The Dollar and U.S. Imports after 1985

by Thomas Klitgaard

The dollar's dramatic appreciation in the first half of the 1980s made imported goods more affordable relative to those manufactured in the United States. Indeed, the strong dollar helped to make the volume of U.S. non-oil imports grow three and a half times faster than overall domestic purchases in the United States from 1980 to 1985. The dollar's subsequent fall might have been expected to slow the penetration of foreign goods into U.S. markets, yet the volume of imported goods still grew three times faster than total domestic purchases from 1985 to 1992.

Some observers have interpreted the continued rapid growth of imports in recent years as evidence that changes in the dollar exchange rate have lost some of their power to influence the demand for foreign goods. In particular, they contend that import behavior may have undergone a permanent structural shift in the first half of the 1980s when the dollar's value was persistently far above levels warranted by foreign and domestic price levels. Such overvaluation of the dollar may have caused important changes in U.S. markets that could not be reversed by the dollar's subsequent fall.

This article examines whether structural changes have, in fact, significantly altered import behavior. It tests this hypothesis by determining whether imports after 1985 responded to the dollar and other macroeconomic forces in a manner consistent with, or contrary to, historical norms.

The article begins by assessing the relationship between the dollar and imports. It surveys the arguments supporting the claim that the dollar's strength in the early 1980s made imports in subsequent years unusually resilient to the dollar's decline and to changes in other macroeconomic determinants. The second section reviews import developments after 1985, highlighting the extent of the dollar's fall, the penetration of imports into U.S. markets, and the behavior of import prices relative to those for domestically produced goods. In the article's third section, a simple macroeconomic model for non-oil imports based on data up to the dollar's peak in 1985 is estimated to compare import behavior before and after 1985. Finally, the analysis is extended to four major commodity groups to search for market-specific changes that may have been obscured by the focus on imports as a whole.

The results indicate that any changes in market structures over the 1980s have not been large enough to alter import behavior significantly. The prices and volumes of imports responded as strongly to the dollar after 1985 as they did before 1985. In particular, both the rise in import prices and the moderation in the demand for foreign goods after 1985 appear to be in line with historical experience once the dollar is considered alongside the behavior of other relevant macroeconomic factors. Most notable among these macroeconomic factors is the increase in domestic prices after 1985, a development that helped ensure the continuing attractiveness of foreign goods and thereby offset some of the impact of the dollar's fall. The rapidly increasing prominence of computers as a share of total non-oil imports also contributed to the perception that the dollar had lost some of its influence on imports after 1985. The price and volume measures of computers are designed to reflect the pace of technological innovation, a practice that makes their behavior largely unresponsive to changes in the dollar. The analysis shows that once computers are excluded, the demand for foreign

goods since 1985 seems to have been somewhat weaker than expected.

The analysis by commodity groups, while highlighting differences in behavior, confirms that the demand for imported goods since the mid-1980s can be well explained by macroeconomic determinants. The demand for capital goods, consumer goods, and industrial supplies after 1985 roughly matches historical experience; only in the case of autos does a macroeconomic model fail to accurately track import behavior after 1985. One reason for this failure is that the model does not account for the transfer by Japanese firms of a sizable share of their assembly production to the United States in recent years.

The dollar's influence on imports

Concerns about the long-run impact of the strong dollar are rooted in the notion that the dollar's rise in the first half of the 1980s was so out of line with relative unit labor costs or relative prices that it severely damaged the competitive position of U.S. firms. The implication is that U.S. markets were significantly altered in ways that were not offset when the dollar eventually returned to a more reasonable range. These alleged structural changes would consequently affect the response of import prices and volumes to the dollar and other macroeconomic forces after 1985.

Several arguments have been advanced to justify these concerns. Some analysts have suggested that the dollar's strength in the first half of the 1980s significantly increased the competitive pressure in U.S. markets. In theory, a dollar appreciation restrains import prices since it lowers the production costs for foreign producers when these costs are denominated in dollar terms.[1] The dollar's strength in the first half of the 1980s made sales to the United States more profitable by widening the gap, in home currency terms, between revenues and costs for an extended period. As a result, many foreign firms were encouraged to make the initial investment needed to enter U.S. markets—an investment that they would otherwise have viewed as too expensive.[2] Since the entry of additional firms made U.S. markets more competitive, exerting downward pressure on prices, all firms ended up suffering a secular decline in profit rates over the course of the 1980s.[3] Consequently, foreign firms were not able to raise their prices as much as they had in the past when the dollar fell.[4] If foreign goods remained unusually competitive in price, then import demand may not have weakened as much as it normally would have.

Another theory is that the dollar's strength, by lowering foreign production costs relative to domestic costs, encouraged significantly more investment abroad than in the United States during the first half of the 1980s.[5] By this reasoning, foreign plants had an unusual opportunity to develop products that could compete in quality and technical sophistication with those produced in the United States. These plants were therefore better positioned than in the past to maintain sales when the dollar depreciated.

An additional suggestion is that the dollar's strength may have forced an unusually large number of domestic firms to either fold or shift production overseas. The dollar's subsequent decline was not enough, according to this view, to return this lost production capacity to the United States. Consequently, as the availability of domestically produced alternatives to foreign goods diminished, consumers were less likely than in the past to shift away from foreign goods when import prices were pushed up by the falling dollar.

These arguments appear plausible, but there is reason to question their empirical significance. The proliferation of foreign goods in U.S. markets and the investment in plants abroad by domestic firms have been ongoing developments. Although the rise in the dollar may have accelerated the process, it is not clear that it has significantly altered the previously observed relationship between the dollar and imports. In addition, while some industries may have undergone important structural changes because of the dollar's strength, the

[1]Foreign firms, operating in imperfect markets, have some latitude in deciding how much of any decline in dollar production costs to pass on through lower prices. Import price behavior in imperfectly competitive markets is discussed in Rudiger Dornbusch, "Exchange Rates and Prices," *American Economic Review*, January 1987, pp 93-106; Paul Krugman, "Pricing to Market when the Exchange Rate Changes," in Sven Arndt and J. David Richardson, eds., *Real-Financial Linkages Among Open Economies* (Boston: MIT Press); and Ken Froot and Paul Klemperer, "Exchange Rate Pass-Through When Market Share Matters," *American Economic Review*, September 1989, pp. 637-54.

[2]Richard Baldwin refers to this as establishing a beachhead once *Footnote 2 continued* foreign firms gets into U.S. markets, it is difficult to get them out ("Hysteresis in Import Prices: The Beachhead Effect," *American Economic Review*, December 1988, pp. 773-85).

[3]Ferdinand Protzman, "Why the Lower Dollar Didn't Work," *New York Times*, December 1, 1992, p. D1.

[4]This argument posits a decline in the markup but not in the dollar elasticity. Narrower profit margins might actually increase the role of the dollar since foreign firms would be less able to absorb currency swings.

[5]Peter Hooper found evidence of relatively rapid investment abroad in the first half of the 1980s, although he noted that this trend continued even after the dollar had depreciated. See "Comments on 'U.S. External Adjustment: Progress, Prognosis, and Interpretation'" by William Cline, in C. Fred Bergsten, ed., *International Adjustment and Financing* (Washington, D.C.: Institute of International Economics, 1991), pp. 57-63.

industries affected may not be large enough to influence the behavior of imports as a whole

