data include both cross-sectional and time-series observations, a dynamic fixed effects model is used. The F-tests for fixed effects for each group are significant and can be found in the Appendix. The model is estimated in first differences using two stage least squares. First differencing controls for the unavoidable bias in the dynamic fixed effects model [Hsiao, 1986, 73-76] and controls for heterogeneity by eliminating the individual effects of each industry (the constants representing each industry). By removing any long-term trends, estimating the model in first differences means there will be no long-run steady state solution; what is estimated is the short-run import supply curve, which is generally assumed to be elastic. Following Hsiao, Q_{it-2} and P^F_{it-1} are used as instruments for $Q_{it-1} - Q_{it-2}$ and $P^F_{it-1} - P^F_{it-2}$. The structural estimates for the dynamic import supply and demand model are presented in Tables 2 and 3. The coefficient estimates in the model represent those of equations (4) and (6).

The coefficients in Tables 2 and 3 display the expected signs; however, all regressions exhibit low R^2. This is not uncommon for fixed effects models. Björklund [1989] attributes low R^2s to measurement problems inherent in panel data and maintains that the advantages of controlling for fixed effects outweighs the problems created by measurement errors. The problem is enhanced by simultaneous estimation. The R^2 for simultaneous equations models can even be negative, meaning that a *positive* R^2 might be considered relatively high [Goldstein and Khan, 1978].

Derivations of the elasticities discussed in equations (1) and (2) are in Table 4. The variances used to calculate the *t*-statistics reported in Table 4 follow the procedure reported in Kmenta [1986, 486]. The import supply price elasticity (for supply measured in dollars) is positive in all groups, but it is not significantly different from zero for Ricardo and for product cycle goods industries. For the case of Heckscher-Ohlin industries, however, the supply price elasticity is near 3, signifying a positively

TABLE 2
Structural Estimates of Import Supply by Trade Group for the U. S. in the 1980s

Variable	All Goods	Ricardo Goods	Heckscher-Ohlin Goods	Product-Cycle Goods
Estimated Import Price	1.4293	0.0868	2.9976	1.0089
	(0.7542)[b]	(0.9788)	(0.7658)[a]	(0.9281)
Lagged Imports	0.0219	0.0271	0.0131	0.0251
	(0.0075)[a]	(0.0140)[b]	(0.0068)[b]	(0.0098)[a]
World Invest/GDP Ratio	2.2500	0.5589	1.7423	3.0925
	(0.5406)[a]	(1.156)	(0.5206)[a]	(1.0291)[a]
Relative Foreign Wage	-1.1383	-0.7821	-1.6953	-1.0176
	(0.3899)[a]	(0.5318)[c]	(0.3588)[a]	(0.6215)[c]
R^2	0.08	0.14	0.08	0.06
Degrees of Freedom	255	52	129	66

Asymptotic SE in parentheses .
a. significant at 1 percent level. b. significant at 5 percent level. c. significant at 10 percent level.

sloped supply curve. This estimate indicates that a rather large increase in imports supplied to the United States by these industries accompanies a change in the dollar price. When all industries are combined, the estimated supply price elasticity is approximately 1.5 and is statistically significant at the 5 percent level. This estimate is a weighted average of all of the industry price elasticities in the sample and should be interpreted as such.

The simultaneous equations estimates challenge the common assumption of an infinite supply price elasticity for supply measured in foreign currency. The use of the simultaneous equations method raises the estimated demand price elasticity from the estimate obtained using the same data and a single equation regression. Single equation estimates are a weighted average of the demand and supply price elasticities. The single equation (fixed effects model) demand price elasticity estimates are in brackets in Table 4. The elasticities in the Ricardo and Heckscher-Ohlin groups are raised substantially.

The relative wage elasticity is significantly negative for the Ricardo and Heckscher-Ohlin groups. The relative wage[8] is affected by two things: (1) changes in the foreign wage in the foreign currency and (2) changes in U. S. wages in dollars. During the time period of the study, the U. S. experienced falling relative manufacturing wages. Imports increased in all groups throughout the early 1980s when relative wages were falling. While the imports in all groups did not decline with the depreciation that began in 1985, their growth slowed, which is consistent with the negative coefficient.

Interestingly though not surprising, investment-to-GDP elasticities are larger for product-cycle and Heckscher-Ohlin goods industries more than for Ricardo goods industries. The greatest effect is on product-cycle industries, in which new technol-

Table 3
Structural Estimates of Import Demand Price by Trade Group for the U. S. in the 1980s

Variable	All Goods	Ricardo Goods	Heckscher-Ohlin Goods	Product-Cycle Goods
Estimated Imports	-0.5627	-0.3582	-0.2721	-0.9944
	(0.2589)[a]	(0.2250)[c]	(0.0985)[a]	(0.6417)[c]
Lagged Import Price	0.0177	0.0047	0.0130	0.0284
	(0.0065)[a]	(0.0047)	(0.0029)[a]	(0.0125)[b]
Import Competing U.S. Price	0.7018	0.8319	0.8468	0.9036
	(0.5790)	(0.3460)[b]	(0.3778)[b]	(1.9539)
U. S. GDP	3.0826	0.3521	1.9561	7.1019
	(1.8950)[b]	(1.2124)	(0.8223)[a]	(5.9500)
R^2	0.26	0.24	0.22	0.36
Degrees of Freedom	255	52	129	66

Asymptotic SE in parentheses.
a. significant at 1 percent level. b. significant at 5 percent level. c. significant at 10 percent level.

