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Patterns of United States Imports, 1947 - 1958

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PATTERNS OF UNITED STATES IMPORTS, 1947 - 1958*

by

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Introduction

A great many of the discussions of commercial policy in the United States within recent years have been centered on questions of a quantitative nature. The advisability of lowering (or raising) tariffs to a large extent has been determined by what was thought to be the impact of such a reduction on the resulting level of imports.** Furthermore the employment effect of

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** The impact of changes in U. S. Policy on other countries has of course also received great attention.

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increased imports has received much emphasis in appraising the significance of import changes and therefore was weighted in the policy decisions. One need only look at the amount of testimony taken by Congressional committees concerning the loss of jobs directly attributable to imports on the one hand and the dependence of American workers on exports on the other to appreciate the importance of this question to legislators who must after all defend their actions to the electorate.

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Most of the evidence presented to these committees has been in the form of subjective determinations of people closely associated with a particular industrial situation who have attempted to generalize from their experience to conclusions concerning the economy as a whole. It was only with the path breaking efforts of Piquet [5] that any intensive research was devoted to the general effects of a tariff reduction. Within recent years, more sophisticated attempts have been made to determine the employment effects of import changes by Salant [6, 7, 8] and Vaccara [17]. This paper is an attempt to increase this growing body of empirical knowledge concerning American imports.

U. S. Imports and GNP

This study was conducted for the purpose of attempting to explain the product pattern of competitive U. S. imports of manufactured goods since World War II. It is generally believed that imports now pose a much greater "threat" to domestic industries of the United States than they did a decade ago. This is true despite the fact that aggregate imports of merchandise as a per cent of gross national product have not shown a noticeable upward drift (Table 1).

Table 1.

United States Aggregate Imports of Merchandise as a Ratio of GNP

Year	Ratio	Year	Ratio
1960	3.05%*	1953	2.98%
1959	3.19%	1952	3.09%
1958	2.93%	1951	3.33%
1957	2.93%	1950	3.11%
1956	3.01%	1949	2.57%
1955	2.86%	1948	2.75%
1954	2.81%	1947	2.46%

Source: U. S. Dept. of Commerce, Historical Statistics of the United States, U. S. Dept. of Commerce Survey of Current Business.

* Based on the statistics of the first six months.

While the import ratio does fluctuate with the state of business in the U. S. reflecting an income propensity to import of greater than one, this fluctuation has remained around a mean value of 3% for other than the artificially low early postwar years. The increased fear of imports must arise from the fact that the growth of imports has been concentrated in relatively few industries rather than proportionally across our entire productive structure. This tendency toward structural concentration of imports has not only occurred as between industries, but also quite markedly as between different products of the same industry. This suggests that there is some benefit to be gained by studying imports on a disaggregative basis, i.e., the product level. It was hoped that an explanation would be forthcoming as to why some products have resisted the inroads of foreign competition while others have succumbed. The fact that the product is also the decision level for tariff making also provides some additional justification for a disaggregative approach.

Large import gains have been recorded among primary products as well as manufactured goods. The decision to narrow the investigation to competitive imports of manufactured goods stems from the fact that it is in this area that the most spectacular gains have occurred and would be the most sensitive to changes in commercial policy. Furthermore there are certain restrictions in the market that prevent a general analysis from providing sensible explanations for imports of strictly agricultural or extractive products. The quota limitations on most major crops as part of the all encompassing U. S. agricultural policy plus similar barriers on certain primary extractive products make inoperative the normal market forces that usually determine the quantities of

imports. In addition to ascertaining the importance of some of the major variables determining the product structure of U. S. imports as it now exists (1958 is the most recent year for which complete data are available), the changes in this structure over time were also investigated.

Model of Imports

The formal model used to explain the structure of imports is similar to one developed by Chenery with regards to the patterns of industrial growth [1]. The volume of imports of product i in year t is taken from the following identity:

$$(1) \qquad M_i^t = \mu_i^t \ (X_i^t + M_i^t - E_i^t)$$

where M_i^t is the quantity of imports of commodity i in year t,

μ_i^t is the fraction of domestic consumption of good i in year t provided by imports (both intermediate and final use),

X_i^t is the quantity of domestic shipments of good i in year t and

E_i^t is the quantity of exports of good i in year t.

Solving for M_i^t we get

$$(2) \qquad M_i^t = \mu_i^t / 1 + \mu_i^t \quad (X_i^t - E_i^t)$$

Practical considerations forced an alteration of the equation. The variable E_i^t was discarded. Exports on the average represent only 3 to 4 per cent of domestic production and certainly much less than that for products which we import in considerable amounts. It was felt, therefore, that adjusting domestic shipments for exports would not greatly affect the variable X_i^t and it is extremely difficult to do because of classification problems.*

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* An explanation of the classification problem involved in this decision can be found in appendix A along with a discussion of other classification problems in the study.