Import behavior

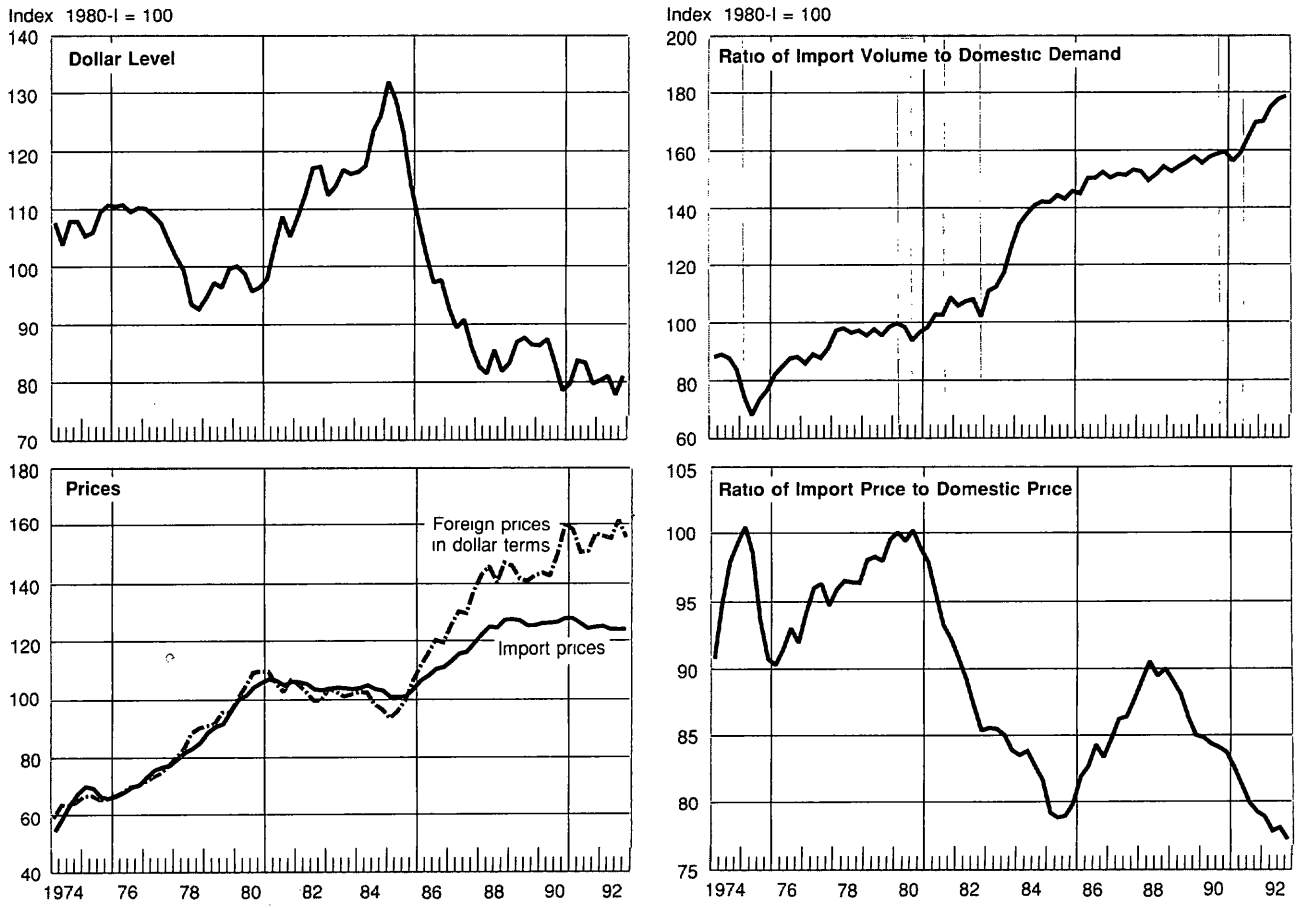
An initial review of import behavior indicates that foreign goods have had continued success in U S markets despite the dollar's decline from its 1985 peak. As the dollar appreciated from 1980 to 1985, the volume of non-oil imports grew at an annual rate of 12 percent, or roughly three and a half time times faster than total domestic purchases by U S residents [6] Import growth did moderate with the dramatic depreciation of the dollar, rising at a 5 percent annual rate from 1985 to 1992 Nevertheless, because of the slowdown in domestic growth, imports still grew three times faster than total domestic purchases

The dollar's rise and subsequent fall over the 1980s were so pronounced that they should have had a substantial impact on U S import behavior Chart 1 plots an import-weighted average of dollar exchange rates against the currencies of the six major industrial countries The index peaked in the first quarter of 1985, reaching a level more than 30 percent above its 1980 average, largely because of the dollar's strength against the European currencies The dollar then fell sharply, so that by the end of 1987 this index was almost 20 percent below the 1980 average. The decline was the most

[6]The term "domestic purchases" represents purchases of domestic and imported goods and services It is equivalent to domestic demand, which is GDP minus exports plus imports

Chart 1

Non-Oil Imports and Their Macroeconomic Determinants



Sources National Income and Product Accounts, Bureau of Labor Statistics, International Monetary Fund

dramatic, by far, against the Japanese yen After 1987, the index rose slightly until the end of the decade, but then declined modestly from 1990 through 1992

A strong connection between the dollar's movements and the purchase of foreign goods seems evident before 1985. When the dollar appreciated in the first half of the 1980s, the ratio of real non-oil imports to domestic purchases jumped sharply (Chart 1) The connection, however, is less clear after 1985 The large dollar depreciation from 1985 to 1987 failed to keep the ratio from rising, and in recent years, despite the dollar's continuing decline, the ratio jumped once again as non-oil imports grew thirteen times faster than domestic purchases from 1990 to 1992

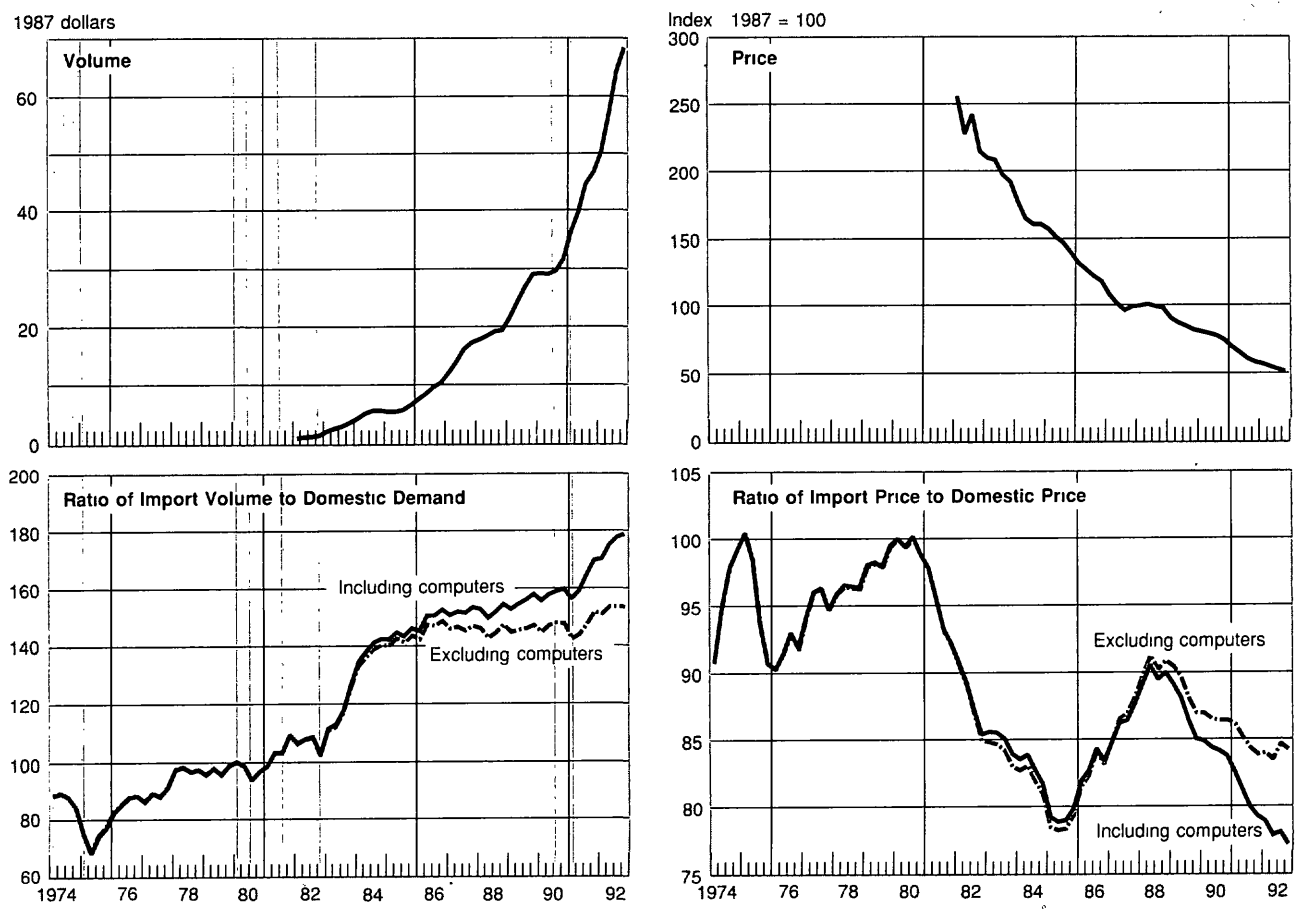
Part of the reason for the strength in imports could be that import prices did not rise as much as expected when the dollar fell. A simple price model that uses foreign production costs converted into dollar terms tracks import prices quite well until 1985 (Chart 1) [7] But after 1985, import prices did not rise nearly as much as foreign production costs, giving some preliminary support to the contention that foreign firms chose to limit their price increases in order to compete in U S markets.