TABLE 4
Elasticity Coefficients for the Supply and Demand Model

Supply Equation Industry Group	$\beta_1=b_1/\gamma$ Import Price	$\beta_2=b_2/\gamma$ Relative Wage	$\beta_3=b_3/\gamma$ Investment to GDP	$\gamma=1-b_2$
All	1.46	-1.16	2.30	0.98
	(1.91)[b]	(5.77)[a]	(4.09)[a]	(2.29)[b]
Ricardo Goods	0.09	-0.80	0.57	0.97
	(0.18)	(-2.95)[a]	(0.97)	(1.94)[b]
Heckscher-Ohlin Goods	3.04	-1.72	1.77	0.99
	(2.11)[b]	(-2.53)[a]	(1.76)[b]	(1.93)[b]
Product Cycle Goods	1.03	-1.04	3.17	0.97
	(0.69)	(-1.03)	(1.92)[b]	(2.56)[a]
Demand Equation Industry Group	$a_1=(1+c_4)/c_1$ Import Price	$a_2=-c_2/c_1$ Domestic Price	$a_3=-c_3/c_1$ U. S. GDP	$\lambda=-c_1/c_4$
All Goods	-1.81	1.25	5.48	31.79
	(-9.14)[a]	(4.77)[a]	(11.12)[a]	(11.91)[a]
	[-0.74]			
Ricardo Goods	-2.80	2.32	0.98	76.21
	(-2.58)[a]	(2.22)[b]	(0.50)	(1.96)[b]
	[-0.74]			
Heckscher-Ohlin Goods	-3.72	3.11	7.19	20.93
	(-4.03)[a]	(3.00)[a]	(5.20)[a]	(5.35)[a]
	[-0.77]			
Product Cycle Goods	-1.03	0.91	7.14	35.01
	(-5.79)[a]	(2.03)[b]	(11.47)[a]	(8.10)[a]
	[-0.83]			

t-statistics in parentheses. a. significant at 1 percent level. b. significant at 5 percent level. c. significant at 10 percent level. Single equation demand price elasticity estimates in brackets. [All estimates are significant at 1 percent.]

ogy is most important. The large effect on Heckscher-Ohlin goods industries indicates that when countries are acquiring standardized technology or investing to improve capacity, they significantly increase exports to the United States. The investment-to-GDP ratio is a weighted sum of two variables: (1) foreign investment to GDP ratios and (2) the U. S. investment to GDP ratio. During the period studied the United States experienced a decline in its investment to GDP ratio while average foreign investment to GDP ratios rose, leading to an increase in the index. This suggests that declining investment by U. S. firms and subsequent productivity declines may have profoundly impacted U. S. competitiveness.

Table 4 presents the import demand estimates. All variables have the expected signs. The price elasticities are higher than many previous estimates for U. S. goods. Part of this is a reflection of disaggregation by industry. Since many studies use total U. S. imports, the elasticities are generally lower, reflecting averages of all goods. Houthakker and Magee [1969] use disaggregated U. S. data and find a demand price elasticity of 4.5 for finished manufactures which is in line with the findings here. Heckscher-Ohlin goods and Ricardo goods are more sensitive to price than are product-cycle goods as is expected, since they are more likely to be homogeneous with many substitutes.

The income elasticities are also relatively high compared to prior studies, probably for the same reasons as above. Ricardo goods appear to be normal goods, as would be expected, given that they are mostly food, paper, and wood items. Heckscher-Ohlin goods and product-cycle goods appear to be a bit more of a luxury to U. S. citizens. The overall income elasticity also reveals the considerable fondness U. S. citizens have acquired for foreign goods.

The domestic import competing price is significant in determining demand for all industry groups. The cross-price elasticity is higher for Ricardo and Heckscher-Ohlin goods than for product-cycle goods. This reveals how readily consumers will switch from foreign to domestic goods when relative prices change. This is probably due to the more homogeneous nature of the goods. Consumers are more reluctant to switch from foreign brands of product cycle goods. Since these are new, and relatively-new, products, few domestic substitutes likely exist.

CONCLUSION

The structural model that I employ gives information on the effects of changes in relative foreign wages and investment to GDP ratios on U. S. imports. The results indicate that falling relative U. S. wages and a depreciating dollar make the United States more competitive, particularly in Ricardo and Heckscher-Ohlin industries. However, I also find that investment is very important in the determination of imports for Heckscher-Ohlin and product-cycle industries. This helps explain why imports did not decline in the wake of the large depreciation of the late 1980s. While rising relative wages dampened import growth, the increasing foreign investment of U. S. competitors had a profound positive impact.

