IMPORT COMPETITION FROM DEVELOPED AND DEVELOPING COUNTRIES

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I. Introduction and Summary

RECENTLY there has been much renewed interest in the price competitiveness of U.S. goods. Competition from our industrialized trading partners seems to have intensified, and has invoked renewed protectionist pressures. Furthermore, the fantastic rate of growth of imports from some less developed countries has given even greater significance to the import competition question, and has made the fear of "many more Japans" a recurrent theme. The extent to which imports provide a perfect substitute for domestically produced goods will have an important bearing on the future of many industries in the United States.

From the perspective of the less developed countries (LDCs), the importance of the substitutability of their exports for the goods produced by the developed countries (DCs) is evident. Although considerable research effort has been devoted to the evaluation of the impact of an export-led growth strategy on the supply-side relationships of the less developed economy, consideration of the demand for LDC goods has received relatively little empirical scrutiny.[1] The continued growth of demand for LDC products, critical to the success of the export-led growth strategy, depends upon both the price competitiveness of the LDC goods in the United States and other developed country markets, and on the future course of trade policies in these importing countries.

The much sought after tariff preference schemes instituted by the United States, and earlier by the European Economic Community (E.E.C.) and Japan, gave the LDCs hope for expanding their shares in developed country markets. More recently, however, fears have been aroused among the export-oriented LDCs that the tariff reductions at the Tokyo Round of multilateral trade negotiations will erode the benefits provided by the preference schemes.[2] Whether or not this will, in fact, come to pass depends critically on the degree of substitutability between imports from LDCs and those from developed countries in third country markets.

This paper investigates the substitutability between imports from developed countries, imports from less developed countries, and home goods in the U.S. market for certain manufactures. Separate import demand equations are estimated for imports from developed countries and from LDCs for each of eleven representative commodity groups. The commodities studied include: bovine leather; tires and tubes; veneer sheets; chinaware and earthenware; hardboard; iron and steel wire rods; iron and steel bars; iron and steel shapes, angles and sections; typewriters; television receivers; and still cameras. These categories were chosen to represent both consumer and intermediate goods for which imports constitute a large, and in many cases growing, share of the U.S. domestic market, and for which the LDC share in total U.S. imports is significant.

The main conclusion to be drawn from this study is that imports from both developed countries and LDCs are in most cases relatively close substitutes for domestically produced commodities, but quite imperfect substitutes for one another. A detailed investigation of the particular products that make up the commodity groups suggests an explanation for this finding. Whereas the domestic industries produce a wide spectrum of goods within each category, the DCs and the LDCs were found to export to the United States smaller and minimally overlapping subsets of the

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[1] Two exceptions are Khan (1974) and Grossman (1978).

[2] On this issue see Baldwin and Murray (1977) and Ahmad (1978).

goods consumed here. The results of this research indicate that the tariff preference schemes will more likely provide benefits to the LDCs through *trade creation*, rather than through *trade diversion*, for any given preferential margin.[3] They also suggest that any pains of adjustment that result from the rapid growth of LDC exports will be felt more severely in home good industries in the United States than in the export industries in other developed countries.

II. Import Competition and Product Substitutability

Imports of manufactures have been growing at a consistently rapid pace in the United States during the last decade. The value of total manufactured imports grew at an annual rate of 17.9% per year between 1968 and 1978,[4] compared to a 9.5% growth rate for the value of shipments of domestically produced manufactures during this period.[5] The performance of imports of manufactured goods from the less developed countries has been even more spectacular. These imports have been growing at an annual rate of 25.6%, thereby increasing their share in total manufactured imports from 13.1% in 1968 to 24.7% in 1978.[6]

The value of imports from developed and less developed countries for each good studied here is presented in table 1. The annual growth rates of imports of these goods from the developed countries have been large. Nine of the eleven categories have displayed rates of growth in excess of 8%, and for cameras, tires and tubes, and typewriters the rate has exceeded 20% per annum. The growth rates of imports from LDCs are even more striking. In five of the eleven categories

[3] This result provides further support for the conclusion reached by Baldwin and Murray (1977), that trade creation is a more important source of market share expansion for the LDCs than is trade diversion. Baldwin and Murray derive their estimates of benefits to the LDCs based on the assumption that domestic products, LDC imports and DC imports are equally substitutable. Ahmad (1978) challenges this assumption, citing evidence from Verdoon and Schwartz (1972, p. 322) that the "elasticity of substitution between domestic products and imports is smaller than between competing imports." Our results suggest the opposite pattern of substitution possibilities.

[4] U.S. Department of Commerce, *Highlights of U.S. Export and Import Trade*, FR990, Dec. 1968 and Dec. 1978.

[5] U.S. Department of Commerce, *Survey of Current Business*, Apr. 1969 and Apr. 1979.

[6] U.S. Department of Commerce, *Highlights of U.S. Export and Import Trade*, op cit.