Another important factor is that domestic prices continued to rise at a steady pace after 1985, offsetting the increase in import prices While import prices did rise significantly after 1985, the impact on import demand

[7]Foreign production costs are proxied by an import-weighted average of producer price inflation in the six major foreign countries Canada, France, Germany, Italy, Japan, and the United Kingdom

Chart 2

Computer Imports



Sources National Income and Product Accounts, Bureau of Labor Statistics

would ultimately depend on how import prices moved relative to domestic prices In the first half of the 1980s, the ratio of import prices to domestic producer prices fell as domestic prices rose while import prices declined slightly, held down by the strong dollar (Chart 1). The result was a sharp improvement in the price competitiveness of foreign goods that mirrored the rise in the dollar The depreciation of the dollar then pushed import prices higher, but domestic inflation prevented domestic products from regaining all the price advantage they had lost in the first half of the 1980s. When the dollar stabilized around the end of 1987, U S prices continued to rise while import prices remained essentially unchanged, causing the ratio to turn against domestic goods By the early 1990s, this measure of price competitiveness returned to the unfavorable level it had held in 1985 when the dollar was at its peak, indicating that all the gains from the dollar's steep fall had by then disappeared

A factor beyond macroeconomic considerations that explains the resilience of imports is the methodology used to measure computer imports. Specifically, the price index for computers used in the National Income and Product Accounts (NIPA) reflects the steep decline in the price of computing power over time. Consequently, this index is driven entirely by technological progress rather than by dollar movements or foreign production costs (Chart 2) [8] Since the volume measure for computers is defined as the nominal value divided by the technology-adjusted price index, its very rapid

[8]Ellen Meade discusses the construction of the NIPA computer price deflator in "Computers and the Trade Deficit The Case of Falling Prices," in Peter Hooper and J David Richardson, eds , *International Economic Transactions* (Chicago University of Chicago Press, 1991), pp 61-81 Also see Dan Citrin, "The Recent Behavior of U S Trade Prices," *IMF Staff Papers*, December 1989, pp 934-49, and Robert Lawrence, "The Current Account Adjustment An Appraisal," *Brookings Papers on Economic Activity*, 1990 2, pp 343-92

Table 1

Price and Volume Regressions

	Price					
	Constant	Trend	Foreign Production Costs	Dollar	Adjusted R-squared	Augmented Dickey-Fuller Statistic
1974-I to 1985-I						
Non-oil	1 4	−0 002	1 1	−0 7	0 99	4 9
	(3 2)	(1 1)	(11 1)	(13 1)		
Non-oil, noncomputers	1 3	−0 002	1 1	−0 7	0 99	4 6
	(3 1)	(1 4)	(11 3)	(13 4)		
1981-IV to 1992-IV						
Non-oil	1 2	−0 003	1 1	−0 6	0 95	2 9
	(1 6)	(2 8)	(4 3)	(10 5)		
Non-oil, noncomputers	0 4	−0 002	1 3	−0 7	0 98	3 9
	(0 5)	(2 2)	(5 9)	(13 3)		

	Volume					
	Constant	Trend	Domestic Demand	Relative Price	Adjusted R-squared	Augmented Dickey-Fuller Statistic
1974-I to 1985-I						
Non-oil	−12 7	−0 002	2 6	−0 7	0 97	5 3
	(6 7)	(0 2)	(11 1)	(5 2)		
Non-oil, noncomputers	−12 8	−0 001	2 6	−0 7	0 97	5 3
	(6 8)	(0 3)	(11 2)	(4 9)		
1981-I to 1992-IV						
Non-oil	−13 2	−0 002	2 7	−0 8	0 99	4 5
	(13 6)	(2 5)	(22 7)	(9 7)		
Non-oil, noncomputers	−13 8	−0 004	2 8	−0 8	0 99	4 5
	(13 5)	(5 3)	(23.9)	(10 2)		

Notes Data are in log levels Data from the National Income and Product Accounts reflect August 1993 revisions The MacKinnon ADF critical values are 4 1 (10 percent) and 4 4 (5 percent)

growth is also a reflection of technological progress, making this component of imports essentially independent of domestic demand and relative price development [9]

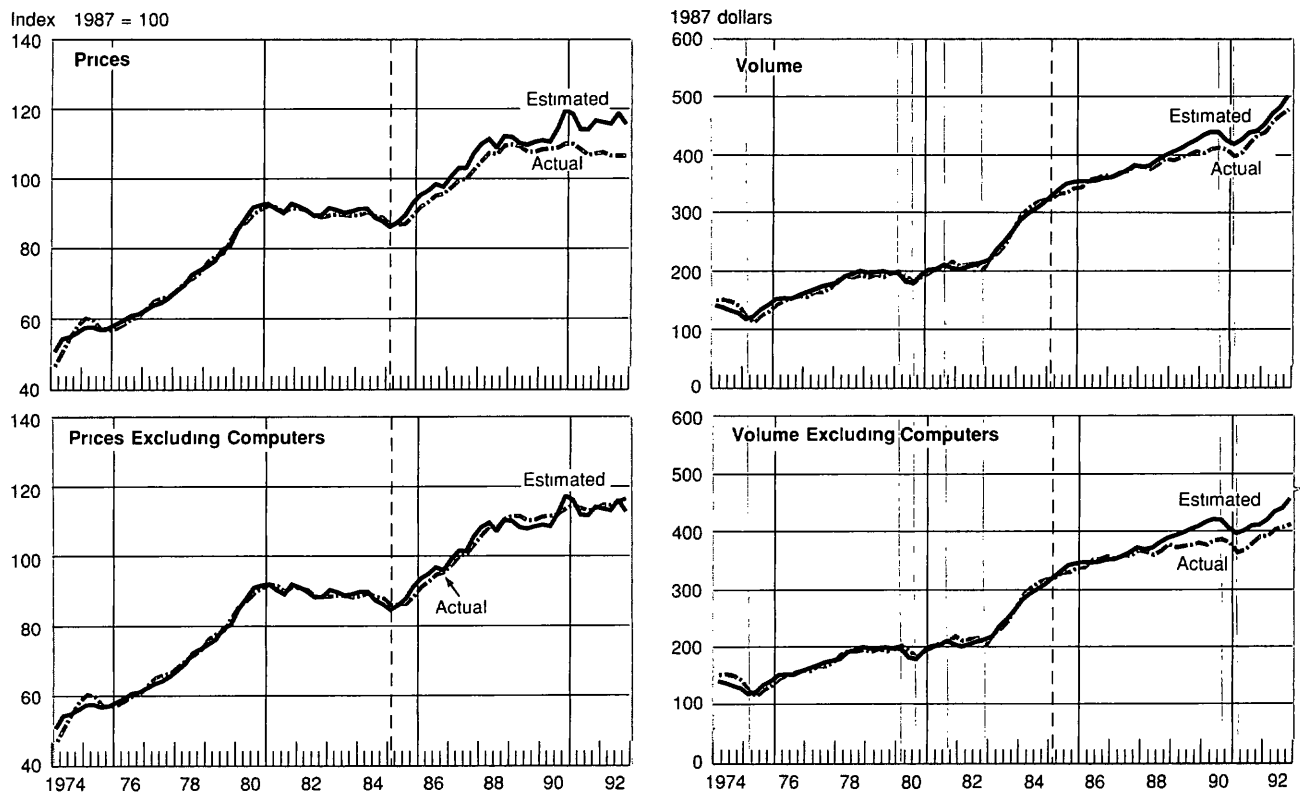
The measurement of computers has become increasingly important in interpreting the connection between imports and macroeconomic forces over time since computers have grown much more rapidly than total imports. In 1985, the difference between import prices with and without computers was small, but by 1992, the deflationary impact of computer prices had become quite large Excluding computers reduces the 1992 gap between import prices and foreign production costs seen in Chart 1 by almost half. In addition, the ratio of import to domestic prices, whose decline since the late 1980s indicates a loss of U.S. price competitiveness, falls only half as much if computers are not included (Chart 2). As for import volume, the contribution of computers accounts for much of the resilience of non-oil imports after 1985. If computers are excluded from the ratio of imports to domestic purchases, the increased penetration of U S. markets by foreign goods in the second half of the 1980s disappears, while the jump in the ratio in 1991 and 1992 is much more modest than the earlier calculation suggested (Chart 2).