The ratio of the share of domestic consumption of product i provided by imports to the share provided by domestic supplies $(\mu_i^t/1-\mu_i^t)$ is considered to be a function of the ratio of the price of the import in the U. S. to the domestic price and the level of domestic shipments of the product.

$$(3) \qquad \mu_i^t/1-\mu_i^t = f\ (P_{mi}^t /P_{di}^t \quad X_i^t$$

Where P_{mi}^t is the import price of good i in year t in the U. S. and

P_{di}^t is the price of domestically produced good i in year t

The price of good i in the United States from foreign suppliers is taken from the following identity:

$$(4) \qquad P_{mi}^t = P_{fi}^t \quad (1 + T_1^t) + F_i^t$$

Where P_{fi}^t is the foreign price (FOB) of good i in year t

T_i^t is the U. S. ad valorem tariff rate for good i in year t .

F_i^t is the freight charge on good i in year t for transportation to the U. S.

Since the data are not available for transportation costs by product, the variable F_i^t has been disregarded in subsequent formulations. This is defensible on an 'equal ignorance' basis as the price datum for domestic supplies also disregards the transportation cost to final markets.

Combining equations (2), (3) and (4) and dividing through by λ_i^t yields:

$$(5) \qquad M_i^t/X_i^t = f\,[P_{fi}^t\,,\ P_{di}^t\ ,\ (1 + T_i^t)\,,\ X_i^t\ ]$$

It should be noted that relative prices and the level of ad valorem tariffs could be treated as a single variable rather than separating them as is done in this formulation. This form was selected because a price decline resulting from a tariff reduction has a different supply effect as compared to one resulting from a lowering of the foreign offer price. In the former case, the foreign supplier will receive the same return per unit (or even higher if the entire tariff change is not passed on to the consumer) while in the latter one, he will receive less. This would lead one to expect

that the quantity of goods imported would react differently to an equal percentage change in the two elements.

The dependent variable M_i^t / X_i^t, the ratio of imports to domestic shipments was taken to be a multiplicative function of the three variables P_{fi}^t / P_{di}^t, $1 + T_i^t$, and X_i^t.

$$(6a) \qquad M_i^t / X_i^t = K^t (P_{fi}^t / P_{di}^t)^{\alpha_1} (1+T_i^t)^{\alpha_2} (X_i^t)^{\alpha_3}$$

where K^t is a constant in year t for all products.

This form of the equation was selected because it yields parameters in the form of elasticities and tends to give the best statistical fit. Estimates were made for the parameters K, α_1, α_2, α_3 and are identified as the results of model I. The actual estimating was done after making a double logarithmic transformation of equation (6a). This converted the equation into a linear form allowing the use of a simple least squares estimating procedure.

$$(6b) \qquad \text{LOG}(M_i^t / X_i^t) = \text{LOG } K^t + \alpha_1 \text{ LOG } (P_{fi}^t / P_{di}^t) + \alpha_2 \text{ LOG } (1+T_i^t) + \alpha_3 \text{ LOG } (X_i^t)$$

Model II

A second model was required in order to investigate the changes that have occurred in the structure of United States imports over time. Changes

in the dependent variable M_i^t / X_i^t were again taken to be a multiplicative function of changes in the independent variables P_{fi}^t / P_{di}^t , $1 + T_i^t$, X_i^t . A first difference transformation of equation (6b) was employed as follows:

$$(7) \quad \text{LOG}\,(M_i^t / X_i^t) - \text{LOG}\, M_i^{t-n}/X_i^{t-n} = \text{LOG}\, C_t^{t-n} + \beta_1 [\text{LOG}\,(P_{fi}^t / P_{di}^t) - \text{LOG}\,(P_{fi}^{t-n}/P_{di}^{t-n})$$

$$+ \beta_2 [\text{LOG}(1+T_i^t) - \text{LOG}\,(1+T_i^{t-n})]$$

$$+ \beta_3 [\text{LOG}\, X_i^t - \text{LOG}\, X_i^{t-n}]$$

where C_t^{t-n} is a constant for all products but changes depending on the years involved.

The estimates obtained using equation (7) are identified as model II.

