ABSTRACT

THE UNITED STATES DEMAND FOR IMPORTS OF MATERIALS, 1923-60

by Richard Dale Reimer

The purpose of this study was to add to our empirical knowledge concerning the relationships which exist between the quantity of materials imported by the United States and the level of industrial production and prices of imports. In order to make some quantitative estimates of the effects of changes in the level of industrial production and prices of imports on the quantity of materials imported, least-squares regression analysis was used and estimates of the income and price elasticities were derived. Separate import functions were derived for total imports of materials, as well as for imports of materials from six geographical or political regions. The six regions were; European Payments Union countries, Total Europe, Canada, Latin America, Overseas Sterling Area, and the Rest of the World. The analysis was divided into three time periods; prewar, postwar, and total period, which included data from both the prewar and postwar periods. The study used as basic data for the regression analysis special unit value and quantity indexes for total imports of materials and for imports of materials for each of the regions. The indexes were computed according to the Fisher "Ideal" index number formula.

The least-squares method was chosen because it was considered to be the most desirable method of analysis given the nature of the study and the type of data available. This method was chosen despite the fact

that least-squares estimates are known to yield biased results in some instances and in the case of price elasticities this bias will usually be toward zero.

A second part of the study dealt with some structural changes which have occurred in the demand for imports of materials since 1923. Some of the structural changes discussed included the effects of World War II, tariff changes, and internal disturbances such as a steel strike. Perhaps the most important structural change that has occurred is the downward trend in the quantity of materials imported relative to the level of industrial production. This relative downward trend can be traced to an actual decline in imports of a few commodities such as; crude rubber, silk, cotton, and wool, all of which have been affected by technological developments such as the introduction of synthetics.

Numerous regression equations incorporating different variables into the analysis were fitted. A total of 82 estimating equations for total imports of materials and for imports of materials from the different regions are presented in the study. The results obtained indicate that changes in the quantity of materials imported by the United States are quite closely related to changes in the level of industrial production. Most of the estimates of the income elasticity ranged from +0.7 to +1.0 which is well within the range indicated by economic theory. Two different price elasticities were computed. The first of these was based on the price of imports from one region relative to the price of imports from all other regions and was termed the competitive price elasticity. The estimates of the competitive price elasticity that were obtained, while generally less than one, did indicate that import prices are an important factor in determining the regional pattern of United States imports of materials. On the other, the price of imports relative to the domestic price level did not appear to be a significant factor, although, there was some indication that its importance was growing during the postwar period.

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By

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CHAPTER I

INTRODUCTION

Since the end of World War II a considerable amount of interest has been expressed in the United States demand for imports. This has been true not only in this country, but also in various foreign countries. This interest in the United States import demand abroad should not be surprising, since the United States ranks first in the volume of international trade among the countries of the world. Furthermore, for some Latin American countries, exports to the United States have accounted for up to 75 per cent of their total exports in some years. Another reason for the interest in the United States import demand was due to the serious dollar shortage faced by many countries, especially European countries, immediately following World War II. At the time, there appeared to be a feeling among economists and others that the United States propensity to import had declined during the thirties and that this decline had either continued or at least had not been arrested during the forties. The acceptance of this unverified hypothesis then led to the conclusion that the then serious dollar shortage might even grow worse.

It was during this period that the initial flurry of import studies appeared. A few of these studies are discussed briefly in the next section.

With the start of the Korean War in 1950 the United States government became concerned with the availability of raw materials needed for the war and the buildup of United States defences. This concern was expressed in the establishment of the President's Materials Policy Commission. The report of this commission, Resources for Freedom,

more popularly known as the Paley Commission Report, named after the Commission chairman, was published in 1952. The purpose of the Commission was to recommend appropriate policies which would insure the United States an adequate supply of raw materials for its military and civilian needs.

However, the need to know more about the factors which influence the demand for imports of materials has not ended with the end of the Korean War.[1] Exports of materials, along with grants and loans, comprise the major source of foreign exchange for most of the lesser developed countries throughout the world. The shortage of foreign exchange which many of these developing nations face, is as serious at present as it was for many European countries following World War II, therefore, since the United States is the major importer of raw materials and since the economic problems of the developing nations are perhaps the most pressing economic problems of the day, it is doubly important that more empirical evidence be made available concerning the factors which influence the demand for imports of materials.

It is the purpose of this study to add to our empirical knowledge concerning the relationship between imports of materials and the level of economic activity and prices, as well as to make some quantitative estimates of the magnitude of the influence which industrial production and prices have in determining the volume and origin of this country's imports. Particular attention is focused on the relationships which existed prior to World War II and to the situation that is believed to be in existence at present. While most of the empirical work that has appeared in this area up to now has of necessity had to rely on prewar data, a long enough time period has now elapsed since the end of the war to permit use of data from the postwar period in a statistical analysis.

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[1]The economic classification, materials, as used in this study includes all crude materials and semimanufactures plus two finished manufacturers, burlap and newsprint.

The particular contributions of this study are presented following a brief review of a few of the earlier studies and a discussion of their limitations.

A number of studies which attempt to make estimates of price and income elasticities in international trade have appeared during the last twenty years. This was especially true of the period immediately following World War II when most of the countries of the world were faced with a serious dollar shortage and a solution to the problem was badly needed. These studies have varied as to method and have ranged all the way from an attempt to estimate one countries' import demand for a single commodity to estimating the influence of price and income on the balance of payments of a number of countries. A brief summary of a few of these studies is presented below.[2]

One of the first of these studies to be published was written by Imre de Vegh and dealt with the relationship between imports and income in the United States and Canada.[3] Using data from the inter-war period, de Vegh fitted a large number of regression equations using different import series i.e., value of retained imports and quantity indexes of imports and correlating these with different types of income definitions such as gross national product, income payments and an index of industrial production. He also fitted equations of various forms; linear, logarithmic, and first differences. Income elasticity estimates obtained by de Vegh for total United States imports varied from 0.7 to 2.0. The lower range of the estimates were obtained when using a regression

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[2]For a more comprehensive summary of estimates of elasticities in international trade the reader is referred to: Hang Sheng Cheng, "Statistical Estimates of Elasticities and Propensities in International Trade," IMF Staff Papers, Vol. VII (1959-60), pp. 107-158.

[3]Imre de Vegh, "Imports and Income in the United States and Canada," Review of Economic Statistics, Vol. XXIII (1941), pp. 130-146.

of the quantity index of imports on the Federal Reserve index of industrial production, while the higher range was obtained when using a regression of the value of imports on the United States gross national product. The value of the correlation coefficient, (r) varied from 0.82 to 0.98.

Another interesting set of equations fitted by de Vegh were those relating the value of United States imports from Canada to United States gross national product using different time periods. The correlation coefficient in each case was high, 0.95 to 0.97, however, the income elasticity varied from 1.35 to 1922-37 to 5.6 in 1937-38. However, the 5.6 figure is entirely meaningless, since the analysis only covered a period of two years.

In addition to these regressions, de Vegh also fitted equations for Canadian imports as well as for some individual commodities imported by the United States with quite similar results, except that the income elasticities derived for some of the individual commodities are somewhat lower.

In another pioneer article John H. Adler used least-squares regression analysis to study the relationship between imports, real national income and relative prices.[4] Using as his period of analysis 1922-37 Adler found that relative prices played only a small part in the determination of import volume. He attributed this to a downward shift in the propensity to import which occurred around 1930. He then ran separate regressions on the period up to 1930, after 1930 and for the entire period. Three of the regression equations fitted are given below.

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[4]John H. Adler, "United States Import Demand During the Interwar Period," American Economic Review, Vol. XXXV (June 1945), pp. 418-30.

		Correlation Coefficient	Income Elasticity	Price Elasticity
1922-37	M=8.233+1.652Y-.071P	.948	1.005	-0.092
1922-29	M=35.019+1.857Y-.357P	.947	1.157	-0.517
1930-37	M=-19.648+1.601Y+.237P	.971	0.964	*

* The result indicates a positive rather than a negative relationship between quantity and price.

M = Total imports in millions of dollars at constant prices 1935-39=100

Y = National income in billions of dollars at a constant cost of living 1935-39=100

P = Price index of total imports corrected for duties divided by U. S. wholesale Price index 1935-39=100.

Adler concludes his study by saying that the results obtained from these and other regressions indicate that the income elasticity is somewhere around 1.0 while the price elasticity is probably between -0.3 and -0.5.

A second and more extensive study in which Adler participated was authored jointly with Eugene R. Schlesinger and Evelyn Van Westerborg.[5] In this study the authors computed unit value and quantity indexes for United States for the period 1923-50. These indexes are computed for total United States imports and for imports from eight regions and nine individual countries. Separate indexes are computed for each region and country for four economic classes.[6]

[5]John H. Adler, Eugene R. Schlesinger and Evelyn Van Westerborg, The Pattern of United States Import Trade Since 1923. (Federal Reserve Bank of New York), May 1952.

[6]The eight regions were; European Recovery Program countries, other European countries, Scandinavia, total Europe, North America, Latin America, Overseas Sterling Area, and Rest of the World. The nine countries were; Belgium, France, Germany, Greece and Turkey together, Italy, Netherlands, Portugal, Switzerland and United Kingdom. The four economic classes were; crude foodstuffs, manufactured foodstuffs, crude and semi-manufactured materials and finished manufactures.