In sum, an examination of the data indicates that the robust demand for foreign goods after 1985 can be explained, at least in part, by domestic inflation that offset the rise in import prices following the dollar's decline and by the special technology adjustment used

[9]The impact of computers on the growth of real non-oil imports after 1985 was much greater when the NIPA data were calculated in 1982 dollars

Chart 3

Comparison of Actual and Estimated Non-Oil Imports



Note Estimated values are based on regressions from 1974-I to 1985-I

Sources National Income and Product Accounts, Bureau of Labor Statistics

to measure computer imports Still, given the complicated relationship between imports and macroeconomic forces, this initial examination is not sufficient to determine whether import behavior has changed over time The statistical analysis in the next section addresses this question by comparing import behavior before and after 1985

Empirical analysis

The simple model of U S non-oil imports developed here has two equations one for dollar import prices dependent on foreign production costs and the dollar and another for volumes based on domestic purchases and relative prices The equations, estimated in log level form and without lags, initially use data only up to the dollar's peak in the first quarter of 1985 to create a baseline representation of import behavior before the dollar's fall [10] These results are interpreted as representing the expectations held in 1985 of how imports would respond to the dollar's fall and other macroeconomic developments.

Using this framework, one can then search for changes in import behavior The regressions are rerun in a sequence, each time subtracting the first year in the estimation period and adding a more recent year to identify any systematic change in the estimated elasticities over time To get another perspective, the base model is used to project price and volume behavior since 1985 and these out-of-sample results are compared with actual imports over the last eight years This procedure visually underscores any behavior diverging from pre-1985 expectations and, in those cases where the elasticities appear to remain constant, highlights important developments not captured by basic macroeconomic determinants.

Once a model for non-oil imports is constructed, the analysis is extended to the four major commodity groups to see if particular industries have experienced structural changes not evident when imports are con-

[10] Spurious results from using levels are avoided if the residuals from the regressions are stationary The test for stationary used here is the augmented Dickey-Fuller statistic See Robert Engle and Clive Granger, "Co-integration and Error Correction Representation, Estimation, and Testing," *Econometrica*, March 1987, pp 251-76 James Stock shows that using levels is more efficient than using

Footnote 10 continued
first differences ("Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors," *Econometrica*, December 1987, pp 1035-56) Note that the equations have high serial correlation, a feature that makes the t-statistics unreliable All the variables involved are nonstationary

Table 2

Import Prices by Commodity Group

	Constant	Trend	Foreign Production Costs	Dollar	Adjusted R-squared	Augmented Dickey-Fuller Statistic
1974-I to 1985-I						
Industrial supplies	1 0 (2 3)	−0 014 (5 3)	1 7 (14 9)	−0 7 (6 4)	0 98	4 8
Capital goods (excluding computers)	2 5 (4 5)	−0 002 (0 9)	0 8 (6 1)	−0 5 (9 2)	0 94	4 6
Autos	2 7 (4 1)	0 015 (6 1)	0 6 (3 5)	−0 7 (8 2)	0 98	4 7
Consumer goods	3 6 (6 0)	0 003 (1 4)	0 6 (4 2)	−0 5 (7 9)	0 95	4 2
1981-IV to 1992-IV						
Industrial supplies	2 3 (2 4)	−0 004 (3 7)	0 8 (4 0)	−0 8 (8 1)	0 79	2 2
Capital goods (excluding computers)	0 9 (0 9)	−0 004 (2 8)	1 4 (4 6)	−0 8 (11 4)	0 97	3 9
Autos	7 3 (9 2)	0 009 (11 9)	−0 6 (3 1)	−0 2 (5 0)	0 99	2 2
Consumer goods	3 2 (3 9)	0 002 (2 0)	0 6 (2 6)	−0 4 (7 2)	0 98	3 0

Note The MacKinnon ADF critical values are 4 1 (10 percent) and 4 4 (5 percent)

sidered as a whole [11] There are significant gains in evaluating volume behavior in this manner since the demand and price determinants can be chosen to correspond narrowly to developments in each commodity group. The commodity-specific approach is less useful for understanding prices because data on foreign production costs for each commodity group are not available. Price equations, therefore, rely on cost information that is essentially the same as that used for total imports to capture significant differences in price behavior.[12] Even with this limitation, the results offer some insight into how the dollar's impact may or may not have changed over time

[11]The components of real non-oil imports not modeled are food ($26 billion in 1992), computers ($60 billion), aircraft ($10 billion), and "other" ($31 billion)

[12]Exchange rate and foreign cost data were reweighted on the basis of import shares in each category

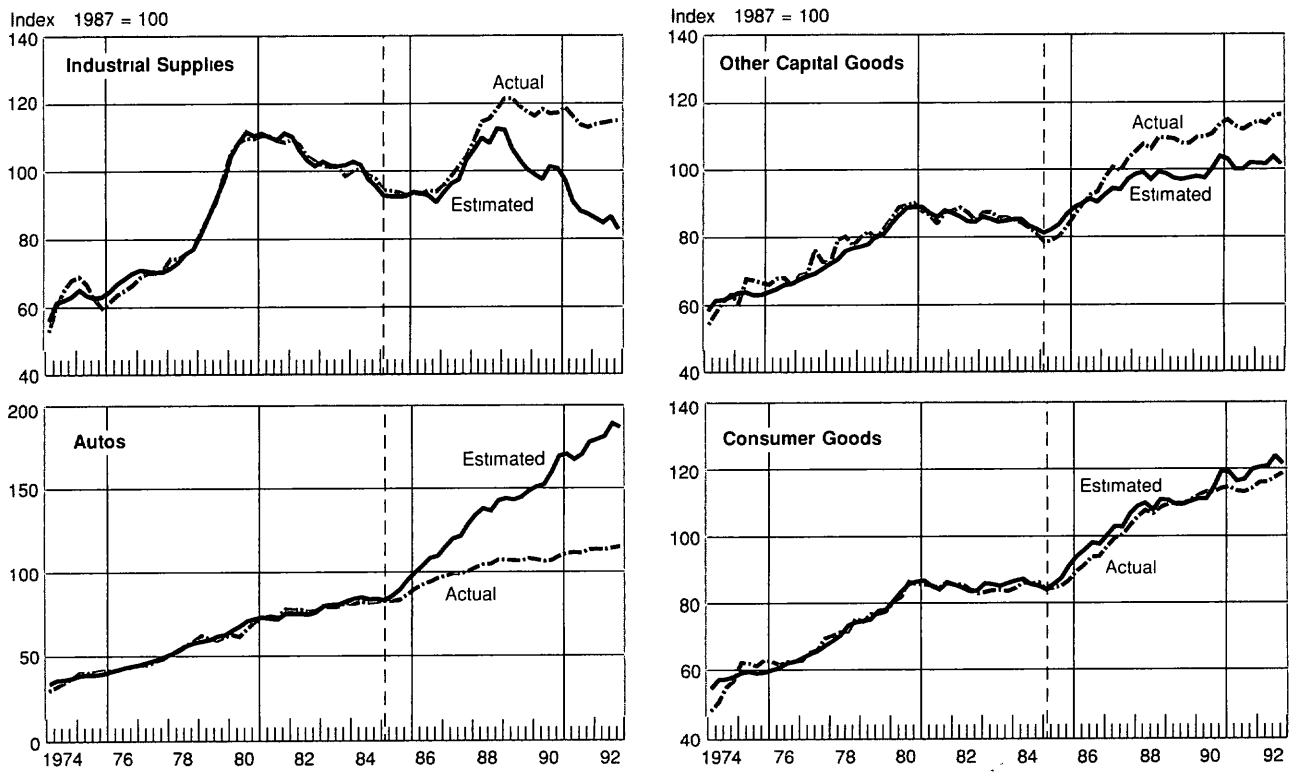
Non-oil imports

The price equations, estimated only with data up to the dollar's peak in the first quarter of 1985, indicate that foreign firms reacted less than fully to the dollar before 1985 (Table 1) [13] The dollar elasticity of −0 7 suggests that a 10 percent fall in the dollar tends to raise import prices by 7 percent This estimate is in line with those reached in previous empirical studies that found foreign firms absorbing part of any exchange rate swing into their profits. A 1986 survey reported that most dollar price elasticity estimates