Appendix Table
Data Sources and Industries Used in the Study

Import and Producer Price Indexes	**Bureau of Labor Statistics.** When four-digit SIC code indexes were not available, corresponding three digit indexes were used.
U. S. GDP; U. S. GDP deflator	**IMF.** *International Financial Statistics Yearbook.*
Import values	**U. S. Department of Commerce.** Various issues of *Trade and Employment.* Import quantities are obtained by deflating the import values with the corresponding import price indexes. This removes both the dollar price and the exchange rate.
Foreign Wage Index	Created from **U. S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology.** *Hourly Compensation Costs for Production Workers in Manufacturing: 33 Countries, All Manufacturing, Steel, and Motor Vehicles for 1975 and 1980-1990 and 37 Other Manufacturing Industries for 1975 and 1979-1989.* Washington, D.C.: The Office, 1991.
Investment to GDP ratios	*International Financial Statistics Yearbook.* An index of investment to GDP ratios of industrial countries is used to represent foreign investment. U. S. investment is included in this measure. Foreign firms (multinationals in particular) benefit from spillover effects from U. S. investment.
F-Test for Individual Effects	All: Import Price: F=7.44[a] Import Quantity: F=285.103[a]
	Ricardo Goods Industries:
	Import Price: F=8.53[a] Import Quantity: F=122.55[a]
	Heckscher-Ohlin Goods Industries:
	Import Price: F=6.909[a] Import Quantity: F=404.63[a]
	Product Cycle Goods Industries:
	Import Price: F=7.265[a] Import Quantity: F=52.751[a]
Division by Trade Theory (SIC Industry Codes)	
Ricardo Goods	2010,2030,2060,2080,2420,2435,2621,3350
Heckscher-Ohlin Goods	2220,2290,2310,2321,2380,2510,2590,3010,3143,3144,3260,3310, 3450,3496,3651,3691,3694,3710,3940
Product Cycle Goods	3531,3540,3552,3569,3570,3643,3823,3825,3861,3873

a. Significant at 1 percent.

I find that when a full structural model is employed, satisfactory estimates of import supply elasticities (from dollar prices) may be obtained for some industry groups. I find that the U. S. import supply price elasticity for Heckscher-Ohlin goods industries is almost 3, indicating an upward sloping supply curve for this group. I also obtain an overall supply elasticity for the sample of approximately 1.5. In addition, since the use of the simultaneous equations method raises the demand price elasticities over those obtained using a single equation estimate, the assumption of an infinite supply elasticity (from foreign currency prices) may not be valid in many demand studies.

NOTES

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1. The Marshall-Lerner condition says that if the sum of the price elasticities of import demand and export demand are greater than one in absolute value, then depreciation will improve the balance of trade.
2. Single equation demand price estimates are biased downward because they are weighted averages of the supply and demand price elasticities. Simply fitting a curve to price and quantity combinations of imports will lead to estimation of the import demand curve only if the movement between points on the curve represents a shift in the supply curve. If the movement is due to a shift in the demand curve, then a supply curve is being estimated. It is also possible that the movement is due to combinations of shifts of both supply and demand, in which case, the estimate has little meaning. Single equation estimates of demand are common "in practice" [Thursby and Thursby, 1984]. Haynes and Stone [1983] use the single equation method to estimate import and export supply curves.
3. Marquez [1994] with a study of U S. imports and Newman, Lavy, and de Vreyer [1995], Sukar and Krishnan [1995], Eales and Unnevehr [1993], and Beenstock, Lavi, and Ribon [1994], Wahl and Hayes [1990] with various studies of domestic and export supply.
4. This measure is also used by Marquez [1994] and Haynes and Stone [1983].
5. Bilateral or single industry studies are also common.
6. Of recent studies using simultaneous models, some measure of production costs has been used. (For example, Newman, Lavy, and de Vreyer [1995] use wages; Eales and Umevebr [1993] use livestock production costs; Leamer [1981] uses civilian employment.) Both Marquez [1994] and Leamer [1981] concede the shortcomings of ignoring some measure of capital. Newman, Lavy and Vreyer [1995] include a capital stock variable in their supply curve equation.
7. Hysteresis in the international context refers to the failure of U. S. imports to decline following the large depreciation of the dollar in the latter half of the 1980s. In the hysteresis literature, sunk costs of entry are the primary wedge between entry and exit costs. An appreciation of the dollar (such as the appreciation in the early half of the 1980s) that allows foreign firms to cover their sunk costs of entry must be followed by a much larger depreciation to encourage exit [Baldwin, 1988; Baldwin and Krugman, 1988].
8. Country wages are expressed in dollars as a percentage of U. S. wages. I used the following weights for the top ten U. S. trading partners in 1985: Germany 0.082, France 0.027, Italy 0.027, Canada 0.202, Japan 0.202, United Kingdom 0.183, South Korea 0.037, Singapore 0.021, Taiwan 0.123, Brazil 0.096. The countries and country weights used are from Mohamed [1990]. After creation of the index, I multiplied the index by a (Federal Reserve) measure for the real exchange rate to remove the effects of the exchange rate on wages.

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