TABLE 1.—IMPORT VALUES AND RATES OF GROWTH

	Imports from DCs (million U.S. dollars)				Imports from LDCs (million U.S. dollars)			
Commodity	1968	1978	Annual Growth Rate	Main Sources	1968	1978	Annual Growth Rate	Main Sources
Bovine Leather	38.3	46.8	2.0%	Canada, France, U.K.	12.4	97.5	22.9%	Argentina, Brazil, India
Tires and Tubes	117.4	962.7	23.8	France, Canada, Japan	4.0	93.4	36.9	Taiwan, Korea
Veneer Sheets	29.7	69.8	8.9	Canada	21.2	31.0	3.9	Philippines, Brazil
Hardboard	18.2	29.6	5.0	Canada, Finland, Sweden	2.1	21.8	26.1	Brazil, Argentina, Chile
Chinaware and Earthenware	53.8	181.1	12.9	Japan, U.K.	0.6	46.0	55.0	Taiwan, Hong Kong, Korea
Iron & Steel Wire Rods	148.2	370.4	9.6	Japan, France, Germany	2.3	17.6	22.5	Argentina, Brazil, Taiwan
Iron & Steel Bars	157.9	380.0	9.2	Japan, Belgium, U.K., Canada	7.2	34.2	16.9	Argentina, Brazil, Korea
Iron & Steel Shapes, Angles and Sections	207.4	545.5	10.2	Belgium, Japan, Germany	4.8	37.8	23.0	Argentina, Mexico, Brazil
Typewriters	14.7	311.1	35.7	Germany, Canada, Italy	0.04	21.0	87.1	Singapore, Brazil, Mexico
Television Receivers	188.9	607.8	12.4	Japan	15.9	762.7	47.3	Taiwan, Korea, Mexico
Cameras—still	46.9	499.8	26.7	Japan, Germany	2.4	60.2	38.0	Hong Kong, Taiwan, Singapore

Source: U.S. Department of Commerce, U.S. General Imports, FT 135, Dec. 1968 and Dec. 1978.

imports from these countries have been growing at a rate faster than 35% per year in value terms. Furthermore, this performance has been fairly broadly based across countries. A glance at the last column of table 1 indicates that ten different less developed countries are represented as significant suppliers of at least one of the eleven commodities.

Given the already substantial and ever growing shares of manufactured goods from both developed and especially less developed country sources in the U.S. domestic market, import competition is likely to become an increasingly important topic of concern. In order to forecast which industries are likely targets for intensified competition it is necessary to consider the substitutability between imports and domestic products within commodity groups. Domestic industry displacement is more likely to occur where imports are close substitutes for domestically produced goods than in cases in which the domestic good is a distinct and differentiated product.

This study takes as its starting point the assumption that goods produced in one country are likely to be imperfect substitutes for the "same" good produced elsewhere. It thus rejects the "law of one price" assumption that is traditional in trade theory.[7] Since goods supplied from alternative sources that fall into the same detailed trade category will inevitably exhibit characteristics of product differentiation along a multitude of dimensions, it would seem impracticable to define trade categories so finely that perfect substitutability would be a tenable assumption.[8] In particular, products are differentiated by physical attributes such as quality and durability, as well as by terms of sale characteristics such as credit terms, lags in deliveries, security of future supply and reliability of post-sale service and maintenance.

[7] The law of one price has been taken to task in recent empirical work. Careful investigations of price behavior by Isard (1977), Kravis and Lipsey (1977, 1978) and Richardson (1978) provide evidence that strict commodity arbitrage fails to hold even for relatively homogeneous trade categories (four and five digit Standard Industrial Trade Classification and seven digit T.S.U.S.A. classifications). All of these studies found systematic and persistent changes in relative common currency prices at the most detailed level for which such comparison is possible.

[8] The recognition of this possibility antedates the work on the "law of one price." Armington (1969) developed a theory of demand for products distinguished by place of production.

III. Specification and Estimation of Import Demand

The demand for imports from a given source is assumed to be a function of the price of that import good, the price of the similar import that originates in the alternative supply source (i.e., DC vs. LDC), the price of the good produced by the U.S. industry, and a real activity variable.[9] In the case of final consumer goods the activity variable is the relevant subcategory of real consumer expenditure. Import demand for intermediate goods is a derived demand, and the appropriate activity variable is the real output level of the industry(s) that uses the input.

Demand theory rarely makes reference to the time period over which optimization is assumed to take place.[10] When quarterly trade data are used, current period levels of imports may depend upon prior period prices for a number of reasons, including lags between contract agreements and the recording of the transaction, delivery lags, informational lags, and lags in the demand response that result from uncertainty regarding both the future price of the product from a given source and the reliability of supply from that source. The estimation equations discussed below include a four quarter lag on import prices and a three quarter lag on the domestic price. The shorter lag on the domestic price reflects the shorter informational lags that are involved in purchasing domestically produced goods, and also reflects the fact that wholesale price data are based on contract prices, rather than on prices recorded at the time of delivery.[11] The lengths of

[9] These variables are standard ones used in the literature on import demand. See Leamer and Stern (1970) for a thorough discussion of specification issues. The specification is validated by the assumption that the good in question, with three possible sources of supply, is separable from all other goods in the consumer's utility function (for consumer goods) or the production function for final output (in the case of intermediate goods). See, for example, Armington (1969).