[13]For a theoretical justification, see Peter Hooper and Catherine Mann, "Exchange Rate Pass-through in the 1980s The Case of U S Imports of Manufacturers," *Brookings Papers on Economic Activity*, 1989 2, pp 297-329 Another common specification views import prices as dependent on foreign export prices in dollar terms See Lawrence, "The Current Account Adjustment," and Citrin, "The Recent Behavior of U S Trade Prices " U S prices are also sometimes included to capture the practice of pricing to market, but they are not found to be significant in this study

Chart 4

Comparison of Actual and Estimated Import Prices



Note Estimated values are based on regressions from 1974-I to 1985-I

Sources National Income and Product Accounts, Bureau of Labor Statistics

were between −0 5 and −0.7, while a 1989 survey found that elasticity estimates were centered around −0.8.[14] The foreign production cost elasticity is 1 1, indicating that any increase in costs borne by foreign firms is fully incorporated into their dollar prices.[15] Earlier studies tended to find a somewhat lower cost elasticity of between 0 7 and 1.0.[16] The estimated equation for import prices with computers excluded is essentially the same since computers represent a small share of imports during the estimation period.

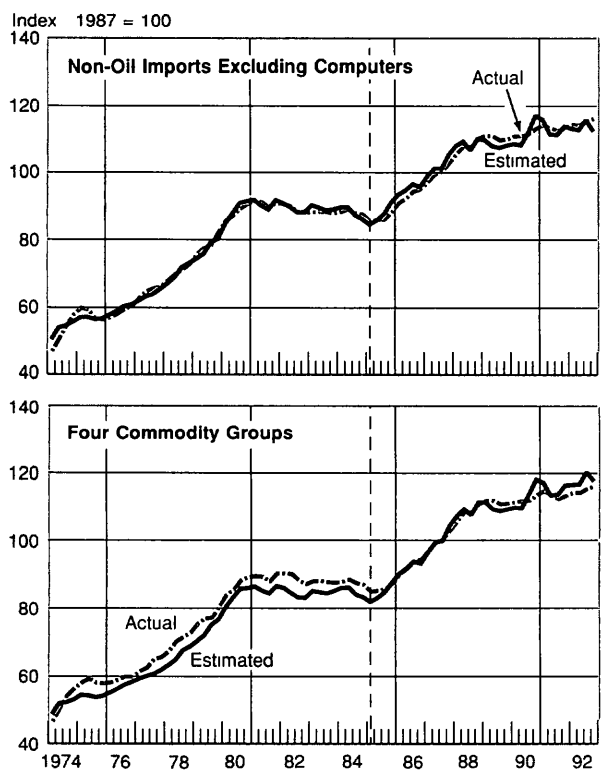
The coefficients in the volume equations are also similar to those found in other studies (Table 1).[17] The estimated elasticity for changes in import prices relative to domestic prices is −0.7, implying that a 10 percent rise in import prices lowers real imports 7 percent. Price elasticities in previous models tended to be in the range of −0 7 to −1.0.[18] The coefficient on domestic demand, meant to reflect the demand for both domestic and foreign goods, is 2.6, indicating that U S consumers spend 2.6 percent more on imported goods for every 1 0 percent increase in domestic purchases of goods and services As a consequence, real imports typically rise faster than domestic demand when the economy is growing and fall faster when the economy is in a recession In previous studies, the domestic demand or income (depending on the model) elasticity tended to be around 2 0, although a higher value was not unusual For example, a model developed by Lawrence in 1989 found a domestic demand elasticity of 2 5 [19] Like the results for the two price equations, the elasticity estimates are essentially unchanged when computers are excluded.

The price and volume equations estimated are roughly consistent with previous empirical work and so will be interpreted as reasonable representations of import behavior up to 1985 The lower half of Table 1 lists the final regressions from a series of rolling regressions, with the interim set of estimates left to the appendix (Table A1) The results from the last estimation period indicate little change in the response of imports to the dollar after 1985· both the dollar elasticity in the price equation and the relative price elasticity in the volume equation remain roughly the same in the two sample periods. This conclusion is not affected by computers.

The importance of computers becomes clear, however, when the regressions are used to project import

Chart 5

Import Prices



Notes Estimated values are based on regressions estimated from 1974-I to 1985-I Lower panel of chart shows weighted averages of results of commodity group regressions This average excludes food, computers, aircraft, and "other "

Sources National Income and Product Accounts, Bureau of Labor Statistics

[14]For the survey results, see Catherine Mann, "Prices, Profit Margins, and Exchange Rates," *Federal Reserve Bulletin*, June 1986, pp 366-79, and Hooper and Mann, "Exchange Rate Pass-through in the 1980s " Hooper and Mann's own analysis found elasticity estimates of between −0 5 and −0 6

[15]An alternative measure of foreign production costs, unit labor costs, yielded a lower estimate of 0 7

[16]Estimates included 0 9 in Helkie and Hooper, "An Empirical

Footnote 16 continued
Analysis of the External Deficit," 0 8 in Lawrence, "The Current Account Adjustment An Appraisal," and 0 8 in Michael Moffet, "The J-Curve Revisited An Empirical Examination for the United States," *Journal of International Money and Finance*, September 1989, pp 425-44

[17]Actual rather than projected import prices are used for the volume regressions

[18]Elasticities in other models are listed in Ralph Bryant, Gerald Holtham, and Peter Hooper, *External Deficits and the Dollar* (Washington D C Brookings Institution), pp 133-34

[19]Many studies use gross domestic product (GDP) instead of domestic demand, which is GDP minus net exports Using GDP in these regressions raises the elasticity by roughly 0 5

behavior after the first quarter of 1985 (Chart 3) For non-oil import prices, the projected path closely tracks the substantial rise in prices that immediately followed the dollar's fall But over time a large gap develops, with import prices falling in recent years while the projected path rises. Once the deflationary impact of computers is eliminated, this gap disappears and the projected path closely tracks prices through 1992. The influence of computers on import volumes is also evident the projection of non-oil imports is fairly accurate through 1992, while the equation without computers indicates that imports were unexpectedly weak starting in 1988. The conclusions from this analysis—that import prices behaved in an expected fashion and that real imports have been surprisingly weak—are consistent with the findings of other recent empirical studies With computers excluded, the volume equation here overpredicts real imports in 1990 by $20 billion, a discrepancy that remains roughly unchanged through 1992. A model developed by Lawrence found that non-oil, non-computer imports were $30 billion less than expected in 1990, while the Helkie-Hooper model found that non-oil imports were $20 billion less [20]

Major commodity groups

The estimated import price equations for each of the major commodity groupings—industrial supplies, capital goods, autos, and consumer goods—tend to be similar to the non-oil price equation (Table 2). The dollar elasticity of −0 7 for both industrial supplies and autos is the same as the estimate for non-oil imports, while capital goods and consumer goods, with elasticities of

[20]See Lawrence, "The Current Account Adjustment An Appraisal," including Peter Hooper's comments