Using these new indexes for much of their data the authors attempted to derive the "rules" for U. S. import demand during the interwar period. The rules are obtained by least-squares regression analysis, using quantity of imports as the dependent variable and some measure of U. S. income and various relative prices as the independent variables. Separate regressions are obtained for imports of crude and semi-manufactured materials, crude foodstuffs and manufactured foodstuffs from each of the regions. In addition, regressions are also fitted for imports of finished manufactures from ERP countries as a group and for some of them individually. The regressions that were obtained for imports of crude and semi-manufactured materials are given below in Table 1. The data used in these regressions are from the time period 1923-37.

As is indicated, the industrial production elasticity derived by Adler, Schlesinger and Van Westerborg, for crude and semi-manufactured materials ranges from 0.4 to 1.2, while the competitive price factor ranges from -0.02 to -1.1. No equations are given where the domestic price level enters into the equation. In general the income elasticity for foods was found to be somewhat lower and no competitive price factor is calculated for the two classes of food. For finished manufactures the income elasticity goes as high as 4.6 for imports from the United Kingdom. The price elasticity for finished manufactures is also quite high, ranging from -0.7 for imports from Switzerland to -6.6 for imports from the United Kingdom.

Another quite extensive study using the least-squares method was published by Neisser and Modigliani in 1953.[7] The Countries which are included in the study are divided into six groups; the United Kingdom,

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[7]Hans Neisser and Franco Modigliani, National Incomes and International Trade (Urbana, Illinois: University of Illinois Press), 1953.

Table 1. Relationship Between Industrial Production, Relative Prices, and Quantities of Crude and Semi-manufactured Materials Imported from Various Regions 1923-1937.

Region of Origin	Estimating Equation	Correlation Coefficient	Industrial Production Elasticity	Competitive Price Factor
ERP Countries	M=201.8+0.5Y-1.4P	.96	0.4	-1.1
Europe	M=134.3+0.7Y-0.9P	.97	0.5	-0.8
North American	M=-13.1+1.2Y-0.01P	.99	1.2	-0.02
Latin America	M=90.4+1.1Y-0.8P	.77	0.9	-0.8
Overseas Sterling Area	M=16.4+1.1Y-0.3P	.86	1.1	-0.3
Total Sterling Area	M=19.4+1.1Y-0.2P	.91	1.0	-0.1
"Rest of the World"	M=50.4+0.7Y-0.1P	.87	0.7	-0.2

M=Index of quantity of imports

Y=Index of industrial production

P=Price index of imports from one region divided by an index of import prices from all other regions. The elasticity derived from this price is termed the competitive price factor.

Source: John H. Adler, Eugene R. Schlesinger, and Evelyn Van Westerborg, The Pattern of United States Import Trade Since 1923. (Federal Reserve Bank of New York, May 1952), p. 71.

United States, Germany, France, the remaining industrial countries,[8] and the primary producing countries.[9] Imports for each of the country groups are divided into three economic classifications, foods, raw materials and manufactures. The raw materials classification includes both crude materials and semi-manufactures. The quantity index which is used as the dependent variable in the raw materials equation for the United States is a weighted arithmetic average of the crude materials, weighted two, and semi-manufactures, weighted one, indexes as published by the U. S. Bureau of the Census.

In their regression analysis the authors discovered a marked decrease in the import propensity which they claim occurred around 1934.[10] As a possible explanation of this phenomenon they examined various possibilities including; relative import prices, tariff changes, domestic production of raw materials, changes in stocks, changes in construction activity, and changes in composition of output. All of these factors were rejected as having any significant influence and they are left with a simple regression of import quantities as a function of U. S. industrial production. The regression coefficients and correlation coefficients derived for the different time periods are as follows:

	1925-33	1934-39	1925-37
b	.93	.77	.83
r	.99	.88	.91

While no industrial production elasticities are computed, both indexes have 1928 as their base year so that for 1928, at least, the production elasticity would be equal to the regression coefficient.

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[8]Austria, Belgium, Czechoslovakia, Italy, Japan, Sweden and Switzerland.

[9]The rest of the world excluding the U.S.S.R.

[10]In his early study Adler also found a marked decrease in the propensity to import, but claims this occurred around 1930. See p. 4.

Another elasticity study, but one using an entirely different method was conducted by Barend A. de Vries in the early 1950's.[11] In this paper de Vries makes estimates of import price elasticities for a large number of individual commodities. The estimates are based on the U. S. Tariff Commission's study in 1945 of the long run effects of a 50 per cent reduction and of a 50 per cent increase of U. S. tariff rates in 1939 on the volume of U. S. imports during the postwar period. A change in tariff rates is equivalent to a shift in the demand curve so that the 1939 volume of imports along with the estimated volume of imports for the two assumed tariff changes will yield three points on the supply curve. From these points on the supply curve de Vries calculates three points through which the demand curve must pass. With this information it is possible to derive two price elasticities for each commodity studied, one corresponding to the tariff decrease and another for the tariff increase. These elasticities are computed for 176 individual commodities which in 1939 comprised 29.4 per cent of total U. S. imports. The weighted average of the price elasticities for the tariff increase was -2.23 while the weighted average for the tariff increase was -2.74. A total of 27 raw materials were included in the group and when price elasticities were computed for these 27 commodities, the result was a weighted average price elasticity of -0.80 for a tariff decrease and -1.62 for the tariff increase. Unfortunately the validity of these estimates rests on two factors, neither of which can readily be determined. The first of these is the accuracy of the Tariff Commission forecasts of import volumes and this cannot be determined because the assumptions of the Tariff Commission were not met during the post war period 1950-51.[12] The other factor which must be considered is the

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[11]Barend A. de Vries, "Price Elasticities of Demand for Individual Commodities Imported into the United States," IMF Staff Papers, Vol. I. (1950-51), pp. 397-419.

[12]The Tariff Commission assumed a 75 per cent increase in per capita incomes and a 35 per cent price increase in the price levels prevailing in 1939.

slope of the supply curve and here too, very little is known concerning this point. The average total price elasticity given by de Vries is actually very close to the price elasticity derived by Adler et al. for finished manufactures. However, the price elasticity for raw materials seems somewhat high since both the Adler et al. and Neisser and Modigliani studies indicated that the price variable was not a significant factor in determining the volume of imports of materials. The discrepency, however, may simply be due to the characteristics of the individual commodities being studied.

Another rather unique method of deriving price elasticities has been used by Arnold Harberger in a more recent study.[13] After citing several reasons why the measurement of price elasticities from the interwar time series data has proved difficult, Harberger states that he doesn't believe that an exact measurement is possible with the existing tools.[14] Harberger continues by saying, "When all or most of a set of uncertain and imprecise pieces of evidence point in the same direction, we have the sort of situation where ignorance turns into hunch, hunch into belief, and ultimately belief into knowledge."[15]

Harberger presents three pieces of evidence regarding the effectiveness of the international price mechanism. Two of these deal with export demand elasticities of individual countries and the third deals with the elasticity of import demand for an individual country. He estimates the import demand elasticity by making what he terms a "crude experiment." He compares the imports of eight different countries in 1954 with

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[13]Arnold Harberger, "Some Evidence on the International Price Mechanism," Review of Economics and Statistics, Vol. XL, (1958), pp. 123-127.

[14]For a discussion of Harberger's reasons as well as earlier criticisms of the least-squares method by Guy Orcut and Harberger, see Appendix A of this study.

[15]Harberger, op. cit., p. 124.

either their 1937 or 1938 imports.[16] He then uses income elasticities derived by J. J. Polack[17] to explain changes in imports due to income changes and the residuals or changes in imports not explained by income are all attributed to price changes. Six of the price elasticities derived in this manner turn out to be negative and range in value from -0.56 for the United Kingdom to -2.12 for Canada. The elasticity estimate thus derived is open to a number of interpretations. In the event that all the price changes that occurred between 1937-38 and 1954 would have been in the same direction, then Harberger's estimates could be termed something of a hybrid between long run and short run elasticity since some of the price changes must have occurred early in the period and others in 1953-54. On the other hand if price changes occurred in both directions, (as they actually did) then it is possible that the long run effects may have cancelled themselves out and what remains is a relatively short run elasticity. One assumption necessary in this type of study is that when income changes are taken into account the demand schedule has remained constant from 1937-38 to 1954. While it is true that the price elasticities derived by Harberger are quite plausible, it is necessary to bear in mind the various dangers which are inherent when making a comparison of only two years which in turn are 17 years apart. Basically these dangers all revolve around the necessary assumption that both demand and supply conditions have remained unchanged, thus excluding such external factors as drought, strikes or changes in taste.

While it is quite true that a great deal of work has been done in deriving estimates of United States import demand elasticities, it is,

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[16]The countries included in the study are: United Kingdom, Netherlands, United States, Canada, Australia, New Zealand, Union of South Africa and Sweden.

[17]J. J. Polak, An International Economic System, (Chicago: University of Chicago Press, 1953).

nevertheless, also true that most of these studies possess several limitations when one attempts to apply the results to the policy questions which are paramount at the present time.

First, most of the studies using the least squares method use data from the prewar period. Any projection or use of elasticities derived from data of this period must assume that the U. S. import function has not changed since before the war. While this may in fact turn out to be the actual situation, the need for some empirical evidence on this point should be readily apparent. It is true that a few studies have incorporated some post war data with the pre war data,[18] however, if the import function derived in this manner is to be meaningful then the same assumption must be made.