Sources of Data

The data used for estimating the pattern of U. S. imports were taken from cross sections at the product level. Since the cross sections are available at a number of points in time, a rectangular array of data results. Published reports of agencies of the U. S. Government provided the primary source of data. The import figures were taken from the Census Bureau's reports [10]. While quantity statistics are called for in the model, constant dollar amounts (1947-49 base) were used in order to make cross product calculations possible. The domestic price statistics used are the wholesale price

indexes of individual commodities, 1947-49 base, as reported by the Bureau of Labor Statistics [14]. For products having a legislative tariff already in the ad valorem form, the rates were taken directly from the Census Bureau's tariff lists [11]. In the case of all other products, the ad valorem equivalent of the specific or compound rate had to be used. The data are calculated on a continuing basis by the U. S. Tariff Commission and were made available by them although they are not published. The statistics of domestic shipments were taken from three major sources: the Censuses of Manufacturing [12], the Bureau of Mines production series [15], and the U. S. Tariff Commission reports of production of the organic chemical industry [16]. These figures are also constant dollar values on a 1947-49 base.

The measure of foreign prices was calculated by forming an index of unit values (value divided by quantity) of import products with a 1947-49 base. Haberler [3], among others, has pointed out a number of reasons why unit values will yield poor estimates of price movements. Unit values operate as if the statistical class is made up either of homogeneous products or the structure does not change over time and they do not allow for any change in quality. While these criticisms can be leveled against any price index, unit value indexes are certainly worse than most on this score. No other source of foreign export prices are available, however, so deficiencies had to be overlooked.*

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* The inadequacy of the import price data did have an effect on the study. Since unit values are notoriously poor as measures of prices of machinery, many products of this type that had all the characteristics necessary for inclusion in the sample had to be excluded on this ground. Exclusions included agricultural machinery, transport equipment, machine tools and many others.

Selection of Sample

There are approximately 20,000 separate import classes as identified in U. S. import statistics. While imports are actually recorded in less than half of the classes, the numbers involved and the degree of disaggregation make it impossible to deal with each class as a separate product. A sample was therefore drawn from the population of imports to be represented in the study.* A product was included in the sample of import products if it was

* This sample was not drawn through a probability mechanism of any sort.

manufactured and imported into the United States in the value of at least one million dollars in 1957 or 1958 and the data were available from all of the relevant sources. A total of 150 products were finally selected for inclusion on this basis representing roughly 900 import classes. Complete data were available for the census years 1947, 1954 and 1958. Most of the data were available for the intermediate years by use of the Annual Surveys of Manufacturing [13], but there are instances of lack of detailed breakdowns and certainly the reliability of the statistics are on a much lower level. For this reason, the only non-census year involved in the estimates was 1957.

The products in the sample were directed into one of two groups depending on their physical characteristics. The determining characteristic involves the elasticity of the short run supply curve of the major raw materials incorporated into the product. For illustrative purposes, let us consider changes in the importation of a raw material (even though they are outside the bounds of study).

The United States has only a limited supply of pulp woods. If there is an increase in demand for pulp woods in the U. S., the enlargement in domestic supply forthcoming would be only nominal as the short run supply curve is almost perfectly inelastic and therefore practically all of the increase in demand will be met through larger imports. Variations in quantity imported are going to reflect changes in total market demand and to a much lesser extent, the state of relative prices. While pulp woods, non-manufactured products, are excluded from the study, wood pulps are included. The conditions determining variations in the quantities of wood pulps imported, however, are very similar to those affecting pulp woods. If there is an increase in demand for wood pulp in the U. S., it is possible for domestic supply to provide for the additional requirements. Domestic production of wood pulps can be increased through greater use of domestic raw materials, or, if they are not available, through increased imports of pulp woods. On the other hand, pulp woods are very difficult to transport and although they do enter international trade, location factors usually force the processing of pulp woods into wood pulps before shipping them. The short run domestic supply curve of wood pulps is likely to be inelastic because the raw material is inelastic in supply and variations in quantities imported will reflect mainly changes in total demand, although relative prices do have some influence. The closer the manufactured product is to the raw material stage and the greater the difficulty of shipping the raw material, the more important will be changes in total demand relative to prices in determining quantity of imports. Products greatly affected by conditions of the raw material were classified as group B, while all others

were classified as group A. Paper products and aluminum sheets are included in group A, while wood pulps and aluminum ingots were put into group B. There are a total of 91 Group A and 59 Group B products in the sample.*

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* The products included in groups A and B are listed in appendix B.

The Regression Analysis

Import functions of the type represented by equation (6) that are estimated from cross section data attempt to explain the pattern of imports existing at a point in time. While one estimate of the equation results, this cannot be interpreted in the same way as an equation dealing with imports as an aggregate and using time series as observations. The parameter α_1 is a price elasticity estimate but it cannot be used uncritically in estimating changes in aggregate imports that would result from an across the board change in relative prices for the same reasons that the marginal propensity to consume as calculated from cross sections is inappropriate for estimating changes in aggregate consumption resulting from a new level of income. Model I states that the variance of the ratios of imports to domestic shipments of different products is partially determined by the foreign-domestic price relationships, the levels of tariffs and the amounts of domestic shipments of the products.