Table 3

Import Volume by Commodity Group

	Constant	Trend	Demand	Price	Adjusted R-squared	Augmented Dickey-Fuller Statistic
1974-I to 1985-I						
Industrial supplies	0 0	−0 007	1 8	−0 9	0 82	5 2
	(0 0)	(4 5)	(9 6)	(6 5)		
Capital goods (excluding computers)	0 7	0 015	1 2	−0 8	0 98	4 2
	(0 7)	(4 4)	(7 9)	(5 2)		
Autos	3 5	0 012	0 8	−0 8	0 84	3 9
	(3 1)	(8 6)	(8 2)	(3 3)		
Consumer goods	−4 2	−0 013	2 7	−1 4	0 96	4 3
	(2 7)	(2 8)	(8 0)	(5 4)		
1981-IV to 1992-IV						
Industrial supplies	1 9	−0 003	1 7	−1 1	0 95	3 4
	(2 3)	(3 2)	(11 3)	(11 9)		
Capital goods (excluding computers)	−2 2	0 011	1 6	−0 6	0 96	4 3
	(2 2)	(10 4)	(11 9)	(4 7)		
Autos	−1 4	0 002	1 1	−0 0	0 92	2 8
	(1 1)	(1 0)	(13 9)	(0 1)		
Consumer goods	−5 4	−0 012	2 6	−1 0	0 97	3 5
	(6 3)	(7 2)	(18 5)	(7 4)		

Notes Demand and domestic price variables are defined for each commodity group as follows

Imports	Specific Demand	U S Producer Prices
Non-oil	Domestic purchases (GDP minus net exports)	Finished goods excluding food and energy
Industrial supplies	Industrial production	Intermediate goods excluding food and energy
Capital goods, excluding computers, aircraft	Producers' durable equipment excluding autos, aircraft, and computers	Capital goods
Autos	Personal consumption of autos	Motor vehicles and equipment
Consumer goods	Personal consumption of selected items	Finished consumer goods

The MacKinnon ADF critical values are 4 1 (10 percent) and 4 4 (5 percent)

−0.5, appear to be somewhat less responsive to the dollar The production cost elasticities for all categories but industrial supplies fall in the range of 0.6 to 0.8, below the 1 1 estimate for non-oil imports, while the estimate for industrial supplies is 1 7

When the equations are reestimated using recent data, the dollar's influence either stays roughly the same or becomes stronger for all the categories except autos, while the cost elasticities change dramatically in three of the four categories the elasticity for autos falls from 0 6 to −0 6 and for industrial supplies from 1 7 to 0 8, it rises from 0 8 to 1 4 for capital goods (see appendix, Table A2). These large shifts in the cost elasticities should be interpreted with caution since they may be due more to the lack of production cost data by commodity group than to any systematic change in the response of import prices to costs

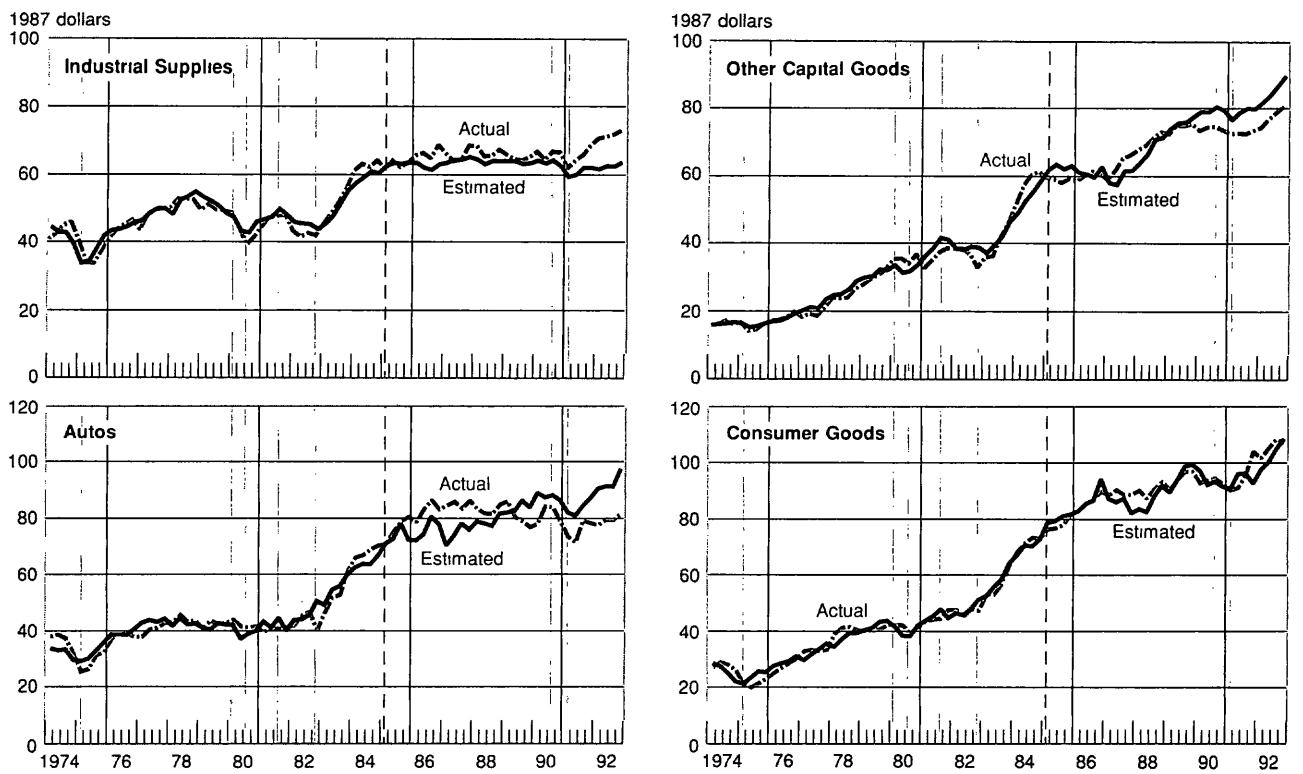
The instability of the production cost elasticities probably explains why the regression projections do a poor job of tracking import prices, particularly for autos and industrial supplies. One factor specific to autos is the impact of the voluntary export constraints on prices in the first half of the 1980s (Chart 4).[21] These restrictions distorted price behavior from 1981 to 1985 by pushing up import prices to match demand just when the rising dollar would have suggested more modest price increases [22] They became nonbinding in 1985, at a time

[21]Efforts to use either a dummy for the period of import restraints or a measure of domestic prices to catch any response to market prices were not successful

[22]Charles Collyns and Stephan Dunaway estimated that the base price of Japanese cars was $600 higher in 1984 because of the voluntary restraints ("The Cost of Trade Restraints The Case of Japanese Automobile Exports to the United States," *IMF Staff Papers*, March 1987, pp 150-75)

Chart 6

Comparison of Actual and Estimated Import Volumes



Note Estimated values are based on regressions from 1974-I to 1985-I

Sources National Income and Product Accounts, Bureau of Labor Statistics

when the dollar was beginning to fall, and thereby took upward pressure off prices just when the dollar would have suggested a pickup in prices The effort to capture the rapid price inflation in the first half of the 1980s forces the regression to greatly overestimate import price inflation in the second half of the decade

The inability to track import prices after 1985 does not prevent the four projections, when averaged according to their import shares, from being consistent with the close fit achieved by the non-oil price equation seen above (Chart 5) The errors of the four projections, driven in part by the use of broad production cost measures for each category, roughly offset each other, with the less than expected increase in auto prices after 1985 matched by the larger than expected price hikes for industrial supplies and, to a lesser extent, for capital goods

The import volume regressions by commodity group differ from the non-oil equation in that they have somewhat more important relative price elasticities and substantially different demand elasticities Using the more narrowly defined price ratios puts the relative price elasticities for all four categories between −0 8 and −1 4, compared with the −0 7 estimated for non-oil imports The demand elasticities for autos and capital goods are roughly 1 0, while the demand estimate for industrial supplies, using overall industrial production, is 1.8 [23] Only in the case of consumer goods is the demand elasticity of 2 7 near the 2 6 estimate for non-oil imports.[24]

The high domestic demand elasticity for non-oil imports has been interpreted by some as reflecting a secular decline in the competitiveness of U S goods [25] The argument is that the demand elasticity is affected by the failure of price data to provide a suitable measure of the relative attractiveness of imported goods. In particular, import prices do not adequately capture the impact of the steady stream of new, increasingly sophisticated imported goods entering U S. markets As a result, the declining competitiveness of U S. goods finds expression in either a large positive trend term or a high elasticity estimate for domestic demand [26]