Another limitation of many of the previous studies is related to the problem of aggregation. Many of the studies especially the earlier ones, simply relate either value or volume of imports to some measure of income and prices. While the information yielded by estimates of this type is certainly useful, we also need to know more about the import functions of broad classifications of commodities such as foods, materials, and manufactures, since there is ample evidence that price and income do not effect all types of commodities in the same manner. The problem of disaggregation has been attacked by deriving import functions for various individual commodities. Information supplied by this type of study is useful when we are interested in analyzing the behavior of certain industries, or the effects of tariff changes of particular commodities. However, the attempt to derive a total import demand elasticity by computing a large number of single commodity

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[18]J. J. Polak, "Contribution of the September 1949 Devaluations to the Solution of Europe's Dollar Problem," I.M.F. Staff Papers, Vol. 2, 1951-52, pp. 1-32 and Herbert K. Zassenhaus, "Direct Effects of a United States Recession on Imports: Expectations and Events," The Review of Economics and Statistics, Vol. XXXVII, 1955, pp. 231-55.

elasticities and then taking some sort of a weighted average as the total import elasticity is certainly not warranted. This is true because many imports are substitutes for other imports and while a price increase of one commodity may cause a sharp curtailment of imports of that commodity, it is quite likely that imports of some close substitute would increase. In this case the result would be that total import prices would have risen slightly while quantity of total imports would not have changed, only the composition of the total. This would probably be the case for imports of certain metals, fibers, and foods.

Two of the publications discussed in the previous section solved the disaggregation problem by dividing imports into three or four broad economic classifications.[19] The division of imports into broad economic classifications recognizes that the import function for foods may be quite different than that for raw materials, but at the same time also recognizes that substitutions within the economic classification do occur. The Adler et al. study has as an additional contribution the derivation of import functions from various regions of the world. This is quite important when one realizes that the composition of any one economic class of imports will be quite different for Europe as compared to Latin America.

Estimates of elasticities derived by a direct comparison of any two time periods, such as those of Harberger and Polak, may be further criticized by pointing out that if the demand curve has shifted to any extent, even though it be a completely random shift, the effects of such a shift will be embodied in the estimates.

Contributions of this Study

The present study continues the practice followed by Adler, Schlesinger, and Van Westerborg and derives separate import functions

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[19]Niesser and Modigliani, op. cit., p. 8, and Adler, Schlesinger and Van Westerborg, op. cit., p. 5.

for United States imports of materials from six different regions of the world. Separate functions are also derived for total imports of materials. As the basic tools for the analysis this study uses the unit value and quantity indexes first computed by Adler, Schlesinger and Van Westerborg and which have been carried forward through 1960 as a part of this study. These indexes are presented in Appendix C. A complete discussion of how they were computed is given in Chapter III.

As mentioned earlier in this chapter, the fact that a considerable time period has now elapsed since the end of World War II has made it possible to derive separate import functions for the postwar period which in turn provide an indication of the relationships between quantity of imports, prices, and income during the postwar period. Most of the earlier studies indicated that import prices relative to domestic prices had little effect on the volume of imports of materials. The present study seems to confirm this for the prewar period. However, for the postwar period the available evidence seems to indicate that the price of imports relative to the domestic price level is a factor in determining the volume of imports of materials.

A third contribution of this study is the analysis of some of the structural changes which have occurred in the United States demand for imports of materials since 1923. Structural changes in demand are defined as those changes in demand which can not be explained by changes in the level of United States industrial production or changes in relative prices and which, at the same time are not simply random year to year fluctuations.

CHAPTER II

METHOD OF ANALYSIS

The United States Department of Commerce has divided U. S. imports into five economic classes; crude materials, semi-manufactures, crude foodstuffs, manufactured foodstuffs and beverages, and finished manufactures. Imports of materials as defined in this study include those commodities which comprise the first two economic classifications, crude materials and semi-manufactures. In addition, two finished manufactures, newsprint and burlap, have been included in the materials category.

This study makes use of unit value and quantity indexes of imports first computed by John H. Adler, Eugene R. Schlesinger and Evelyn Van Westerborg in 1952.[1] These indexes were computed for the years 1923 through 1950. Since that time Adler, now with the International Bank for Reconstruction and Development, and Charles G. Goor, also with the International Bank, have revised the indexes for 1949-50 and have carried them forward through 1953. As part of the present study, the indexes of total imports of materials and imports of materials from seven geographic or political regions have been carried forward through 1960. The seven regions are: European Payments Union countries, Other European countries, Total Europe, Canada, Latin America, Overseas Sterling Area, and the Rest of the World.

As is indicated by the use of regional indexes, this study attempts not only to analyze the demand for total but also the demand for imports from

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[1]Adler, Schlesinger, and Van Westerborg, op. cit., p. 4.

various regions of the world. While an analysis of total imports of materials is important and quite informative, a large amount of important information is entirely covered up in any global treatment of imports. One of the reasons why this is true is that even within the classification of materials the composition of imports differs greatly from one area to another. For instance, lumber and newsprint comprise a large per cent of United States imports of materials from Canada. Very little lumber or newsprint is imported from any other region with the exception of pulpwood, much of which comes from the Scandinavian countries. Similarly, many of United States imports of semi-manufactured steel come from the European countries while imports of crude metals come largely from Latin America and the Overseas Sterling Area. Given these differences in the composition of imports of materials there is ample reason why the level of United States industrial production and relative prices might effect the volume of imports coming from various regions quite differently. A changing pattern of U. S. industrial production, due either to a change in taste or technology might also be expected to exert quite different influences for the various regions. Thus, the change from the use of silk to synthetic fibers had quite different effects for Japan as compared to the European countries. Similarly, an internal disturbance, such as a steel strike, could be expected to increase imports from Europe, while imports from Latin America might decline because of a decrease in the demand for iron ore.

A second reason for doing a study based on imports from various regions is the effect that an increase or decrease in U. S. imports has on the exporting countries. The United States purchases a large share of the materials exports of various Latin American countries and Canada; furthermore, materials comprise a major share of the exports of these countries. On the other hand, certain East European countries and some of the countries that were formerly colonies have never looked on the

United States as an important outlet for their markets. For this reason the effects of a changing level of U. S. imports will effect various countries quite differently.

The Use of Index Numbers in Computing Elasticities

The index numbers that are used in this study are derived from the Fisher "Ideal" index number formula.[2] For the years 1923-48 a fixed base period, 1935-39 is used. Starting in 1949, the indexes were placed on a chain base. This was done because of the inadequacy of the original sample for the postwar period and the necessity for making additions to the sample which is most easily facilitated when using a chain index.[3]

The use of index numbers in regression analysis has been criticized by Guy Orcutt in an article which appeared in 1950.[4] In this study, Orcutt points out that historical price and quantity indexes reflect price changes of a large group of commodities with very different price elasticities. He points out that it seems reasonable to assume that historical price changes have been largest for those commodities with low price elasticities. Thus, any index which includes commodities with low price elasticities might exhibit price changes which were due only to price changes in a few price inelastic commodities. Since these price changes would be associated with only small quantity changes, the derived price elasticities quite likely will be too low. Orcutt's point is quite valid for any study based on price and quantity indexes of total imports. However, when indexes are used which include only commodities which would be classified

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[2]A complete description of the indexes and the computational procedures followed in the computation is given in Chapter 3.

[3]Adler, Schlesinger and Van Westerborg, p. f10.

[4]Guy H. Orcutt, "Measurement of Price Elasticities in International Trade," The Review of Economics and Statistics, Vol. XXXII (May, 1950), p. 125.

as materials, it may be expected that the price elasticities of the various commodities will be much more similar. Orcutt's criticism is also partly invalidated in the present study by the use which is made of the regional indexes which will also tend to eliminate the problem of widely divergent price elasticities of the various commodities. The reason for this is that the price elasticities of the materials imported from any one region such as Latin America or Europe are much more likely to be similar than the price elasticities of the materials imported from all of the regions.

Least-Squares Regression Analysis

As was indicated in the introductory chapter, the present study attempts to make an estimate of the quantitative influence which certain factors have on the volume of United States imports of materials. In other words, estimates are made of the income (industrial production) elasticity and price elasticity (relative to prices of competing foreign sources of supply and relative to domestic prices). In making these estimates, the classical least-squares regression analysis is used. This method of analysis was selected because it was considered to be the most appropriate method, given the type of data available and the purposes for which the study was conducted. This decision was made despite the limitations of the least-squares approach. It is also recognized that the estimates obtained by the least-squares approach may under certain conditions be subject to a bias and this fact must be considered when interpreting the results that are obtained.[5]

While the indexes that are used have been computed for the years 1923-60 inclusive, not all of the years could be included in the regressions because of the disturbances due to World War II. Therefore, three

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[5]A more complete discussion of the criticisms of the least-squares method and the conditions under which least-squares estimates are unbiased is presented in Appendix A. Appendix A also contains a brief discussion of alternative econometric methods and a comparison of results obtained by the various methods.

different time periods have been used in the regression analysis; prewar period, postwar period, and a third set of regressions which combine both the prewar and postwar years.