Note that the activity variable captures both cyclical and secular income effects on import demand. As a referee for this *Review* correctly points out, these two elasticities are not necessarily the same, and it might have been possible to split the activity variable into cyclical and secular components in order to isolate these separate effects.

[10] For an excellent discussion of the time dimension in time series estimation of import and export demand relations see Leamer and Stern (1970, pp. 19f.).

[11] Hooper (1976) estimated a one quarter delivery lag between the time an order is contracted and the time the transaction is recorded in the trade statistics. Similarly, Magee (1974) found an average transportation and order-delivery lag of ninety days.

the lags are chosen to be consistent with recent empirical research on the price lag structure in import demand equations, which has suggested that the largest part of the response to import price changes occurs within three quarters.[12] All of the lagged price variables are entered into the demand equation unconstrained in order to allow the data to choose the shape of the response distribution.[13]

The flow of traded goods is occasionally disrupted by dock strikes.[14] The volume of trade, which is curtailed during the strike period, may be expanded both before and after the actual strike. Such disruptions, if left unaccounted for, could bias the coefficients of variables that are spuriously correlated with the dock strike effects. Many previous studies have ignored these strikes, or have adjusted for them in an *ad hoc* manner. In this study dock strike effects are taken into account with a more sophisticated adjustment technique developed in Isard (1975).[15]

Finally, dummy variables for each quarter are included to reflect seasonal shifts in the level of the constant term of the regression. The final specification of the import demand equation is

$$\log M_i(t) = a_0 + a_1 \log ACT(t) + a_2 \log DS(t) + \sum_{j=0}^{j=3} b_j \log P_{LDC}(t-j) + \sum_{k=0}^{k=3} c_k \log P_{DC}(t-k) + \sum_{m=0}^{m=2} d_m \log P_{US}(t-m) + a_3 D1 + a_4 D2 + a_5 D3 + u(t); \quad (1)$$

where

$M_i(t)$ = quantity of imports from source i in period t; i = DC, LDC
$P_i(t)$ = price of the good from source i in period t; i = DC, LDC, US
$DS(t)$ = dock strike adjustment factor for period t
$ACT(t)$ = "activity" or scale variable for period t
$D1$, $D2$, $D3$ = dummy variables for quarters 1, 2, and 3, respectively
$u(t)$ = random error term.

The functional form of (1) is log-linear to allow direct estimation of the desired elasticities.[16] The specification used does not impose long-run homogeneity of degree zero in prices. In a properly specified demand equation the absence of money illusion is a sufficient condition for long-run price homogeneity. However, there are two sources of misspecification in (1) that provide reasons why homogeneity may fail to hold even when money illusion is absent. First, equation (1) does not include the prices of other goods that may substitute for the import good in question. The omission of the prices of other competing goods introduces misspecification bias. This bias might be manifested as a failure of price homogeneity to hold if equiproportionate increases in the three included prices were not always associated with an equiproportionate increase in all excluded prices.

Second, the demand equation omits many non-price factors, such as credit terms, delivery lags, and post-sale service, as well as the level of advertising and marketing activities. To the extent that these factors either fluctuate cyclically or follow a time trend, the stability of the demand relationship requires their inclusion. Unfortunately, quantitative data on these terms-of-sales aspects are generally unavailable.[17] Again the

[12] Hooper (1976) estimated that three-fourths of the full demand response to a price change occurs within three quarters. Wilson and Takacs (1977) estimated lags in demand that averaged seven quarters in length, but found that in most cases the largest response occurred shortly after the import price change. Some initial experimentation with longer lags suggested that the three and four quarter lags were sufficient to capture the full demand response for the categories studied here.

[13] Due to the high degree of multicollinearity between the current and lagged price series it was impossible to get precise estimates of the individual lag components. However, since our main interest concerned the total elasticities the unconstrained lag structure was deemed preferable to the imposition of a priori restrictions.

[14] Three such strikes took place during the last decade.

[15] Isard estimated what the time path of longshore man-hours would have been in the absence of the strikes, and weighted the deviations from the actual time profile by the share of trade volume that is transported by ship through the region affected by the strike. He arrived at an adjustment factor for each of six commodity categories.

[16] Khan and Ross (1977) showed empirically that a log-linear specification is better than a linear one for aggregate import demand elasticities. However, this functional form does have the disadvantage, in the present context, of preventing the imposition of, or tests for, the Slutsky symmetry conditions. These conditions refer to the cross-partial derivatives, and imply no testable constraints on the cross elasticities when a log-linear specification is used.

[17] Gregory (1971) and Trivedi (1970) used capacity utilization rates as proxies for non-price rationing variables, since high capacity utilization rates are associated with tight supply, and therefore presumably worsened terms-of-sale. Unfortunately, for many of the commodities studied here the available data on domestic capacity utilization do not corre-

misspecification bias arising from the omission of these variables will be manifested by the nonhomogeneity of the estimated equation, if the pricing behavior of firms is not independent of their non-price rationing behavior. Periods of short supply may elicit both price increases and the lengthening of queues, for example, and the division between the price and non-price methods of allocation of short supply may differ between domestic and foreign firms, and between LDC firms and developed country firms. If this is so, then equiproportionate price increases will result in shifts of market shares due to the associated modifications in non-price rationing behavior.