The estimates of the regressions of equation (6b) are shown for group A in Table 2 and for group B in Table 3. Figures in parenthesis are the standard errors. The units of measurement involved are as follows: the dependent variable is a ratio of constant dollar figures, the price variable is a ratio of indexes on the same base, the tariff variable is the actual level of ad valorem tariffs, and the domestic shipments variable is in thousands of constant dollars.

Table 2

Regression of Import Ratios of Group A Products on
Relative Prices, ad valorem Tariffs and Domestic Shipments

Year	Constant	α_1(Prices)	α_2(Tariffs)	α_3(Dom.Ship.)	R^2, n
1958	2.383 (3.095)	-.648 (.157)**	-.283 (.627)	-.777 (.044)**	.791** n = 91
1957	2.811 (3.106)	-.584 (.173)**	-.190 (.629)	-.789 (.045)**	.794** n = 90
1954	1.757 (1.671)	-.404 (.221)**	-.368 (.338)	-.849 (.054)**	.741** n = 91

* Significant at .95 level
** Significant at .99 level

Table 3

Regression of Import Ratios of Group B Products on
Relative Prices, ad valorem Tariffs and Domestic Shipments

Year	Constant	α_1 (Prices)	α_2(Tariffs)	α_3(Dom.Ship.)	R^2, n
1958	1.887 (4.397)	-.139 (.524)	-.430 (.882)	-.674 (.082)**	.557** n = 59
1957	.920 (5.078)	.367 (.583)	-.635 (1.020)	-.691 (.085)**	.548** n = 59
1954	.540 (5.688)	1.008 (.740)	-.677 (1.142)	-.736 (.099)**	.503** n = 59

* Significant at .95 level
** Significant at .99 level

Table 4

Regression of Import Ratios of Group A Products on Relative Prices, ad valorem Tariffs, Domestic Shipments and Dummy Variables for the Paper, Leather, Non-Metallic Mineral, and Metal Products Industries.

Year	Constant	α_1(Prices)	α_2(Tariffs)	α_3(D.Ship.)	α_4(Paper)	α_5(Leather)	α_6 (Non-Metallic)	α_7(Metal)	R^2, N	$R^2_{4567.123}$
1958	.814 (2.994)	-.746 (.157)***	-.601 (.606)	-.728 (.045)***	-.117 (.091)*	-.001 (.096)	.214 (.096)**	-.193 (.078)***	.822*** N= 91	.151***
1957	1.322 (2.969)	-.740 (.174)***	-.492 (.601)	-.745 (.044)***	-.105 (.090)	-.036 (.095)	.203 (.093)***	-.220 (.078)***	.828*** N= 90	.164***
1954	1.610 (1.572)	-.645 (.217)***	-.397 (.317)	-.774 (.055)***	.004 (.108)	-.158 (.113)*	.284 (.114)***	-.248 (.096)***	.784*** N = 91	.166***

* Significant at .90 level
** Significant at .95 level
*** Significant at .99 level

All of the estimates were calculated without imposing any à priori restrictions on the parameters. The estimates of the parameters were expected, however, to conform to some preconceived notions as to their signs and, to a lesser extent, their magnitudes. The price elasticity parameter (α_1) should have a negative sign reflecting the expectation that the higher the level of the foreign price relative to the domestic price, the smaller will be the import ratio of the product. For the same reason, the parameter associated with the level of ad valorem tariffs (α_2) should also be negative. Domestic shipments, on the other hand, have an ambivalent position with respect to the import ratio. If import quantities by themselves were unrelated to domestic shipments, then α_3 would be equal to -1.0 as X_i^t appears in the denominator of the export ratio as well as being an independent variable. It is believed, however, that imports are related to X_i^t because the higher the level of domestic production, the larger the domestic market and, ceteris paribus, the larger the domestic market, the higher will be the level of imports. This would lead one to expect the domestic shipments' parameter (α_3) to be greater (less negative) than -1.0. At the same time, however, imports and domestic production of the same product are direct substitutes. With a given level of market demand, the greater the quantity supplied by domestic sources, the less room will there be for imports leading to the anticipation that α_3 should be less than -1.0. The estimated size of α_3 will depend therefore on whether the market or the substitution effect predominates.

Since there is no income variable directly entered into the equation, comparisons of the constant term for different years should reflect different

income levels. Imports in general are positively related to income leading to the expectation that the constant term for the most recent years will be larger as compared to the early years.