However, the division of the analysis into prewar and postwar periods has created another problem. Namely, that the number of observations included in the regressions has been sharply reduced. This problem is especially evident for the regressions using postwar data. The effect of a limited number of observations is that the values of the error terms are increased which, in turn, decreases the reliability of estimates of the coefficients derived from the regression equation. For this reason, the regressions which incorporate the total time period into the analysis are considered to have greater validity, provided it can be assumed that the basic relationships among the variables remained the same throughout the period. In the present study, there is evidence that a shift in the import function did occur during the war. This apparent shift and the statistical technique used to cope with the problem are explained in detail in Chapter IV.

Another problem that arises in a study of this type has to do with the nature of the available data. Strictly speaking, least-squares regression analysis assumes that each of the observations used in the analysis is chosen from the universe in a purely random manner and that each observation is independent of the previous one. Obvisouly, this condition is not met when time series data are used, since the price in time period two quite frequently may be related to the price in time period one. This relationship between the variable and its value lagged one time period is called autocorrelation. Tests have been devised to determine if autocorrelation is present in the residuals and all of the regressions fitted in the following chapter have been tested for autocorrelation and the results are indicated.

Another technique that is used in the present study, in addition to the division of the analysis into two time periods, is the fitting of two different types of regressions. In addition to fitting the usual linear regressions, use has also been made of the technique whereby all values of the variables are transformed into logarithms and the resulting values used in the regression equation. Where this is done the regression coefficients obtained are the elasticities desired and there is no need to associate any given elasticity with only one point on the function. However, this factor should not be the determining one in deciding which type of regression to use. Richard Foote has given three criteria to use in deciding whether or not to use logarithmic equations.[6] Essentially, these three criteria amount to the fact that if the relations between the variables are more stable in percentage than in absolute terms, logarithms should be used.

In the present study, the position is taken that on an a priori basis there is no reason for preferring one form over the other and that the final choice must be based on the results, namely, the degree of correlation that is obtained, the randomness of the residuals, and the plausibility of the sign and value of the regression coefficients. Since in the present study the two forms give similar results for most cases, it is felt that the validity of the estimates is strengthened by using both forms and, therefore, the results obtained from both methods are given.

The effects of structural changes and other disturbances on the United States import demand for materials are considered to some extent by the choice of the time period included in the regression analysis and also by including time as one of the variables in some of the regressions.

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[6]Richard J. Foote, Analytical Tools for Studying Demand and Price Structures, Agricultural Handbook No. 146, United States Department of Agriculture, Washington D. C. (August, 1958), p. 37.

The years included in the prewar period are 1923-38 inclusive except for the regressions for the E. P. U. countries and total Europe where the year 1938 is excluded, because of the start of World War II. The postwar period includes the years 1948-60, except that as in the prewar period it was necessary to shorten the time period for the regressions for the E. P. U. countries and for total Europe. Because of the destruction which occurred in Europe during the war and because the reconstruction was not completed by 1948, the years 1948 and 1949 were excluded from the analysis.

Following the presentation of the results of the regression analysis, an attempt is made to analyze the causes of the apparent downward trend in the quantity of materials imported relative to the level of United States industrial production. In addition, a discussion of the effects on the geographical pattern of U. S. imports of such occurrences as World War II and the prolonged steel strike in 1959 is presented.

CHAPTER III

DERIVATION OF THE IMPORT INDEXES[1]

The data from which the import indexes were computed are taken from two sources published by the Bureau of the Census. For the years 1923-33 figures for general imports were used; for the subsequent period, data for imports of consumption were used. Data for general imports are for total arrivals of merchandise and do not reflect changes in warehouse stocks. Imports for consumption represent total imports for consumption plus withdrawals from warehouses. The use of general imports was necessary because data for imports for consumption from the various regions are not available for the early period. However, the global data which are available indicate that the differences are small. For the period 1923-46, data was taken from the annual volumes of Foreign Commerce and Navigation of the United States, published by the Bureau of Foreign and Domestic Commerce. For the years 1947-60, data were taken from the Bureau of the Census, Calendar Year Reports No. FT110, United States Imports of Merchandise for Consumption.[2]

One problem encountered in computing the indexes was that the data for some of the postwar years are not strictly comparable. This is due to some changes in coverage and compiling procedures by the Bureau of the Census. Prior to July 1953, all formal entries were fully compiled

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[1]The material in this section that is related to the import indexes for the years 1923-50 is taken from the Adler, Schlesinger and Van Westerborg study, Appendix A, pp. 60-63.

[2]The import data given in the FT110 Reports are imports for consumption and consist of imports of merchandise entered into United States consumption channels. Thus government purchases of strategic materials for stockpiling are not included, and the value of imports and quantity indexes are understated to this extent. At the same time the elasticity estimates derived in the next chapter are free of what might be termed a stockpiling bias.

by seven digit commodity numbers. Informal entry items valued at $100 or less were excluded. Starting in July, all formal entries $100 and less were included in a "miscellaneous" category and beginning in September, informal entries $250 and less were excluded. During the period 1954-57, all entries of $250 or less were included in the commodity group or sub-group total only. Beginning in 1958, all formal entries under $100 and all informal items were summarized under a special "Miscellaneous" category. Since all of the data used in the computation of the indexes in this study are based on the seven digit individual commodity data, the quantity indexes will be slightly underestimated, beginning in 1953. However, the extent of this underestimation is probably almost negligible. The Department of Commerce has estimated that the total value of entries valued at less than $250 in 1957 was approximately $134 million. Or about one per cent of total imports. About $49 million of this is on formal entries and the remainder on informal entries, many of which have always been excluded from the seven digit classification. While it is impossible to determine exactly how much of this $134 million would be classified as materials, examination of the data published by the Department of Commerce pertaining to 1957 indicates that the figure would probably be about $10 million. Since about 65 per cent of this amount is comprised of informal entries, part of which have never been included in the seven digit classification, the extent of the underestimation for materials imports is probably somewhere in the vicinity of one-tenth of one per cent.

The list of the countries which comprise the geographic and political regions for which separate indexes have been computed is given on the following page. Two minor changes in the country classifications have occurred since 1923. The division of Germany is perhaps the most serious of the two. West Germany is included in the E.P.U. countries group, while East Germany is now classified with the Other Europe group.

Regional Classification of Countries

EUROPEAN PAYMENTS UNION COUNTRIES

Austria
Belguim and Luxemborg
Denmark
Ireland
France
West Germany
Greece
Iceland
Italy
Netherlands
Norway
Portugal
Sweden
Switzerland
Trieste
Turkey
United Kingdom and Northern Ireland

OTHER EUROPE

Albania
Bulgaria
Czechoslovakia
Estonia
Finland
Hungary
Latvia
Lithuania
Poland
Romania
Spain
USSR
Yugoslavia

CANADA

Canada including
Newfoundland

LATIN AMERICA

Argentina
Bolivia
Brazil
Chile
Colombia

LATIN AMERICA (continued)

Costa Rica
Cuba
Dominican Republic
Ecuador
Guatemala
Haiti
Honduras
Mexico
Nicaragua
Panama
Panama Canal Zone
Paraguay
Peru
Salvador
Uruguay
Venezula

OVERSEAS STERLING AREA

British Honduras
Bermuda
Bahamas
Jamica
Leeward Islands
Windward Islands
Barbados
Trinidad and Tobago
British Guiana
Falkland Islands
Gibralter
Malta
Gozo
Cyprus
Iraq
Kuwait
Seychelles and dependencies
Maurituis and dependencies
British East Africa
Union of South Africa
Northern and Southern Rhodesia
and Nyasaland
Southern British Africa
Aden
Bahrein
India
Pakistan
Ceylon

Regional Classification of Countries, (continued)

OVERSEAS STERLING AREA (continued)

Burma
Federation of Malaya
Hongkong
Australia
New Guinea
New Zealand
New Hebrides
British Oceania
Ghana
British West Africa, n.e.s.
Southern British Africa

REST OF THE WORLD

Greenland
Miquelon and St. Pierre
Netherlands Antilles
French West Africa
Surinam
Guinea
Azores
Aegean Islands
Syria
Lebanon
Israel, Palestine and Jordan
Iran
Arabia
Afghanistan
Thailand
Vietnam, Laos, and Cambodia
Netherlands Indies
Indonesia
Philippines
Portuguese Asia
Nepal
Southern and Southeastern Aria, n.e.s.

REST OF THE WORLD (continued)

China
Outer Mongolia
Republic of Korea
North Korea
Taiwan
Kwantung
Japan
French Pacific Islands
Nasei and Nampo Islands
Morocco
Tangier
Algeria
Tunisia
Libya
Egypt
Sudan
Canary Islands
Spanish Africa, n.e.s.
Cameroon
French Equatorial Africa
French West Africa
Madeira
Cape Verde Islands
West Portuguese Africa
Angola
Liberia
Belgian Congo
Somali Republic
Ethiopia
Mozambique
Madagascar
Canary Islands
Macao
Madeira

n.e.s. - not elsewhere specified.

However, imports of materials from East Germany have not been particularly large since the war. Starting from a level of almost nothing, imports from East Germany gradually climbed and reached a peak of approximately $2 million in 1955 and have been declining steadily since then. The other reclassification made was due to the unification of Somaliland, a Rest of the World country, and British Somaliland, an Overseas Sterling Area country, which occurred in July 1960. The new country is known as the Somali Republic and has been included in the Rest of the World category. Total imports of materials from the Somali Republic during the last half of 1960 totaled approximately $200,000.