The lower demand elasticities in three of the four categories suggest that the high domestic demand elasticity estimates for non-oil imports as a whole may arise because too broad a definition of demand is used in conventional models of import behavior. To illustrate the point, the non-oil equation can be reestimated with a measure of domestic demand that excludes two large components not associated with trade, consumption of services and government spending The narrow domestic demand measure lowers the demand elasticity from 2.6 to 1 4, leaving the relative price elasticity and trend term essentially unchanged

As for changes in import behavior over time, the rolling regression results show a decline in the importance of import prices only in the case of autos (Table 3) The decline in relative price elasticity for capital and consumer goods occurs once 1974 data are dropped and 1985 data are added, and from then on, the sequence of regressions shows no further decline for capital goods and a recovery for consumer goods (see appendix, Table A3) This finding suggests that the drop

[23]Unfortunately, a more accurate measure of purchases for industrial supplies is not available

[24]The demand measure for consumer goods is composed of goods that tend to be imported small appliances, consumer electronics, jewelry, toys, sports equipment, clothes, and shoes The major consumer goods excluded are food, energy, autos, large appliances, rugs, and computers

[25]See Paul Krugman, *Has the Adjustment Process Worked?* (Washington, D C Institute of International Economics, 1991), and Lawrence, "The Current Account Adjustment "

[26]Helkie and Hooper try to compensate for this problem by adding a relative capital stock measure to their model ("An Empirical Analysis of the External Deficit, 1980-86")

Table 4

Auto Retail Sales

Market Share

Market Share	1983	1985	1987	1989	1991	1992
U S firms	73	72	63	62	57	59
Japanese firms	22	22	27	30	36	35
Imports	21	20	21	20	18	18
Transplants	1	2	6	10	18	18
Other imports	4	5	10	8	7	7
Total	100	100	100	100	100	100

in the two price elasticities largely developed before 1985 and that they have not undergone any systematic decline in importance in recent years The demand elasticities showed some movement over the sequence of regressions, increasing for capital goods and autos and remaining unchanged for industrial supplies and consumer goods

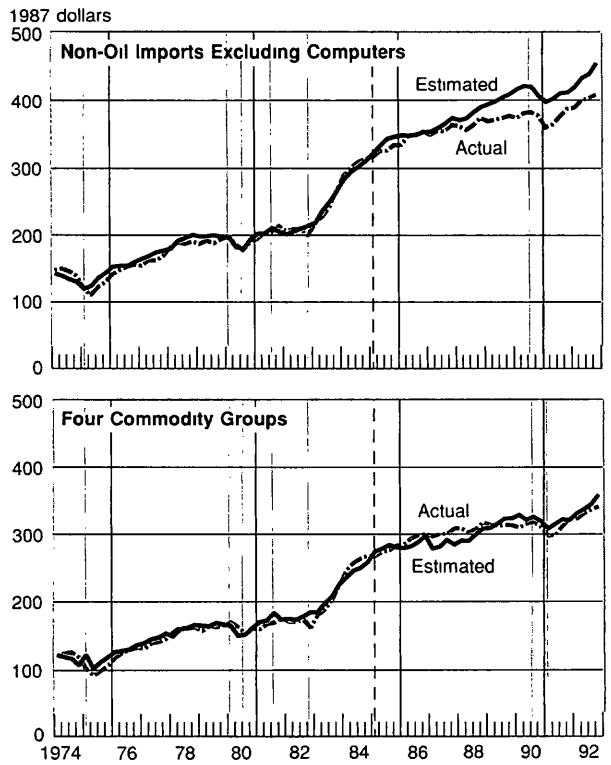
The projection of real imports based on the pre-1985 regressions is very close to actual values for consumer goods and somewhat less close for industrial supplies, which are stronger than expected, and for capital goods, which are weaker than expected The projection for autos is the least reliable, it shows an increase in imports after 1986, while actual imports declined (Chart 6) A key development not captured by the equation helps explain the unexpected weakness in auto imports. Concerned that import quotas might be imposed to limit market share gains, Japanese auto firms shifted a significant amount of their assembly operations to the United States The number of cars produced by Japanese plants in the United States rose from 0.2 million units in 1985 to 1 4 million in 1992 During the same period, auto imports from Japan declined from 2.2 million to 1.5 million units In market share terms, the shift in production allowed Japanese firms to raise their share of retail sales from 22 percent in 1985 to 35 percent in 1992, entirely through increased production in their U.S. plants

The effect of this direct investment in U.S facilities on imports is hard to measure since it depends on unknown factors. If one assumes that 50 percent of transplant production was sold to consumers who would otherwise have bought an imported auto and that 50 percent of the value of the transplant-produced autos was created in the United States, then Japanese plants in the United States reduced auto imports by roughly $5 billion in 1992.[27] Alternatively, if one assumes that transplants replaced imports one for one, then auto imports were $10 billion lower than they would otherwise have been. This factor likely accounts for much of the $13 billion difference between the projected and actual values of auto imports in 1992.

Quality improvements by domestic auto producers may also have contributed to the reduced demand for auto imports. After experiencing a decline in market share from 72 percent of U S. retail auto sales in 1985 to 57 percent in 1991, U S. firms managed in 1992 to

Chart 7

Import Volumes



Notes· Estimated values are based on regressions estimated from 1974-I to 1985-I Lower panel of chart shows sums of results of commodity group regressions This sum excludes food ($26 billion), computers ($60 billion), aircraft ($11 billion), and "other" ($31 billion).

Sources National Income and Product Accounts, Bureau of Labor Statistics

[27]This figure is based on the 1 4 million units assembled in 1991 and an assumed average price of $14,500 For more details, see James Orr, "Foreign Direct Investment in the United States Effects on the Trade Balance," Federal Reserve Bank of New York *Quarterly Review*, Summer 1991, pp 63-76

Table 5

Import Volume: 1992

Billions of 1987 Dollars

	Actual	Estimated	Difference
Industrial supplies	72	63	9
Other capital goods	78	86	−8
Autos	80	93	−13
Consumer goods	105	102	3
Total	335	343	−8
Non-oil imports	401	437	−36

raise their share to 59 percent (Table 4).[28] Indeed, imports fell significantly below projected levels in 1992, while production by Japanese transplants remained unchanged.

Imports for the other three categories since 1985 tend to match their projected levels. The slight growth of industrial supplies and the somewhat more rapid growth of consumer goods imports after 1985 are captured, although industrial supplies rebound much more strongly than expected following the recent recession. Imports of capital goods fall below their expected path in 1989-90, creating a gap that remains roughly unchanged through 1992.

Together, the sum of these projections for the four major commodity groups, each of which relies on narrow measures of the relevant macroeconomic determinants, anticipates import behavior better than the projection derived for non-oil imports as a whole (Chart 7). In this case, the weakness in autos and capital goods is offset by stronger than expected demand for industrial supplies (Table 5). This result suggests that the size of the unexpected weakness in imports found in the aggregate non-oil regression may be somewhat overstated because of that regression's reliance on broad measures of domestic demand and prices.

[28]Total retail sales were 8 2 million in 1992 An assumed average price of $14,500 means that a 1 percent share of the market equals $1.1 billion.

Conclusion

This article began with the observation that the volume of non-oil imports grew three and a half times faster than overall domestic purchases from 1980 to 1985 and three times faster from 1985 to 1992. The apparent failure of imports to slow substantially relative to domestic purchases after 1985 would seem to indicate that the dollar's decline has had a surprisingly modest restraining influence on imports. A more detailed analysis of import behavior, however, confirms the continuing importance of the dollar. It is significant that import growth after 1985 has been concentrated in computers. This category needs to be considered separately because measures of computer import growth reflect improvements in technology and are largely unaffected by the dollar's value. Once computers are excluded, an empirical investigation of non-oil import behavior indicates that imports have for the most part responded in a conventional fashion to the dollar and other macroeconomic developments, particularly the rise in U.S. prices. As a consequence, concerns that the strong dollar caused significant structural changes that gave foreign producers long-term advantages in U.S. markets appear to be unfounded. Although U.S. markets for foreign goods may have changed significantly in the 1980s, the change has not been sufficient to prevent imports from behaving in ways broadly consistent with long-term historical experience.