A test for long-run homogeneity in the estimated equations provides a valuable indication of the importance of those sources of misspecification. The failure to find price homogeneity in the data would suggest that the left out variables play a significant role in import determination.

The estimation of (1) requires import price data disaggregated by commodity and country of origin. Unfortunately, such data are not collected for the United States. Instead it is necessary to rely on unit values derived by deflating the value of imports in a given trade category by the physical volume of imports for that class of goods.[18] As is well known, when these indexes are constructed at aggregate levels, the relationship between the unit values and the true prices becomes distorted over time due to changes in the composition of the commodity bundles represented by the indexes. The degree of bias so introduced into the demand elasticity estimates is related to the heterogeneity of the product category, and to the extent of compositional change that occurs during the estimation period. At the level of commodity aggregation used in this study, the import bundles from the less developed countries have, in most cases, evolved significantly during the past decade. Thus, the bias that could potentially arise if unit values were calculated at this level is considerable. To mitigate this problem, care was taken in generating price indexes that rely on unit values calculated for the most homogeneous product groups that data availability allows.[19]

Equation (1) was estimated by a two-stage least squares procedure, treating the price of LDC imports and the activity variable as endogenous, while taking the prices of domestic goods and developed country imports to be exogenous. The exogeneity of the latter two price variables is justified if both the domestic supply curve and the DC export curve are infinitely price elastic with respect to U.S. demand. This is a plausible assumption in times of excess capacity, such as characterized much of the estimation period.[20] However, the assumption of perfectly elastic import supply to the United States for LDC goods would clearly be untenable.[21] Instead the LDC export supply curve was assumed to be upward sloping and instruments were used for P_{LDC}.[22] The activity variable was also treated as endogenous in recognition of the simultaneity of the choice of output level and the derived demand for imports by firms, and of the

spond closely in level of aggregation to those investigated in the import demand equations. Furthermore, no data at all are available for disaggregate capacity utilization rates in the foreign import supplying industries. Experimentation with the inclusion of the best available domestic capacity utilization variable failed to yield reasonable results. Consequently the variable was not included in the final specification.

[18] For a particularly harsh critique of the use of unit value data in place of price data in empirical trade studies, see Kravis and Lipsey (1971).

[19] The construction of and sources for the price data are discussed in more detail in the appendix.

[20] Richardson (1974) was unable to reject the hypothesis that the United States acts as a "small" country in the market for most of its imported goods. Similarly, studies of domestic manufacturing suggest that infinitely elastic domestic supply curves are also reasonably assumed based on revealed constant cost production functions. See, e.g., the survey by Walters (1963). While in principle it might have been preferable to treat all prices as endogenous, limitations imposed by the sample size made this impractical.

[21] The price of the LDC good can be treated as predetermined in the equation of demand for the developed country import, even when the LDC supply is less than perfectly elastic, if the assumption is made that the errors in the two import demand equations are contemporaneously uncorrelated. However, there are many reasons why we would expect these errors to be correlated (e.g., any left out variable that impacts on imports in general). Consequently, the LDC price is treated as endogenous in both import equations.

[22] The variables used as instruments were those that would appear in an equation of net supply of LDC goods to the United States. The supply of LDC goods is treated as a weighted average of the export supplies from each of the individual LDC countries, less the amount that is demanded by importers in other developed countries. Thus, the instrument list included (the log of) the geometric weighted averages of the following variables: the manufacturing wage in each of the exporting LDCs; the aggregate import price index in each LDC; the capacity of the particular industry in each of the exporting LDCs, proxied by a peak-to-peak interpolation of the industry production level; the dollar exchange rate for each LDC; and the index of industrial production for other developed country purchases of the LDC good in question. The weights used in forming the geometric averages are the 1973 import supply shares, and the 1973 DC demands for the LDC commodity.

levels of expenditure on a class of goods and the demand for specific commodities within the class by consumers. Failure to treat the activity variable as endogenous would introduce bias if, as is likely to be the case, errors in optimizing behavior in the activity level decision are correlated with those made in determining the optimal demand for the import good in question.[23] Where necessary all equations were corrected for first order serial correlation using the nonlinear two-stage least squares procedure first proposed by Fair (1970).

IV. Results

All but one of the import demand equations were estimated using quarterly observations on the variables for the time period 1968:1 through 1978:4.[24] The results are recorded in table 2.[25] To interpret the table, note that in each case the sum of the current and lagged price variables is reported, as a measure of the "total" price elasticity. The dock strike variable should be judged based on its theoretically correct value of unity in each case.[26]

Consider first the test for price homogeneity, which serves as a check on the degree of misspecification bias present in the estimated coefficients. This test is conducted using the Wald test statistic for the single, linear restriction that the eleven price elasticities sum to zero. The Wald statistic for each equation, which is asymptotically distributed as χ^2 with one degree of freedom, is tabulated in the last column of table 2. In eighteen of the twenty-two demand equations we cannot reject the hypothesis of zero degree homogeneity in prices at the 95% significance level. All cases of rejection of this null hypothesis occur for LDC import equations. These tests collectively provide some confidence in the demand specification, especially as regards the demand for imports from the developed countries.