If the division of the products into two groups has any meaning, it should be reflected in the parameter estimates. For group B products, the price variable is not expected to be very important as compared to the domestic shipments variable. There is no preconcerned notion of this sort with respect to group A products. The estimate of α_1 for group A should be more negative, therefore, than for group B and the opposite expectation exists for α_3.

Results of Calculations of Model I

Generally speaking, the results of the calculations of Model I for both groups seem quite satisfactory. Sizeable amounts of the variances of the import ratios are explained (R^2) and they are all significant at a .99 level as measured by their "F" ratios. The use of cross section data in general, of course, does lead to lower levels of explained variance than time series. This is particularly true of these data which are product observations without taking into account industry differences, historical institutional arrangements, or the myriad of location factors unique to products. Each of these factors does influence the level of imports of individual products to a large extent. They were not taken into account primarily because they are of lesser interest for this study and secondarily because of the immense difficulty of doing anything in practice with them.

The parameter estimates agree very well with the à priori expectations. For group A products, the price elasticity (α_1) is negative and significant over the whole period. Furthermore the α_1 estimates are remarkably similar for the different years. While α_2 is negative throughout, the coefficient is not significantly different from zero. It appears as if the tariff level is not an important variable in determining the pattern of U. S. imports, at least within recent years. The market effect of domestic shipments appears to dominate the substitution effect as α_3 was estimated to be significantly greater than -1.0 for all years. Again the estimates showed great stability over time. The constant term also exhibited the expected upward drift reflecting aggregate income changes.

A precursory effort was made to make use of industry differences. The model for group A products was recalculated with four dummy variables standing for wood and paper products, leather and leather products, non-metallic mineral products, and metal and metal products industries.* This assumes that industry

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* These industries were selected by stratifying the 91 group A products in one year (1958) into eight industrial groups and estimating equation (6b) separately for each group. Only the four industries mentioned above turned out to be significant. An inspection of the parameter estimates indicated that the constant term differed considerably among the separate estimates but not the slope coefficients. This allowed the recombining of the products by use of the dummy variable technique.

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differences affect the constant term associated with particular products but do not affect their responses to the real independent variables. The results of the calculations are shown in Table 4. The addition of the dummy variable did significantly add to the explanation as seen by the multiple partial coefficient

of determination ($R^2$4567.123), but did not appreciably change the parameter estimates of the real independent variables.

Model I, Group B

The calculations for group B products also yielded sensible parameter estimates. The price elasticity variable was weakened to such an extent that it proved not to be significantly different from zero in 1958 and 1957, and actually positive in 1954. The estimates of α_2 turned out much as they had for Group A products. Only the domestic shipments variable appears to be very important in determining the group B pattern of imports. The parameter estimates for α_3 were all significantly greater than -1.0 and consistently in excess of the α_3 estimates for group A. The upward drift of the constant term was evidenced again.

Regression Analysis Using Model II

Equation (7) attempts to explain the changes in the pattern of imports that have occurred over time. Since the price elasticity parameter (β_1) does give a measurement of percentage change of the import ratios that would result from a uniform change in relative prices, it is possible to interpret the results of Model II somewhat the way one would interpret an aggregate import function. There are some significant differences, however, that limit the analogy. An aggregate import function would certainly include national income as an explanatory variable. Income in this formulation is picked up exclusively through the constant term, so in general, the estimated parameters will differ due to the fact that the interaction of price and income is not represented. Furthermore the parameters estimated in Model II only reflect the products that

happen to be in the sample selected. If they are representative also of excluded products, then this equation may give an approximation of aggregate behavior. Since this will not usually happen when a non-probabalistic mechanism is used for sample selection, a more limited interpretation of the results is required. The estimates of Model II for the products of group A are shown in table 5 and for group B in table 6.

It is also possible to form some à priori expectations concerning the parameter estimates of Model II. One would expect the price elasticity parameter (β_1) to be negative for the same reason as in Model I. In addition, we have some guides as to what magnitudes to expect of this parameter from aggregate studies.*

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* A useful survey of statistical estimates has been published by Cheng [2].

Following the early postwar 'elasticity pessimism' period, estimates of U. S. aggregate price elasticity of demand for imports have appeared within the range of -1.0 to -3.0 , depending on the years included and the level of aggregation chosen. This may well set a sensible range within which this parameter should fall. Furthermore it has been demonstrated that longer run price elasticities will be more negative than short run elasticities [9]. This means that we should expect β_1 to be more negative when a longer time change is involved, i.e., 1958-1947 as compared to a shorter period, i.e., 1958-1957.