The import unit value indexes computed in this study, like most indexes, are based on a sample of commodities. The sample originally chosen by Adler, Schlesinger, and Van Westerborg was found to provide quite adequate coverage up to 1949. However, before Adler and Goor attempted to compute the indexes for the postwar period, they revised their sample to take advantage of changes in the Department of Commerce commodity classification and to include various commodities which had become important components of U. S. imports of materials. The computation of the index numbers had also been changed at this time from a fixed 1935-39 base to a chained base. The chaining process (which will be discussed in greater detail in the next section) made it easy to add additional commodities to the sample whenever it was deemed necessary during the 1949-53 period.

It was the hope of the present author that it would be possible to take the revised sample list, adding commodities when necessary, and compute the indexes through 1960. However, a comparison of the total value of the sample which was computed from the list of commodities supplied by Mr. Goor with the total value of the sample according to the worksheets, also supplied by Mr. Goor, indicated that additional commodities had been added to the sample list. Subsequent correspondence

and personal conversation with Mr. Goor confirmed this, however, he was unable to supply the missing commodity numbers. Further examination of the worksheets supplied by Mr. Goor indicated that the sample had been supplemented considerably in 1952 and somewhat in 1953. Since it was thought desirable to make the new sample as nearly comparable as possible with the old, additional commodities were added in the following manner: Since most of the commodities appeared to have been added in 1951, it was decided to include all commodities whose import value was over $20 million in 1951. This was done with one exception. The reason for the exception was that while imports of the particular commodity totaled almost $25 million in 1951, they fell off to approximately $100,000 in 1952 and remained at a relatively low figure. In addition, three other commodities whose import values were somewhat less than $20 million in 1951, but rose well above the $20 million figure in both 1952 and 1953, were included in the sample. In all, 17 commodities were added to the sample. At the same time the 17 commodities were added to the sample, nine others were dropped from the sample for one of two reasons: (1) their value had dropped to an extremely low figure, or (2) they had been reclassified so that now they appeared in other commodity classifications. To provide a basis for comparison of the revised sample with the old sample, the price index for total imports of materials was computed for 1952 and 1953 and identical results were obtained.

For the period 1954 to 1960, it was thought desirable that the sample comprise approximately 80 percent of the total and for that reason new commodities were added to the sample whenever their value reached $40 million. No commodities were dropped from the sample during this period.

Since the size of the sample was relatively small and included the most important (in dollar terms) import commodities, these commodities

were given a greater weight than they would have received had all the imports been included in the construction of the indexes. If the price of any one of the important commodities had moved differently than the average of all the commodities, this would have biased both the unit value and quantity indexes. During the period covered by the earlier study, the authors considered this situation serious enough in the case of rubber and silk so as to necessitate some adjustments in the indexes, which were made in the following manner:

> The overweighting of these commodities was eliminated by removing them from the samples of crude and semi-manufactured materials. . . , and treating them as separate subclasses; after an individual price series for each of the commodities had been computed, the series were re-combined with the price index for the remainder of the class to form a total class index.[3]

The index numbers used in this study are computed from the formula of Irving Fisher's "Ideal" index. For the years 1923-48 a fixed base is used with the base period being 1935-39. Starting with 1949 and continuing through 1960, a chained index is used. The reason for this change is explained as follows in a footnote in the original study:

> The coverage of the sample in 1948 appeared rather unsatisfactory in comparison with prewar years, largely as a result of war-induced transitional and/or structural changes in United States imports. In order to raise its (the sample) representativeness to approximately the prewar level, commodities which had grown in importance were added to the sample for 1949 and 1950, and placed on a 'chain' base rather than on the 1935-39 base which was used for the other years of the series.[4]

The advantages of a chained index are, in addition to the fact that new commodities may be readily added, (1) weights are changed, (2) commodities that are no longer relevant may be easily dropped from the index.

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[3] Ibid., p. 63.

[4] Ibid., p. f10.

The quantity indexes, during the fixed base period, were obtained simply by dividing the given year price index into a ratio of the given year import volume, divided by the import volume in the base year. This procedure was slightly altered when the change was made to the chained index. This procedure involved the necessary assumption that the prices of the commodities not included in the price index moved on the average the same as those included in the price index.

The formulas used in deriving both the price and quantity indexes are given below in Table 2.

Table 2. Formulas Used for Computation of Fisher's "Ideal" Index Numbers*

Fixed Base		
Price	$P(n, o)$	$= \sqrt{\frac{\Sigma pn \cdot qo}{\Sigma po \cdot qo} \quad \frac{\Sigma pn \cdot qn}{\Sigma po \cdot qn}}$
Quantity	$Q(n, o)$	$= \frac{V}{P(n, o)}$ where $V = \frac{Vn}{Vo}$
Chained		
Price	$P(n, o)$	$= \sqrt{\frac{\Sigma pn \cdot qn-1}{\Sigma pn-1 \cdot qn-1} \quad \frac{\Sigma pn \cdot qn}{\Sigma pn-1 \cdot qn}} \times P(n-1, o)$
Quantity	$Q(n, o)$	$= \frac{Vn}{P(n, n-1)} \quad \frac{Q(n-1, o)}{Vn-1}$

Where o = base period
n = current period
V = volume or $\Sigma p \cdot q$

*R. G. D. Allen and J. Edward Ely, (ed.), International Trade Statistics (New York, John Wiley and Sons, Inc., 1953), p. 193.

CHAPTER IV

RESULTS OF THE REGRESSION ANALYSIS

In order to make some quantitative estimates of the influence which different factors have on the quantity of materials imported by the United States, various least squares regression equations were derived. Separate regressions were derived for total imports of materials and for imports of materials from each of six regions, as well as for three different time periods; prewar, postwar and the total period. A discussion of the results that were obtained will be presented following a brief discussion of the different variables used in the analysis.

It has generally been recognized that two of the most important determinants of the quantity of United States imports are national income and prices. With respect to imports of materials, past studies have indicated that changes in national income alone will explain most of the variation in imports of materials. Both price and income have been included as independent variables in the least-squares equations and estimates of the income and price elasticities have been derived.

In the present study the quantity index of imports of materials, either for total imports of materials or for imports from one of the regions, which was computed as described in the previous chapter, has been used as the dependent variable in all of the regressions. The index of industrial production as computed by the Federal Reserve Board was used as a measure of national income. The level of industrial production was used, rather than some other measure of national income, since imports of materials are much closer related to industrial production than to an alternative measure such as gross national product. This is

true since services are included in the gross national product figure and ordinarily changes in this part of national income would be expected to have little or no effect on the quantity of materials imported. Technically then, the estimates of the income elasticity derived in this study should be termed the industrial production elasticity. However, because the term income elasticity has a more general acceptance, this term is used in the present study.

The problem of an appropriate price to use has proved to be a formidable problem in many studies of the international price mechanism and the present study is no exception. Prices of imports themselves are a rather meaningless concept. Attention needs to be focused not on import prices alone, but rather on import prices relative to prices of substitutes--from alternative sources of supply. For that reason two different prices are used in the regression equations. The first of these, which has been designated (P) in the equations that follow, is the index of import prices from one region divided by the index of import prices from all other regions. A second price used is the index of import prices divided by the United States price index of intermediate materials, supplies and components.[1] This price has been designated (P') in the equations that follow.

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[1]Equations were also derived using as an alternative to the price index of materials supplies and components, the U. S. wholesale price index other than farm products and processed foods. However, both series are very similar and the coefficients derived were almost identical so the equations using the wholesale prices are not included. Actually neither index is entirely satisfactory. The wholesale price index includes finished manufactures and it is probable that these could move quite differently than crude materials and semi-manufactures. On the other hand the index that was used, intermediate materials, supplies and components, while probably more nearly corresponding to imports materials, does include some food, carrying a weight of approximately 5.8 per cent in 1954 according to the Bureau of Labor Statistics Bulletin No. 1214, United States Department of Labor, (September 1957), p. 54. Because of the

Other symbols that are used in the equations include:

Q = index of the quantity of imports, either total imports of meterials or from a specific region.

Y = index of United States industrial production.

t = time.

D = "dummy" or (0-1) variable and is used in some of the equations that include both prewar and postwar data. D has a value of zero for the prewar period and a value of one for the postwar period.

The use of time series data in regression studies like the present one does involve one problem, not encountered when the observations used are completely random samples from the universe, which needs to be discussed at this time. The correlation model assumes that each observation in the sample is selected on a purely random basis from all items in the original universe. In the case of a time series where each successive year is regarded as a successive observation, this obviously is not true. Thus under certain circumstances one might expect that a correlation might exist between the items of a series and the items of the same series lagged one year. This correlation has been termed auto-correlation. However, as Ezekial and Fox have pointed out, this correlation may be irrelevant from a statistical viewpoint.[2] What is important is that; 1) The error terms or disturbances are distributed independently of the explanatory variables in the equation; so that the regression coefficients are unbiased. 2) The error terms or disturbances are

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relatively small weight given to food and the closer correspondence to the import category being studied it was felt that this was the proper index to use.

To test for the possibility that the quantity of materials imported in year (t) might be related to the previous year's prices (t-1), lagged prices were incorporated into the regression equations. Of the 12 regressions computed the regression coefficient for the prices lagged one year carried an implausible sign in seven cases and none of the remaining five were statistically significant.