Appendix

The tables below, listing the results from rerunning the trade equations over different sample periods, shed light on the stability of trade elasticities over time

Table A1

Non-Oil Imports

Excluding Computers

Price

Estimation Period	Constant	Trend	Foreign Costs	Dollar	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	1 3	−0 002	1 1	−0 7	4 6
1975-I to 1986-I	2 5	−0 003	1.2	−0 6	4 2
1976-I to 1987-I	2 5	−0 003	1 2	−0 7	4 6
1977-I to 1988-I	2 7	−0 003	1 1	−0 6	4 3
1978-I to 1989-I	2 8	−0 002	1 1	−0 7	3 8
1979-I to 1990-I	3 1	−0 002	1 0	−0 7	2 7
1980-I to 1991-I	2 7	−0 002	1 1	−0 7	3 6
1981-I to 1992-I	2 2	−0 003	1 3	−0 7	2 8
1981-IV to 1992-IV	1 3	−0 002	1 3	−0 7	3 9
1974-I to 1992-IV	1 4	−0 002	1 1	−0 7	4 9

Volume

Estimation Period	Constant	Trend	Demand	Relative Price	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	−12 8	−0 001	2 6	−0 7	5 3
1975-I to 1986-I	−12 5	−0 003	2 4	−0 5	4 4
1976-I to 1987-I	−11 5	−0 002	2 3	−0 5	4 6
1977-I to 1988-I	−10 8	−0 002	2 3	−0 6	4 7
1978-I to 1989-I	−10 5	−0 000	2 3	−0 8	4 6
1979-I to 1990-I	−11 0	−0 001	2 4	−0 8	4 2
1980-I to 1991-I	−14 6	−0 005	2 8	−0 8	4 5
1981-I to 1992-I	−14 0	−0 004	2 8	−0 8	4 0
1981-IV to 1992-IV	−13.8	−0 004	2 8	−0 8	4 5
1974-I to 1992-IV	−13 0	−0 003	2 7	−0 8	4 8

Appendix *(Continued)*

Table A2

Import Prices

Estimation Period	Industrial Supplies					Other Capital Goods				
	Constant	Trend	Foreign Cost	Dollar	Augmented Dickey-Fuller Statistic	Constant	Trend	Foreign Cost	Dollar	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	1 0	−0 014	1 7	−0 7	4 8	2 5	−0 002	0 8	−0 5	4 6
1975-I to 1986-I	1 2	−0 013	1 7	−0 8	4 2	2 8	−0 004	0 9	−0 5	4 1
1976-I to 1987-I	1 3	−0 013	1 7	−0 8	3 9	3 6	−0 002	0 8	−0 5	3 9
1977-I to 1988-I	1 3	−0 013	1 7	−0 8	3 9	3 9	−0 001	0 7	−0 6	3 2
1978-I to 1989-I	1 6	−0 012	1 6	−0 8	3 9	3 9	−0 001	0 8	−0 6	2 7
1979-I to 1990-I	2 0	−0 011	1 6	−0 9	2 3	3 7	−0 001	0 9	−0 7	2 5
1980-I to 1991-I	2 4	−0 010	1 5	−0 9	1 9	2 6	−0 002	1 2	−0 7	3 2
1981-I to 1992-I	4 4	−0 006	1 0	−0 9	2 2	1.7	−0 003	1 5	−0 8	3 6
1981-IV to 1992-IV	2 3	−0 004	0 8	−0 8	2 2	0 9	−0 004	1 4	−0 8	3 9
1974-I to 1992-IV	0 3	−0 007	1 4	−0 9	2 7	3 4	−0 005	0 6	−0 6	4 1

Estimation Period	Autos					Consumer Goods				
	Constant	Trend	Foreign Cost	Dollar	Augmented Dickey-Fuller Statistic	Constant	Trend	Foreign Cost	Dollar	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	2 7	0 015	0 6	−0 7	4 7	3 6	0 003	0 6	−0 5	4 2
1975-I to 1986-I	1 8	0 010	0 8	−0 6	4 3	3 5	0 001	0 6	−0 4	4 2
1976-I to 1987-I	1 3	0 009	0 9	−0 6	4 3	3 6	0 002	0 6	−0 4	4 2
1977-I to 1988-I	1 1	0 008	0 9	−0 5	4 9	3 7	0 002	0 6	−0 4	4 3
1978-I to 1989-I	1 3	0 009	0 6	−0 3	4 1	3 8	0 002	0 6	−0 4	2 7
1979-I to 1990-I	1 7	0 009	0 6	−0 3	3 8	3 9	0 003	0 6	−0 5	2 6
1980-I to 1991-I	2 5	0 007	0 8	−0 3	3 1	3 3	0 002	0 7	−0 5	3 0
1981-I to 1992-I	6 3	0 010	−0 4	−0 2	2 7	3 3	0 002	0 7	−0 5	3 0
1981-IV to 1992-IV	7 3	0 009	−0 6	−0 2	2 2	3 2	0 002	0 6	−0 4	3 0
1974-I to 1992-IV	−0 3	0 004	1 3	−0 5	4 5	3 4	0 002	0 6	−0 4	4 6

Appendix *(Continued)*

Table A3

Import Volume

Estimation Period	Industrial Supplies Constant	Trend	Demand	Relative Price	Augmented Dickey-Fuller Statistic	Other Capital Goods Constant	Trend	Demand	Relative Price	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	0 0	−0 007	1 8	−0 9	5 2	0 7	0 015	1 2	−0 8	4 2
1975-I to 1986-I	0 2	−0 006	1 9	−1 0	4 9	0 2	0 018	1 1	−0 6	4 0
1976-I to 1987-I	0 1	−0 007	2 0	−1 1	4 7	0 1	0 020	1 1	−0 6	4 1
1977-I to 1988-I	−0 3	−0 007	2 1	−1 0	4 3	−1 4	0 018	1 2	−0 6	4 0
1978-I to 1989-I	−0 3	−0 007	2 0	−1 1	5 0	−0.1	0 017	1 1	−0 6	4 5
1979-I to 1990-I	−0 3	−0 007	2 1	−1 0	4 9	0 6	0 016	1 1	−0 6	4 1
1980-I to 1991-I	−0 4	−0 007	2 1	−1 0	4 4	−0 7	0 014	1 3	−0 6	3 6
1981-I to 1992-I	0 7	−0 005	1 9	−1 1	3 9	−0 1	0 014	1 4	−0 8	3 1
1981-IV to 1992-IV	1 9	−0 003	1 7	−1 1	3 4	−2 2	0 011	1 6	−0 6	4 3
1974-I to 1992-IV	0 7	−0 004	1 7	−0 9	5 9	0 3	0 013	1 3	−0 9	4 4

Estimation Period	Autos Constant	Trend	Demand	Relative Price	Augmented Dickey-Fuller Statistic	Consumer Goods Constant	Trend	Demand	Relative Price	Augmented Dickey-Fuller Statistic
1974-I to 1985-I	3 5	0 012	0 8	−0 8	3 9	−4 2	−0 013	2 7	−1 4	4 3
1975-I to 1986-I	0 4	0 012	0 8	−0 2	4 3	−7 1	−0 006	2 6	−0 7	4 0
1976-I to 1987-I	0 5	0 012	0 8	−0 2	4.3	−5 2	−0 007	2 4	−0 9	4 5
1977-I to 1988-I	0 3	0 013	0 8	−0 2	4 9	−4 9	−0.007	2 4	−0 9	4 1
1978-I to 1989-I	1 6	0 012	0 8	−0 5	4 1	−5 2	−0 010	2 6	−1 0	4 2
1979-I to 1990-I	2 1	0 010	0.9	−0 7	2 4	−4 0	−0 009	2 5	−1 2	3 3
1980-I to 1991-I	−0 1	0 004	1 1	−0 3	3 1	−5 7	−0 014	2 8	−1 2	3 7
1981-I to 1992-I	−0 2	0 004	1 1	−0 3	3 1	−5 0	−0 012	2 7	−1 2	3 7
1981-IV to 1992-IV	−1 4	0.002	1 1	−0 0	2 8	−5 4	−0 012	2 6	−1 0	3 5
1974-I to 1992-IV	−2 1	0 009	0 9	−0 7	3 3	−4 3	−0 012	2 6	−1 3	5 4