Although the estimates recorded in table 2 provide little evidence for the near-perfect substitute hypothesis, price competitiveness does seem to play an important role in the determination of international trade flows. The import demand elasticities for these disaggregate commodity groups are largely of the expected sign, and are of much larger magnitude than those previously found in the literature.

It is perhaps surprising that income elasticities of demand for LDC imports were, in general, larger than those for DC imports. This finding portends an increasingly important role for LDC manufactures in the U.S. market in the future.

The most interesting and important finding, however, concerns the pattern of import competition. In particular, the evidence provided by the estimation of import demand equations for these eleven manufactured commodities does not support the hypothesis of equal substitutability between developing country products, advanced country products and goods produced domestically for the home market. In every case, with the exception of iron and steel products, imports from the LDCs were found to face greater competition from domestically produced goods than from competing developed country imports. Similarly, developed country imports of the eight non-steel commodities were found to be more competitive with the home country product than with imports from the LDCs. This suggests that the effects of the tariff preference scheme will be seen more through trade creation than trade diversion. It has the important implication that future displacement costs that may result from the growth of manufactured exports by the developing countries to the United States are more likely to be concentrated in the U.S. home goods industries than in the export industries of other

[23] It was therefore necessary to expand the instrument list to include variables that are correlated with the activity variable but not with the error in the import demand equation. The variables used were: U.S. industrial production, average hourly earnings and the 4 month commercial paper interest rate, for the equations of demand for an intermediate product; and total personal consumption expenditure in constant dollars, the implicit price deflator for consumer durables, and the total amount of consumer credit outstanding, for those imports that are final, consumer goods.

[24] The television import demand equations were estimated using the shorter time period 1968:1 to 1977:4, to avoid the complication introduced into the demand relationship by the establishment of the Orderly Market Arrangements with Japan late in 1977. The sources for all the data are listed in the appendix.

[25] The regressions reported in table 2 take no account of the changes in tariffs that resulted from the Kennedy Round negotiations, the Nixon import surcharge or the institution of the Generalized System of Preferences. A second set of estimates which incorporate approximate adjustments for tariff changes is available from the author upon request. These adjustments did not affect the results in any major way.

[26] The dock strike adjustment factor is an estimate of the ratio of actual import volume to desired imports, the quantity that is explained by the other variables in the equation. Therefore, it should have a coefficient of one when included in a log-linear specification.

TABLE 2.—TWO-STAGE LEAST SQUARES ESTIMATES OF IMPORT DEMAND EQUATIONS[a,b]

Commodity Group	Imports From	ΣP_{DC}	ΣP_{LDC}	ΣP_{US}	Activity	Dock Strike	Summary Statistics[c] σ	μ	ρ	Test for Homogeneity[d] χ^2
Bovine Leather	DCs	−1.215	−1.487	2.778	0.651	0.497	0.112	4.607	.425	0.091
		(0.519)	(0.518)	(0.739)	(0.658)	(0.400)			(.239)	
	LDCs	−0.087	−3.689	5.287	1.996	1.356	0.164	4.610	.884	3.420
		(1.210)	(1.097)	(1.150)	(0.942)	(0.463)			(.083)	
Tires and Tubes	DCs	−0.701	0.234	0.963	0.482	0.934	0.153	4.426	.847	0.349
		(0.526)	(0.903)	(1.221)	(0.545)	(0.448)			(.146)	
	LDCs	1.264	−0.887	2.290	0.822	0.723	0.330	4.637	.732	7.156
		(0.679)	(1.024)	(0.995)	(0.613)	(1.760)			(.163)	
Veneers—Sheets and Strips	DCs	−1.167	0.008	0.988	0.392	1.529	0.090	4.449	—	2.065
		(0.341)	(0.255)	(0.321)	(0.302)	(0.558)				
	LDCs	0.130	−0.544	1.315	0.239	1.087	0.176	4.118	.548	6.941
		(0.944)	(0.657)	(0.755)	(0.960)	(0.963)			(.191)	
Hardboard	DCs	−1.942	0.370	1.457	3.177	1.100	0.177	3.877	.633	0.065
		(0.776)	(0.625)	(0.648)	(0.840)	(0.524)			(.192)	
	LDCs	1.472	−0.520	1.602	2.335	3.633	0.291	4.164	.815	6.221
		(1.303)	(1.052)	(1.268)	(1.574)	(0.782)			(.206)	
Chinaware and Earthenware	DCs	−0.832	−0.414	1.283	0.376	0.225	0.117	4.608	.518	0.002
		(0.597)	(0.689)	(0.890)	(0.692)	(0.491)			(.221)	
	LDCs	−0.688	−0.520	3.141	3.766	1.083	0.166	4.647	.451	3.217
		(0.927)	(1.052)	(1.206)	(0.973)	(0.713)			(.204)	
Iron and Steel Wire Rods	DCs	−1.995	1.413	1.066	0.501	2.154	0.188	4.498	.547	0.556
		(1.237)	(0.634)	(0.889)	(1.010)	(0.601)			(.212)	
	LDCs	1.272	−1.175	3.555	7.473	11.087	1.131	4.448	—	6.405
		(8.041)	(4.184)	(5.382)	(5.554)	(7.395)				
Iron and Steel Bars	DCs	−2.735	1.594	1.037	0.996	1.417	0.205	4.625	—	0.671
		(0.694)	(0.484)	(0.349)	(1.636)	(0.862)				
	LDCs	2.866	−1.279	−0.998	6.922	4.672	0.668	7.295	—	2.041
		(2.254)	(1.573)	(1.133)	(2.067)	(2.801)				
Iron and Steel Shapes, Angles and Sections	DCs	−3.388	2.039	1.575	1.751	3.160	0.274	4.627	—	0.824
		(1.500)	(1.489)	(0.512)	(0.892)	(1.441)				
	LDCs	4.503	−4.512	0.080	3.019	1.861	0.311	3.686	—	0.040
		(2.143)	(2.216)	(0.732)	(1.274)	(2.059)				
Typewriters	DCs	−0.476	0.125	2.719	1.840	0.159	0.157	4.393	—	1.571
		(0.731)	(0.007)	(2.618)	(0.431)	(0.704)				
	LDCs	0.639	−1.217	6.094	5.392	10.183	1.291	3.283	.233	0.089
		(7.356)	(0.692)	(25.656)	(4.687)	(5.388)			(.133)	
Television Receivers	DCs	−2.617	1.279	9.325	3.823	0.757	0.232	3.512	.618	2.564
		(1.247)	(2.078)	(3.479)	(2.457)	(0.917)			(.255)	
	LDCs	−0.174	−3.380	1.174	1.808	0.545	0.205	2.658	.923	0.137
		(1.767)	(2.956)	(5.000)	(2.324)	(0.699)			(.068)	
Cameras—still	DCs	−0.837	0.261	2.267	1.211	0.281	0.116	4.680	.831	0.694
		(0.499)	(0.180)	(2.373)	(0.570)	(0.421)			(.153)	
	LDCs	0.009	−1.218	2.620	4.063	1.101	0.205	4.451	—	2.469
		(0.218)	(0.527)	(0.930)	(0.590)	(1.048)				