[2]Mordicai Ezekial and Karl A. Fox, Methods of Correlation and Regression Analysis (New York and London, John Wiley and Sons, Inc., 1959), p. 328.

distributed independently of each other; so that the estimated variances (from which the standard errors are obtained) of the regression coefficient estimates are unbiased (and hence tests of significance are valid).[3]

In the event that autocorrelation in the disturbances is present, most statisticians, in the past, have simply concluded that the usual error terms do not apply. Ezekial and Fox, however, add, "The main point is that autocorrelated series give us less information per observation than do completely random ones."[4]

It is possible to test for autocorrelation in the disturbances by the use of the Durbin-Watson test.[5] The use of this test may result in any one of three possible outcomes; rejection of the null hypothesis of autocorrelation, non-rejection of the null hypothesis, or inconclusiveness. Unfortunately, the inconclusive result is quite common. Furthermore, the usual Durbin-Watson tables of significance levels do not list values of significance for analyses with less than 15 observations. The reason for this is that for less than 15 observations the power of the test is quite low.[6] Unfortunately, all of the regressions for the postwar period in the present study have less than 15 observations. However, the test was made where possible and the results are given in Appendix B.[7]

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[3]The author is indebted to Professor Robert L. Gustafson, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan, for clarification on this point.

[4]Ezekial and Fox, op. cit., p. 334.

[5]J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least-Squares Regression, Biometrika, Vol. XXXVIII (1951), pp. 159-178.

[6]Letter from G. S. Watson, Department of Mathematics, University of Toronto, Toronto 5, Canada, May 24, 1962.

[7]A complete summary of all the estimating equations both linear and logarithic and including coefficients of determination, price and income elasticities and the d statistic used to test for autocorrelation is given in Appendix B.

In addition to the Durbin-Watson test, use has also been made of the von Neumann-Hart test which was actually developed to test for serial independence in an observed random sequence. However, past studies have indicated that the performance of the von Neumann-Hart test is quite good.[8]

The results of these two tests do indicate that some autocorrelation does exist, however, not all of the equations given in the Appendix can be considered as being equally reliable. It is the opinion of the author that the equations which most closely express the true relationships among the variables are those that include as independent variables, for the prewar period; industrial production (Y), price of imports from one region relative to the price of imports from all other regions (P), and time (t). For the postwar period the "best" estimating equations in terms of correlation obtained and the plausibility of the sign and size of the regression coefficients are those that incorporate the independent variables; Y, P, and price of imports relative to the domestic price level (P'). For the total period the "best" results appear to be those obtained by including; Y, P, t, and the "dummy" variable (D), except in the case of the Overseas Sterling Area where the use of the "dummy" variable and/or time resulted in implausible signs for the regression coefficients. These equations may be easily found in Appendix B by referring to those equations whose number ends in .2, .4, or .6. Of the 28 cases where it was possible to use the Durbin-Watson test, the null hypothesis was not rejected in a single instance, however, the test proved inconclusive in 12 cases. The results of the von Neumann-Hart test indicated evidence of autocorrelation in 6 out of 42 regressions. However, two of these were for the Overseas Sterling Area for the

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[8]Clifford Hildreth and John Y. Lu, Demand Relations with Autocorrelated Disturbances, (East Lansing, Michigan State University Agricultural Experiment Station, 1960), pp. 6-7.

postwar period where an extremely low correlation was obtained and no reliance can be placed on the estimates at any rate. Thus, we are left with four cases where autocorrelation is indicated and since the test of significance was at the five per cent level we would expect to get significance in five per cent of the cases, which would indicate that the degree of autocorrelation, if any, is slight.

The Total Demand for Imports of Materials

The close relationship which does exist between total imports of materials and industrial production is illustrated by Chart 1. In this chart the index of industrial production is plotted along with the index of the quantity of total imports for the years 1923-60. Except for the war years both series usually move in the same direction.

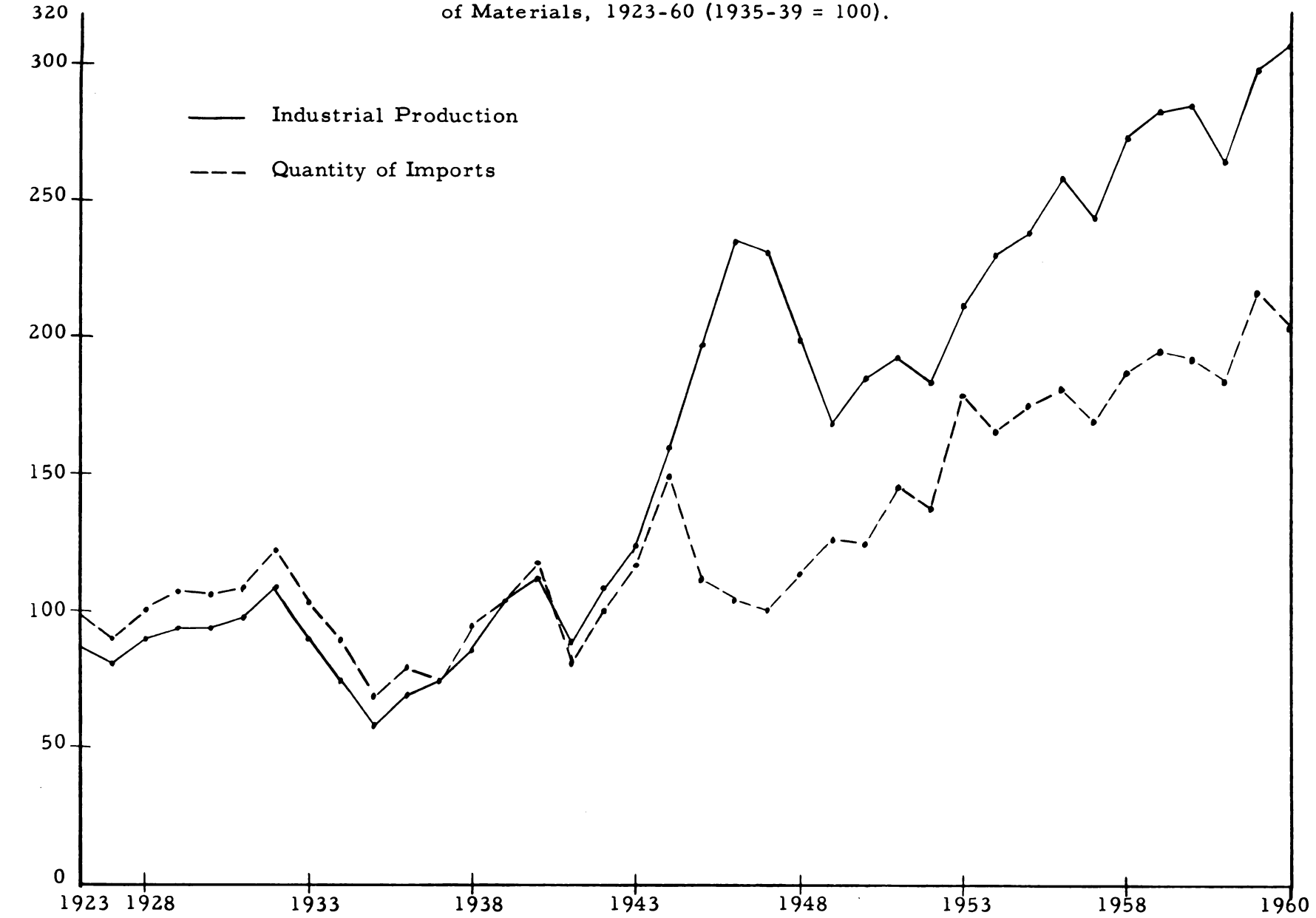
In order to obtain somewhat more precise estimates of the effect of a change in the level of industrial production, as well as price changes, on the quantity of imports various least-squares estimating equations were derived. The results of the simple correlation between the quantity of materials imported and the level of industrial production for different time periods are given below in Table 3.

Table 3. Results of the Simple Correlation Between Quantity of Imports and Industrial Production

Period	Equation Number	Constant Term	Y	$\bar{r}^2$	N_y
Prewar	N1.1	+10.6	+0.976	0.838	+0.889
Prewar	L1.1	+ 0.282	+0.875	0.829	+0.875
Postwar	N1.3	+48.6	+0.520	0.854	+0.729
Postwar	L1.3	+ 0.511	+0.727	0.860	+0.727
Total	N1.5	+50.8	+0.515	0.965	+0.621
Total	L1.5	+ 0.788	+0.613	0.962	+0.613

Y = Index of industrial production and the number appearing below is the regression coefficient for the Y variable in the given equation.
$\bar{r}^2$ = Coefficient of determination adjusted for degrees of freedom.
N_y = Income elasticity.

Chart 1. United States Industrial Production and Total Imports of Materials, 1923-60 (1935-39 = 100).



Whenever the letter N precedes the equation number all variables in the equation are expressed in natural numbers. Whenever the letter L precedes the equation number, all variables have been transformed into logarithms.

A study of the linear equations for the prewar and postwar period indicates that the marginal propensity to import declined substantially during this period.[11] However, the fact that the income elasticity derived for the postwar period is only slightly smaller .729 than the estimate of .889 derived for the prewar period indicates that the average propensity to import must have also declined during the period.[12] While the postwar estimates of the income elasticity for both the linear and logarithmic equations are slightly lower than the prewar estimates, including both prewar and postwar data resulted in estimates that are lower than those derived for either of the periods separately. The reason why this should

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[11]Ordinarily in regression equations using quantitites or values the regression coefficients would be considered the marginal propensity to import, however, in the present study where index numbers are used this is not the case. Although, even here the regression coefficient is indicative of the marginal propensity so that when the regression coefficient is smaller in one period it is possible to say that the marginal propensity to import has declined.