Table 5

Regression of Changes of Import Ratios Over Selected Years of Group A Products on Changes of Relative Prices, Tariffs and Domestic Shipments

Years	Constant	β_1(Δ Prices)	β_2(Δ Tariffs)	β_3(Δ Shipments)	R^2, n
1958-1957	.031 (.012)**	-1.237 (.201)**	.266 (1.934)	-.912 (.088)**	.641** n = 90
1958-1954	.203 (.028)**	-1.322 (.212)**	-.524 (.280)*	-.799 (.248)**	.412** n = 91
1958-1947	.635 (.106)**	-1.769 (.316)**	-5.641 (2.106)**	-.798 (.233)**	.370** n = 91
1954-1947	.539 (.082)**	-1.542 (.309)**	-4.491 (1.832)**	-.709 (.314)**	.317** n = 91

* Significant at .95 level
** Significant at .99 level

Table 6

Regression of Changes of Import Ratios Over Selected Years of Group B Products on Changes of Relative Prices, Tariffs and Domestic Shipments

Years	Constant	β_1(Δ Prices)	β_2(Δ Tariffs)	β_3(Δ Shipments	R^2, n
1958-1957	-.048 (.028)*	-.080 (.278)	-1.256 (.855)	-.688 (.128)**	.365** n = 59
1958-1954	.122 (.044)**	-.082 (.313)	-2.729 (1.991)	-.901 (.246)**	.239** n = 59
1958-1947	.318 (.100)**	-1.977 (.481)**	-.621 (.844)	.831 (.223)**	.332** n = 59
1954-1947	.344 (.076)**	-1.889 (.422)**	-.659 (.777)	.495 (.184)**	.329** n = 59

* Significant at .95 level
** Significant at .99 level

Table 7

Regression of Changes of Import Ratios Over Selected Years of Group A Products on Changes of Relative Prices, Tariffs and Domestic Shipments and Dummy Variables for the Paper, Leather, Non-Metallic Mineral, and Metal Product Industries.

Years	Constant	β_1(ΔPrices)	β_2(ΔTariffs)	β_3(ΔDomestic Ship.)	β_4(Paper)	β_5(Leather)	β_6(Non-Metallic)	β_7(Metal)	R^2,N	$R^2_{4567.123}$
1958-57	.029 (.016)**	-1.222 (.204)***	+.810 (1.989)	-.939 (.098)***	-.009 (.038)	+.034 (.040)	-.034 (.042)	+.025 (.032)	.653*** N = 90	.033
1958-54	.210 (.039)***	-1.207 (.213)***	-.501 (.275)**	-.860 (.276)***	-.089 (.082)	+.129 (.087)*	-.125 (.090)*	+.064 (.070)	.464*** N = 91	.088
1958-47	.741 (.118)***	-1.616 (.319)***	-4.319 (2.050)**	-.790 (.239)***	-.350 (.202)**	-.384 (.222)**	-.180 (.213)	+.350 (.183)**	.455*** N = 91	.135**
1954-47	.629 (.091)***	-1.430 (.301)***	-3.255 (1.749)**	-.728 (.306)**	-.297 (.175)**	-.502 (.190)***	-.089 (.179)	+.304 (.158)**	.434*** N =90	.171***

* Significant at .90 level
** Significant at .95 level
*** Significant at .99 level

The observations made with respect to the tariff level, domestic shipments and the constant term in regards to Model I, also hold for Model II. β_2 should be negative, β_3 may be greater or less than -1.0 and the constant term should reflect changes in income.

Results of Model II Calculations

The estimates of Model II for group A products seem to conform to expectation and are in general satisfactory. Estimates were made for the change in imports from 1957 to 1958, 1954 to 1958, 1947 to 1958 and 1947 to 1954. The estimates indicated that from 30% to 65% of the total variance of import ratio changes was being explained by the independent variables. The R^2's are again significant at the .99 level. When a long period is involved (in the case of the 1958-1947 twelve years), many things can happen that will affect import ratios. Technological changes in production, shifts in taste, alteration of the government non-tariff trade restrictions all work toward weakening the explanatory power of the equation for the longer time spans. With this in mind, a 30% explanatory level seems as high as one could expect without explicitly entering a great many more factors into the analysis.

The parameter estimates of group A are particularly interesting. The price elasticity estimates (β_1) agree perfectly with expectations. They are all negative, significant at the .99 level and within the range of -1.0 to -3.0. While the tendency is not extremely pronounced, the length of the time period does affect the magnitude of the estimate. The largest coefficient (most negative) resulted from the longest time span 1958-1947, and the smallest from the shortest period, 1958-1957. The four estimates of β_1 are really

quite similar, indicating an encouraging degree of stability.