[a] The estimation period covers 1968:1 through 1978:4, except in the case of imported television receivers, which uses quarterly data from 1968:1 through 1977:4.

[b] The symbols used in the table have the following explanations: ΣP are the sum of the current and three lagged price elasticities for import prices, and the sum of the current and two lagged price elasticities for the domestic price; the activity variable for each regression is discussed in the text; σ is the standard error of the regression; μ is the sample mean of the dependent variable; and ρ is the first order serial correlation coefficient. The standard errors of the estimates are in parentheses.

[c] When no value for ρ is tabulated, it indicates that a test of the null hypothesis that ρ differs from zero could not be rejected at the 80% level of confidence. In these cases, the equations were reestimated under the assumption that $\rho = 0$.

[d] The Wald statistic for the null hypothesis that the import demand equation exhibits homogeneity of degree zero in prices is asymptotically distributed as chi-square with one degree of freedom. The critical value for the 95% level of confidence is $\chi^2(1) = 3.84$.

developed countries. Finally, it suggests that the concern expressed by the trade-oriented LDCs over the erosion of their tariff preferences is, in many cases, unwarranted.

Table 3 has been constructed to emphasize these points. The differences between the cross-price elasticities in each demand equation are computed, so that, for example, a positive differ-

TABLE 3.—COMPARISON OF CROSS-PRICE ELASTICITIES

Commodity Group	DC Import Equation $P_{US} - P_{LDC}$	LDC Import Equation $P_{US} - P_{DC}$
Bovine Leather	4.265[a]	5.374[a]
	(1.119)	(1.873)
Tires and Tubes	0.729	1.026
	(1.958)	(1.339)
Veneer Sheets & Strips	0.980[b]	1.185
	(0.525)	(1.515)
Hardboard	1.087	0.130
	(1.061)	(2.134)
Chinaware and Earthenware	1.697[a]	3.829[b]
	(0.618)	(2.093)
Iron and Steel Wire Rods	−0.077	2.283
	(0.611)	(13.245)
Iron and Steel Bars	−0.577	−3.864
	(0.502)	(3.117)
Iron and Steel Shapes, Angles and Sections	−0.464	−4.423[b]
	(1.452)	(2.588)
Typewriters	2.594	5.455
	(2.681)	(32.610)
Television Receivers	8.046	1.348
	(6.275)	(5.263)
Cameras—still	2.006	2.611[a]
	(2.446)	(0.137)

[a] Indicates statistical significance at the 95% level.
[b] Indicates statistical significance at the 90% level.

ence between the cross-price elasticity with respect to the price of the U.S. good and that with respect to the price of imports from DCs in the demand equation for imports from the LDCs indicates that the domestically produced commodity competes more readily with the LDC good than does the competing import. In all sixteen equations that involve goods other than iron and steel products the U.S. cross-price elasticity is seen to be larger.[27] Although in many cases the difference is not statistically significant, the cumulative evidence is convincing.