[12]All of the elasticities computed for the linear equations are computed at the mean. For the logarithmic equations the regression coefficient is the elasticity.

Another point that needs to be mentioned concerning the elasticities derived in this study is the time element. The theoretical concept of elasticity abstracts from time. The data used in the present study are yearly data and elasticities computed reflect not only the change in quantity imported as a result of changes in price or income during the year, but also the interactions that have occurred between the variables during the course of the year. It is also generally recognized that the longer the length of run, the larger will be the elasticities, at least in the case of price elasticities. Therefore, the estimates of the price elasticity derived in this study may not be as large as they might have been had the time period been extended to allow all of the adjustments to a price change to occur.

be the case is illustrated in Chart 2. In this chart the relationship between imports of materials and industrial production has been plotted on a scatter diagram on double logarithmic paper. The three regression lines that are shown have been drawn according to the least-squares equations; L1.1, L1.3 and L1.5.

The position of the dots on the scatter diagram indicates that the import function shifted downward during the war which would account for part of the lower average propensity to import during the postwar period. In addition to the shift in the function, examination of the scatter diagram also indicates the possibility of a declining trend in imports within the time period included in the regression analysis. This is illustrated for the prewar period by the fact that starting with 1934, all of the dots denoting the relationship between imports and industrial production lie below the regression line, thus indicating either another shift in the function in 1934 or else a more gradual year to year trend.

The results obtained by including time as a variable during the prewar period are given in Table 4.

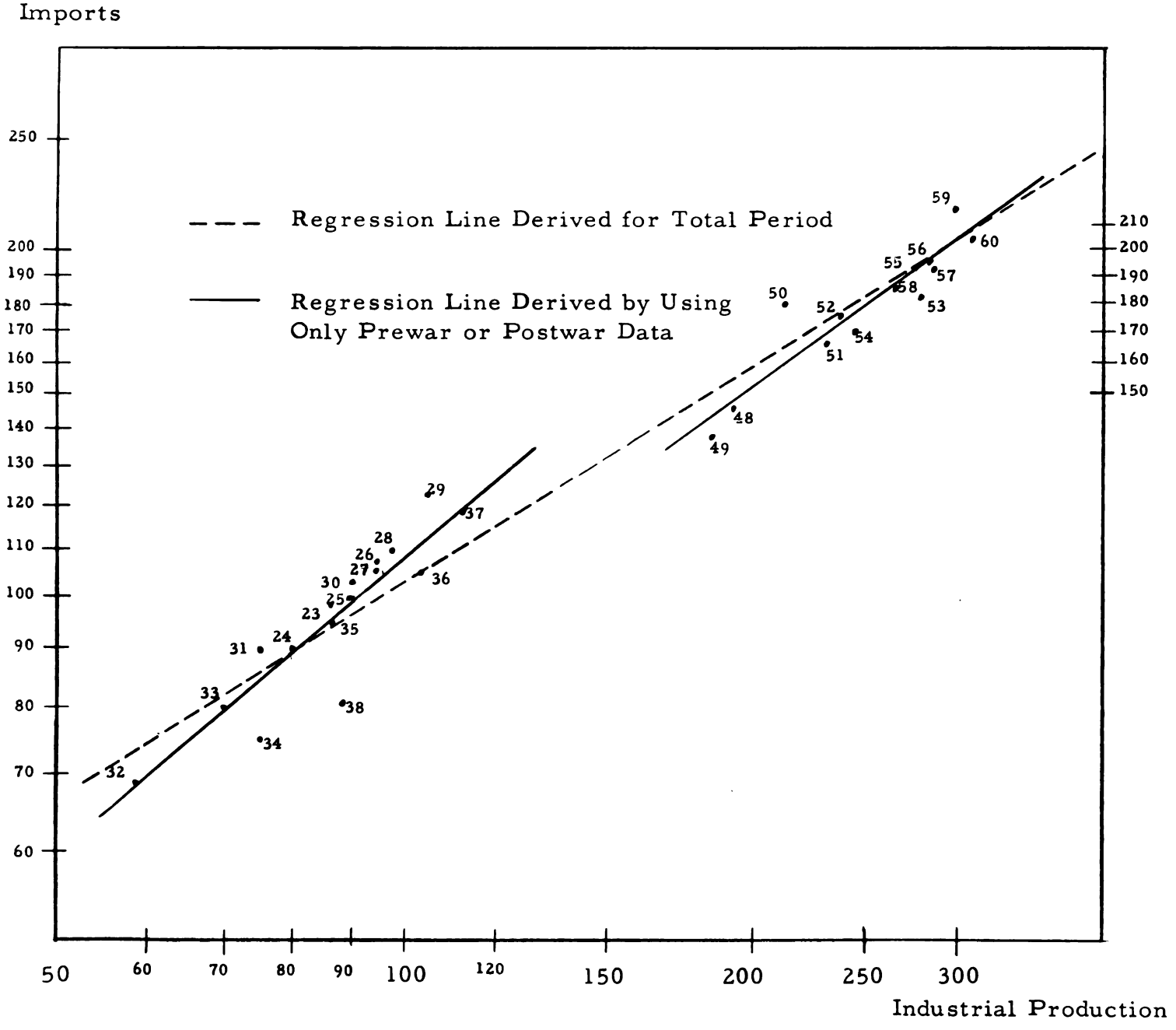
Table 4. Regression Results for Total Imports of Materials During Prewar Period

Equation Number	Constant Term	Y	t	$\bar{R}^2$	N_y
N1.2	+16.8	+0.987	-0.833	.838	+0.899
L1.2	+ 0.321	+0.872	-0.038	.854	+0.872

t = Time

The usual t-test for significance of the regression coefficients was used and the regression coefficient (b) for time in the linear equation was significantly different from zero at the five per cent level while the b value for time from the logarithmic equation was significant at the 10

Chart 2. Relationship Between Industrial Production and the Quantity of Imports of Materials, 1923-38, 1948-60, (1935-39 = 100).



per cent level. It should also be noted that including time as a variable did not significantly alter the regression coefficient for industrial production in either the linear or logarithmic equations.

There is also some evidence of a trend during the postwar period, however this is somewhat more difficult to substantiate by the use of regression analysis. For the postwar period the scatter diagram shows that the dots for 1955, 1956, and 1959 are above the regression line while the dots for 1957, 1958 and 1960 are below. However, if a trend does exist then these dots for the later years are all lower than they would have been in the absence of a trend. This in turn would increase the slope of the regression line which would raise the income elasticity.

The inclusion of time as a variable for the postwar data did result in negative regression coefficients for time in both the linear and logarithmic function, however in both cases the standard errors of the regression coefficients were larger than the coefficients themselves, which indicated that regression coefficients this large could have been obtained in over one-third of the cases even though the true coefficient had a value of zero. Furthermore, the inclusion of time as a variable did not materially affect the coefficient of determination, (R^2) in fact the coefficient of determination adjusted for degrees of freedom ($\bar{R}^2$) was actually smaller because of the loss of an extra degree of freedom, when time was included in the analysis. Time was also used as a variable during the postwar period for each of the regions and in 11 out of 12 cases the regression coefficient turned out to be negative, however, in 9 cases the standard error of the regression coefficient was larger than the coefficient itself and in no case was the coefficient found to be significant at the 5 per cent level. Therefore, because the correlation was not improved and because the regression coefficients were found not to be significantly different from zero, time was not included in any of the equations presented in this study which include only the postwar period.

One problem encountered by using only, either prewar or postwar data, but particularly accute in the postwar period, was the small number of observations that were available for inclusion in the regression analysis. Provided the basic relationship between income and imports and materials had remained the same during the entire period the ideal solution would have been simply to include the entire period in the analysis. This was done and the results are given in Appendix B. Unfortunately, as was mentioned earlier, the estimates of the income elasticities derived in this manner are, in some cases, quite different from those derived from either of the two time periods.

It is possible, however, to combine data from two nonhomogeneous periods, such as this, into a single analysis by the use of a so-called "dummy" or 0-1 variable. The "dummy" variable takes on a value of zero for one period (in this case the prewar period) and a value of one for the second period (postwar). The regression coefficient of this variable indicates the extent to which the dependent variable is smaller or larger in the second period than in the first, after allowing for the net effect of all of the other variables in the analysis. Naturally this approach assumes that the only effect of the structural change is in the level of the independent variable and if the change occurred in a single year or as is the case in the present study during the war years which are omitted from the analysis.[13]

For those equations, in the present study, where all variables are transformed into logs the "dummy" variable has a value of one during the prewar period and a value of ten during the postwar period. This adjustment was necessary since the log of zero is undefined. The numbers one and ten were chosen because the log of one is zero and the

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[13]Richard J. Foote, Analytical Tools for Studying Demand and Price Structures, United States Department of Agriculture, Agricultural Handbook No. 146, (Washington: U. S. Government Printing Office, 1958), p. 22.

log of ten is one. The effect of this adjustment then, is the same as if zero and one had been used and not transformed into logs. In the case of the logarithmic function the antilog of the regression coefficient for the "dummy" variable indicates the amount, in percentage terms, by which the postwar estimate of the dependent variable is smaller (or larger) than the estimate for the prewar period other things being equal. Thus in the equation that was derived,

$$\log Q = \log .404 + .813 \log Y - .100 \log D,$$

where D is the symbol for the "dummy" variable, the antilog of -.100 is approximately .794 which indicates that, ceteris paribus, the postwar quantity of imports will be about 20 per cent less than the prewar quantity.[14]

A comparison between the regressions derived by including the "dummy" variable and the use of separate equations for the prewar and postwar periods is given in Chart 3. The two functions are almost identical, in fact, because of the width of the regressions line it is almost impossible to tell the difference.