The tariff change coefficient (β_2) is even more remarkable. The one year change led to an estimate of β_2 not significantly different from zero similar to the estimates of Model I. This was drastically altered, however, when the changes from 1947 to 1954 and 1947 to 1958 were involved. The year 1947 marked the first multilateral tariff reduction agreement under the auspices of the General Agreement on Tariffs and Trade. At that time, the U. S. drastically reduced its tariff by approximately 50% on practically all dutiable goods. The effect of this tariff reduction as measured by these estimates was remarkable in that it evoked a large increase in imports. Since that time, however, U. S. Tariff reductions have been small and very selective leading to only marginal changes in imports as observed in previous research [4], and confirmed by these estimates.

It was asserted previously that relative price changes and tariff changes of the same magnitude should lead to unequal changes in the import ratio. This hypothesis can be examined by testing the equality of the parameter estimates of β_1 and β_2.* This test was made and the results indicated that β_1 is

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* The test is accomplished by recomputing the equation subject to the following linear restriction; $a_1 k_1 + a_2 k_2 + a_3 k_3 = 0$, where the k's are the new regression coefficients and $a_1 = 1$, $a_2 = -1$, and $a_3 = 0$, and comparing the resulting level of explained variance with that previously obtained by use of the "F" ratio. See Tintner, G., Econometrics.

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significantly different from β_2 at the .95 level for all calculations except the 1958-1957 estimate in which the null hypothesis of equality could not be refuted.

The estimated coefficients associated with changes in domestic shipments (β_3) are all significantly different from zero but not significantly different from -1.0 . Since all the estimates are greater than -1.0 , it appears that the market effect predominates but not as distinctly as with the group B estimates. The constant term does properly reflect changes in income; the largest coefficient is associated with the change in imports from 1947 to 1958. In every case, the constant term is significantly different from zero at a .99 level.

As in the case of Model I, an attempt was made to take into account industry differences between the products by use of the dummy variable technique. Dummy variables were again added for four industries and the equation recomputed. The results are shown in table 7. One would not expect industry affiliation to be very important in the Model II formulation as differences over time are involved and the industry does not change. The dummy variables as a group did turn out to be much less important than in Model I. The only estimates for which some significance was found involved changes from 1947. This may be due to the fact that price indexes were used rather than absolute prices and 1947 was in the base period. The industry coefficients may, therefore, represent an adjustment for the actual price relatives existing in 1947. The coefficients of the real variables are not greatly different from the estimates obtained without taking industry differences into account.

Model II, Group B

The estimates of Model II for the group B products in general are not as good as the previous ones. While the coefficients of determination are all significant at the .99 level, only about 30% of total variance is being explained.

The price elasticity coefficient was uniformly negative. The magnitudes of β_1 in the significant calculations are surprisingly large as compared to the group A estimates. This may, in part, be due to the fact that changes in prices are themselves correlated with changes in tariff rates. For products whose tariff rates are in the specific form (fixed dollar amounts per physical unit), import price changes lead to an ad valorem tariff change in the opposite direction. Most of the group B products do, in fact, have tariff rates in this form. This may mean that the estimates of β_1 and β_2 are not independent and the indicated parameters are biased. The β_3 coefficients, as expected, are significant and quite large.

Conclusions

One can draw a number of tentative conclusions concerning the important determinants of United States import ratios from this study. While the level of national income was not explicitly considered in the calculations, there are indications to support the belief that aggregate imports are, in fact, largely determined by income. In this study, the aggregate level of imports (or changes in this level) are reflected in the constant term. For the calculations which proved to be significant, the constant terms consistently reflected differences in income level and changes in income. These results support the findings of aggregate studies on this question.

Within a given level of aggregate imports, however, the results indicate that relative prices are particularly important in determining the patterns of trade. For other than resource oriented goods, the relative price elasticities

were uniformly negative and indicate a fairly elastic response of demand to prices. This finding does not reflect upon the oft heard thesis that American products are losing their price competitiveness in our own markets, but it does indicate that if the price of a domestic good gets out of line with import prices, a substantial shift toward imports would occur. The results of Model II are most instructive in this regard. The estimate of the short run price elasticity of -1.237 suggests an elastic demand for imports on the part of Americans.