[27] The wholesale price indexes include prices of those imported goods that enter the country at an early stage in the distribution process. This serves to bias the coefficient on the domestically produced good upward, and that on each of the imports downward, by an amount that depends on the percentage weight given to each of the imports in the calculation of the wholesale price index. If the weights applied to the DC and LDC import are x and y, then, referring to equation (1), the "true" U.S. cross-price elasticity is $(1 - x - y)d$, while the "true" DC and LDC price elasticities are $c + xd$ and $b + yd$, respectively. The shares of imports in domestic consumption averaged less than 15% during our sample period for all of the goods, with the exception of television receivers and chinaware and earthenware. Therefore, the entries in table 3 would not be changed drastically if the wholesale prices could be purged of their import element. I would like to thank Rudiger Dornbusch for suggesting this clarification.

What explanation can be offered for this pattern of import competition? Insight into this question can only be derived with reference to detailed information concerning the characteristics of the commodities that make up the bundle of goods in the broader import product categories. Fortunately, such information is available in a series of studies on U.S. imports conducted by the United States Tariff Commission.[28]

If, in each industry, we casually array the finely disaggregated commodities along a quality or technological-sophistication dimension, we find that the set of goods that the United States imports from the LDCs is largely distinct from those imported from developed countries. In particular, imports from developed countries tend to be "up-market" goods, whereas those supplied by the LDCs are "down-market" products. And in each case we find that home firms are engaged in the production of both types of goods.

For example, *leather from cattlehide* may be either heavy leather, used in making shoe soles or machine belting, or lighter leather, for shoe uppers, clothing, and other fancier leather products. Leather from calf or kip is softer and more flexible, and is used for shoe uppers, calf leather for high quality shoes and kip leather for less expensive footwear. Most of the imports from developed countries consist of calf and kip leather, and the finer cattlehide leather. In contrast, the United States imports from LDCs predominantly cattlehide leather. The domestic leather tanneries produce both types of leather of a similar quality to that which is imported. This description is quite consistent with the findings, in table 2, that the two types of imported leather are complements, rather than substitutes (i.e., shoe uppers and shoe soles). It also explains why it is that domestic producers face import competition from each of the alternative import suppliers.

Imports of *tires and tubes* from the developed countries consist largely of tires for trucks, buses and passenger cars, and the larger pneumatic tires for other uses. The LDCs supply a majority share of the imports of bicycle tires and tubes, motorcycle tires, and smaller pneumatic tires. The domestic industry produces all of these

[28] All information concerning the make-up of the import product categories was taken from United States Tariff Commission, *Summaries of Trade and Tariff Information* (various issues).

types of tires and tubes. The smaller firms produce primarily specialty tires for industrial and commercial equipment, and apparently compete mostly with imports from developed countries. But the larger firms produce a wide variety of tires, and the estimates indicate that they face competition in the U.S. market from both DC and LDC producers, according to product line.

Imports of *wood veneers* from the developed countries, mainly Canada, are composed of birch veneer, maple veneer, softwood veneer, and some unspecified veneers. The LDCs supply the U.S. market with Philippine mahogany and lauan veneer, and the bulk of the unspecified hardwood veneers, overlapping with the developed countries only in the latter category. Domestic producers supply all varieties of hardwood and softwood veneer. Again, the estimated coefficients suggest that imports from each source are moderately competitive with domestically produced veneer, whereas they are nonsubstitutable for one another. A similar pattern of production differentiation characterizes the *hardboard* market. The domestic industry produces both tempered and untempered hardboard for construction, as well as a more specialized product for decorative panelling and furniture. Both tempered and untempered hardboards of a similar quality to domestic production are imported from developed countries and from Latin America, although only the former suppliers produce the specialized hardboard products.

The domestic suppliers of *earthenware* produce predominantly dinnerware in the low and medium price ranges. In addition, there are numerous domestic *chinaware* firms that produce bone china and/or hotel china, these representing the opposite extremes on the chinaware quality spectrum. The developed countries, mainly Japan and the United Kingdom, produce high quality bone china and household china, as well as high and medium priced earthen dinnerware. Nearly all the earthen non-dinnerware that is consumed in the United States is imported from Japan. Brazil is the major import supplier of hotel china, a thicker, less decorated and simpler form of dinnerware than the other commodities in this product group. It should be noted that in recent years there has been an increase in the consumption of an alternative type of dinnerware, namely plasticware, and the failure to include the price of this substitutable commodity biases somewhat the estimates on the included price variables. The estimates of each import equation suggest nonetheless the by now familiar scenario that the growing market share of each of the alternative import suppliers in the U.S. market stems primarily from the substitutability of each of the import goods for domestically produced goods, and the nonsubstitutability of the import goods for one another.

Typewriter consumption falls into three main subcategories, portable typewriters, electric office typewriters and non-electric office typewriters, and each of the three varieties is produced domestically. Imports from developed countries consist of predominantly portable typewriters in terms of quantity, and are divided between portable and electric office typewriters in terms of value. The United States imports a significant quantity of portable typewriters from Singapore and non-electric office typewriters from Brazil. Although the estimation of the import demand equation for LDCs was largely unsuccessful, due probably to the rapid growth in supply from a very small base, the DC import equation does suggest that the chief competitor for the DC sellers in the U.S. market is the domestic industry, and not the exporters from the less developed countries.

The domestic *television* industry has faced well-publicized competition from producers in Japan, Taiwan and Korea. Taiwan and Korea both have concentrated until very recently on the production of monochrome receivers. Japan supplies both black and white and color televisions to the U.S. market, but has been devoting more attention to its participation in the latter market in recent years. Color receivers comprise roughly 80% of the output of domestic producers.[29] The DC import demand estimates reveal that Japanese television receivers are very close substitutes for their domestic counterparts. The Japanese do face some competition from LDC producers, which apparently reflects substitutability between the alternative sources of monochrome receivers. Finally, the import demand equation for LDC televisions suggests some competition between these goods and domestically produced receivers, although the standard error on the relevant cross-price elasticity is

[29] United States International Trade Commission (1977, p. A100).

large. Given the concentration of the activity of the U.S. firms in the color set market, this competition reflects either the recent entry of the Koreans and Taiwanese into this market or the substitutability of black and white for color televisions.

Finally, the category of *still cameras* covers a variety of products that differ widely in quality. As with most of the previous commodities, imported cameras from LDCs and from DCs are found to substitute more closely for domestic products than they do for one another. This reflects the fact that the camera market is divided along quality lines, with the LDCs supplying the inexpensive, miniature cameras, and the developed countries trading higher priced items. The domestic producers compete in both segments of the market.

It is evident that there are similarities in the pattern of product differentiation and import competition across the broad range of commodities investigated. In particular, a casual ranking of goods within any product group according to quality or technological sophistication in each case finds the DC imports and LDC imports forming minimally overlapping sets. Such a pattern is consistent with the product cycle theories of Vernon (1966) and Hufbauer (1970), which predict that imports from these alternative sources would be quite imperfect substitutes. The U.S. industry, on the other hand, is found to produce the entire spectrum of products, perhaps continuing to compete with LDC producers after product cycle considerations would dictate otherwise with the aid of the protection afforded by barriers to trade.

The sole exceptions to this prescription among the import categories studied are the three iron and steel products. During much of the estimation period imports of rods and bars consisted largely of products made from the lower grade iron and steel produced by the Thomas process. Such products, unlike those produced domestically, which exclusively embodied the higher quality open hearth steel, were not suitable for all construction uses. Similarly, domestic production of shapes, angles and sections were formerly distinguished by the use of upgraded structural steel, and by the variety of shapes, dimensions and grades of products that generally exceeded those available via importation. On a priori grounds, therefore, we would expect to observe closer competition between the two suppliers of imports, than between either import and the domestic good.

The estimates of the three pairs of import equations for iron and steel products indeed support these priors. While the equations indicate substantial competition between all three suppliers of iron and steel products, in five of the six import demand equations the cross-price elasticity of import demand with respect to the U.S. good is smaller than that with respect to the competing import.

V. Conclusions

Separate demand equations for imports from LDCs and imports from DCs were estimated for each of eleven representative product groups. Imports were found to compete quite readily with domestically produced goods, with plausible own-price and cross-price elasticities. Whereas the quantity of each type of import was found to be quite responsive to changes in the price of U.S. home goods, each appears to be less sensitive to the price of the alternative import. An explanation that is consistent with this observation, and finds support from detailed industry information, is that DCs and LDCs supply goods that are at different stages in the product or technology cycle, whereas U.S. producers compete in all submarkets. This suggests that trade creation rather than trade diversion provides the predominant inroad for LDCs into the U.S. market.

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APPENDIX

Data Sources and Construction

The following were used as sources of data for this study:

(1) Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin.*
(2) Board of Governors of the Federal Reserve System, *Industrial Production:* 1976 revision, Washington, D.C., Dec. 1977.
(3) United Nations, *Monthly Bulletin of Statistics.*
(4) United Nations, *Yearbook of Industrial Statistics: Commodity and Production Data, 1968–1977,* New York, 1979.
(5) United States Bureau of Labor Statistics, *Wholesale Prices and Price Indexes.*
(6) United States Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business.*
(7) United States Department of Commerce, *U.S. General Imports: General and for Consumption,* Schedule A, FT 135.

Values and quantities of imports from LDCs and from DCs were collected at the 7-digit S.I.T.C. level from source (7). Countries were treated as developed or less developed according to the United Nations classification. An index of import prices was calculated for each DC and LDC good by taking a geometric average of the 7-digit S.I.T.C. unit values, with 1973 values serving as fixed weights. A quantity index was then generated by dividing total value of imports by the price index. The domestic price series for each good were taken from source (5). In several cases the component wholesale price series were reweighted to form a series that more closely resembled the S.I.T.C. trade category. In these cases the 1973 trade quantity shares were again used as weights. The activity variables were taken from sources (2) and (6). Quarterly averages of monthly data were computed for both wholesale prices and the activity variables. The dock strike variable is found in Isard (1975), and was extended to the end of the period after personal correspondence with the author. Sources (1), (3), (4) and (5) provided variables that were used in forming the instrument matrices for the first stage regressions.