The frequently discussed factor that is supposedly quite important, the tariff rate, does not appear to be very significant. Particularly since 1947, the level of tariffs did not prove to have an appreciable effect upon import patterns or changes in import ratios. There is, however, a major qualification to this finding. If a tariff rate is high enough to efficiently bar all imports, the value qualification would not have been met and the product therefore could not appear in this study. There is no way to easily measure perfect protection, so this factor has eluded research efforts to date. It is true, none the less, that recent changes in our tariff rates have not led to substantial increases in imports. This is not very surprising when one considers the care that our government goes to in an effort to offer tariff reductions only on products where there is some assurance that imports will not in fact increase. If it weren't for human error, our investigation procedures would effectively eliminate all tariff reductions on sensitive products. Since the size of the tariff reductions since 1947 have themselves been very small, the results seem quite plausible. If we returned to the practice of cutting tariffs by a major fraction applicable to all dutiable imports, we might well find that imports would respond

significantly as they did following 1947. This possibility, however, seems remote at best.

While imports very likely have replaced domestic production in some lines of activity, in general the results of this study indicate that increasing imports are associated with growing domestic production. This is true not only for resource oriented goods, but also for non-resource goods, although to a lesser extent. The market effect dominates the substitution effect in every calculation without exception. This finding has major political importance in that adjustment to competition is always easiest within a growth setting. Since adverse domestic effects have in the past been the primary factor limiting a more liberal commercial policy for the U. S., the belief that American industry could easily adjust to freer trade could lead to a substantial change in our policy if generally held.

APPENDIX A

Classification Problems

The data used in this study came from three major sources, each of which has its own classification scheme. The most detailed statistics came from the import trade returns which are classified on a seven digit basis. Statistics of domestic shipments from the Census of Manufacturers are mainly available only on a five digit basis based on S I C codes. This required some aggregation of import classes to make them comparable to domestic shipments. The price statistics from the Bureau of Labor Statistics represents a third classification scheme based on a six digit breakdown. In a few instances, a further aggregation was required to make this data comparable.

In order to use the export statistics, a further round of aggregation would have been required. Exports statistics are based on a five digit classification scheme which differ in detail from the import data. Since the cost of this aggregation was considerable and the expected benefits quite small, export figures were disregarded.

APPENDIX B

Products Included in Group A

cotton grey cloth
cotton blankets
cotton rugs
wool yarns
wool rugs
Wilton rugs
synthetic yarns
synthetic fabrics
hats
gloves, non-leather
cotton shirts
cotton raincoats
handkerchiefs
woolen wearing apparel
confectionery
canned fruit
canned vegetables
canned fish and meat
plywood
hardwood veneer
softwood veneer
wooden chairs
wallboard and pulpwood
finished paperboard
wallpaper
coated paper
book and printing paper
wrapping paper
dextrine
perfumes
glycerine
ammonium sulphate
primary iron and steel
iron and steel tubes and pipes
steel strip
aluminum sheets
type metal
nuts, bolts, rivets, screws
typewriters
printing presses
duplicating machines
tractors
buttons and notions
sporting goods
metal toys
pins and needles
vinyl resins
menthol
caffeine
medicinals
dyes
organic cyclic intermediates
synthetic rubber
gelatin
cellulose
naphthalene
benzene
creosote oil
tires and tubes
womens' shoes
mens' shoes
calf and kid leather
cattle leather
industrial leather products
leather slippers
leather gloves
leather handbags
other leather products
plate glass
sheet glass
asbestos shingles
asbestos textile fiber
earthenware
china ornaments
household china
blown glass
glassware
asbestos paper fiber
electric lamps
aluminum foil
steel wire, rope and strand
wire mesh
scissors and shears
knives, not all metal
aluminum hospital and household ware
watches
spectacles
photo lenses*
still photo cameras
motion picture cameras
cutlery, all metal

* Not available for 1957.

Products Included in Group B

beer
still wines
distilled liquors
cigars and cheroots
non-woven wool felts
softwood lumber
hardwood lumber
red cedar shakes
wood pulp - mechanically ground
chemical wood pulp, sulphite unbleached
chemical wood pulp, sulphite bleached
wood pulp, soda, bleached and unbleached
chemical wood pulp, sulphate, bleached and unbleached
newsprint
essential oils
potash materials
litharge lead
zinc oxide
iron oxide
acetelene black
sodium sulphate
cobalt oxide
crude drugs
single vitamins
mercury
bismuth
sodium chloride
paints and varnishes
ammonium nitrate
cement
graphite
gypsum
polished marble
asbestos
artificial abrasives
magnesite brick and shape
tiles
Fluorspar - acid grade
Fluorspar - ceramic grade
mica products
magnesite, other
cadmium
platinum
palladium
rhodium
copper, pigs
copper, rolls
lead, pigs
lead, alloys
tin blocks
nickel
antimony
cobalt metal
ferro-silicon
other ferro-alloys
titanium
aluminum, pigs
zinc blocks

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