Table 5 gives the results obtained by including time as well as the "dummy" variable in the analysis.

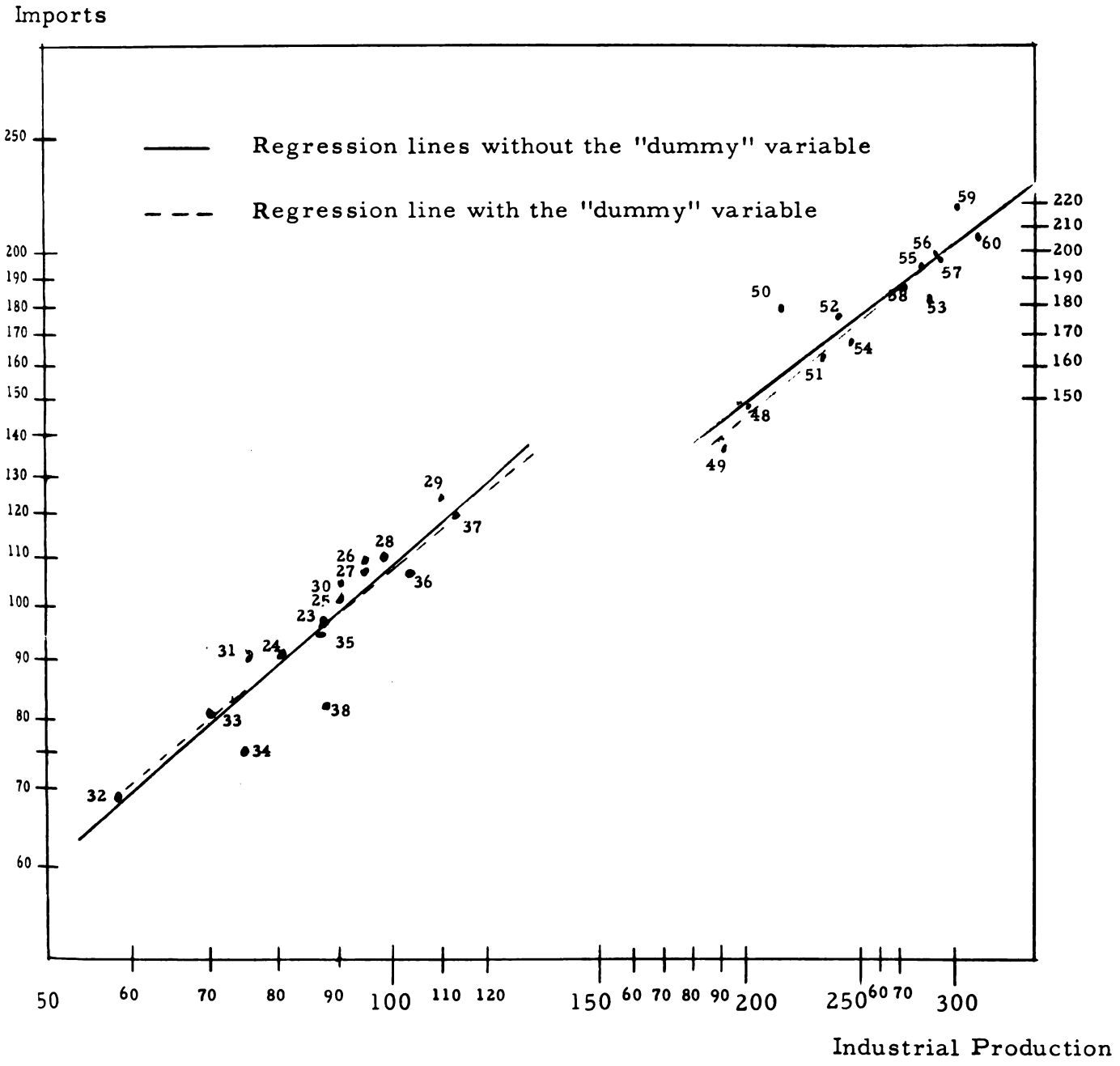
Table 5. Regression Results for the Total Period

Equation Number	Constant Term	Y	t	D	$\bar{R}^2$	N_y
N1.6	+46.4	+0.671	-1.031	-11.939	.972	+0.807
L1.6	+ 0.409	+0.827	-0.040	- 0.086	.975	+0.827

D = "Dummy" variable.

[14]The author is grateful to Professor Robert L. Gustafson for his help in the interpretation of the meaning of the regression coefficient for the "dummy" variable in the case of the logarithmic functions.

Chart 3. Relationship Between Industrial Production and the Quantity of Materials Imported by the United States, 1923-38, 1948-60 (1935-39 = 100).



The estimates derived for the income elasticity are very close to those derived for either the prewar or postwar period (see Table 4). The regression coefficients obtained are all statistically significant at the 5 per cent level, except for the coefficient for the "dummy" variable which is significant at the 20 per cent level, thus indicating that all of the variables included are important factors in determining the quantity of materials imported by the United States. In view of this and because of the high correlation obtained, the estimates of the income elasticity obtained in this manner can probably be considered as being the most reliable estimates of the true relationship.

The results of the regression analysis indicated that price, in this case the price index of imports of materials divided by the domestic price index of intermediate materials, supplies and components (P'), did not effect the level of imports to the extent to be statistically significant. In fact, including this price (P') as a variable in the estimating equation resulted in positive, but statistically nonsignificant, signs for the regression coefficients for both the prewar and total periods. For the postwar period the regression coefficients carried a negative, but statistically nonsignificant sign. The apparent conclusion to be reached from this is that during the postwar period, there is some evidence that price has become a factor in determining the level of imports, but possibly because of the small number of observations, the effect is not statistically significant. This hypothesis concerning the increasing importance of price is further supported by the regional analysis which in almost all cases yielded negative signs for the regression coefficients of (P') during the postwar period. Again, in most cases the coefficients did not turn out to be statistically significant, although there were a few exceptions. The estimate of the price elasticity of imports relative to domestic prices for total imports of materials during the postwar period turned out to be -.155 for the linear function and -.169 for the logarithmic function, equations N1.4 and L1.4 in Appendix B.

The Demand for Imports from the Various Regions

The movements of both the price and quantity import indexes of imports have varied considerably from the different regions. For that reason it might be expected that the results of the regression analysis might differ considerably from the different regions, and a discussion of these regional differences is presented below.

A second price which has been used in the regression analysis, and which appears in all of the equations for the various regions, is the price index of imports from the particular region under consideration divided by the price index of imports from all other regions. This price has been designated (P). The elasticity of import demand with respect to this price will be referred to as the competitive price elasticity while the elasticity of import demand with respect to P' will continue to be referred to as the price elasticity.

As in the case of total imports of materials the inclusion of P' in the regression equation for the prewar and total periods resulted in implausible signs for the b's and in all but two cases and here the standard errors of the b's were larger than b's. For the postwar period, negative coefficients were obtained in all equations except one. However, the large standard errors indicated that the b's were not statistically significant in most cases. Nevertheless, the equations are included in the present study as an indication of the possible increasing importance of price in international trade.

With one exception the use of the data for the entire time period proved to be quite satisfactory when both time and the "dummy" variable were included in the regression, and these equations are referred to most often in the discussion below. The exception was in the case of imports from the Overseas Sterling Area and will be discussed in more detail on page 53.

European Payments Union Countries

As might be expected, imports of materials from the EPU countries fell tremendously during World War II. The extent of this decrease in imports is indicated by the fact that the quantity index dropped from 115.4 in 1937 to 14.6 in 1944. This sharp decrease in the quantity of imports of materials originating from the EPU countries is also depicted in Chart 4, which shows the relationship between imports and United States industrial production. While the decrease in imports of materials from the EPU countries during the war might have been expected, the failure of the EPU countries to regain their prewar share of United States imports is rather surprising. As is indicated in Chart 4, the quantity index of imports of materials, although slightly higher during the postwar period than before the war, has not kept pace with the increase in the level of United States industrial production.

Table 6 gives the estimates of the various elasticities that were obtained for the prewar, postwar, and total periods. As before all equations using natural numbers have the letter N preceding the equation number while those where all variables have been transformed to logarithms are preceded by the letter L.

A comparison of the estimates obtained for the prewar period with those of the postwar period would indicate that the income elasticity has increased considerably while the competitive price elasticity has fallen. Furthermore, domestic prices, as indicated by the estimates of the price elasticity, appear to have little or no effect on the quantity of materials imported from the EPU countries even during the postwar period. However, the estimates obtained for the postwar period are of doubtful validity in view of the fact that the standard errors of regression coefficients of the two prices were larger than the coefficients themselves for both equations. Furthermore the values obtained for $\bar{R}^2$ were only .395 and .502 for equations N2.4 and L2.4 respectively.

Chart 4. United States Industrial Production and Imports of Materials from European Payments Union Countries, 1923-60 (1935-39 = 100).

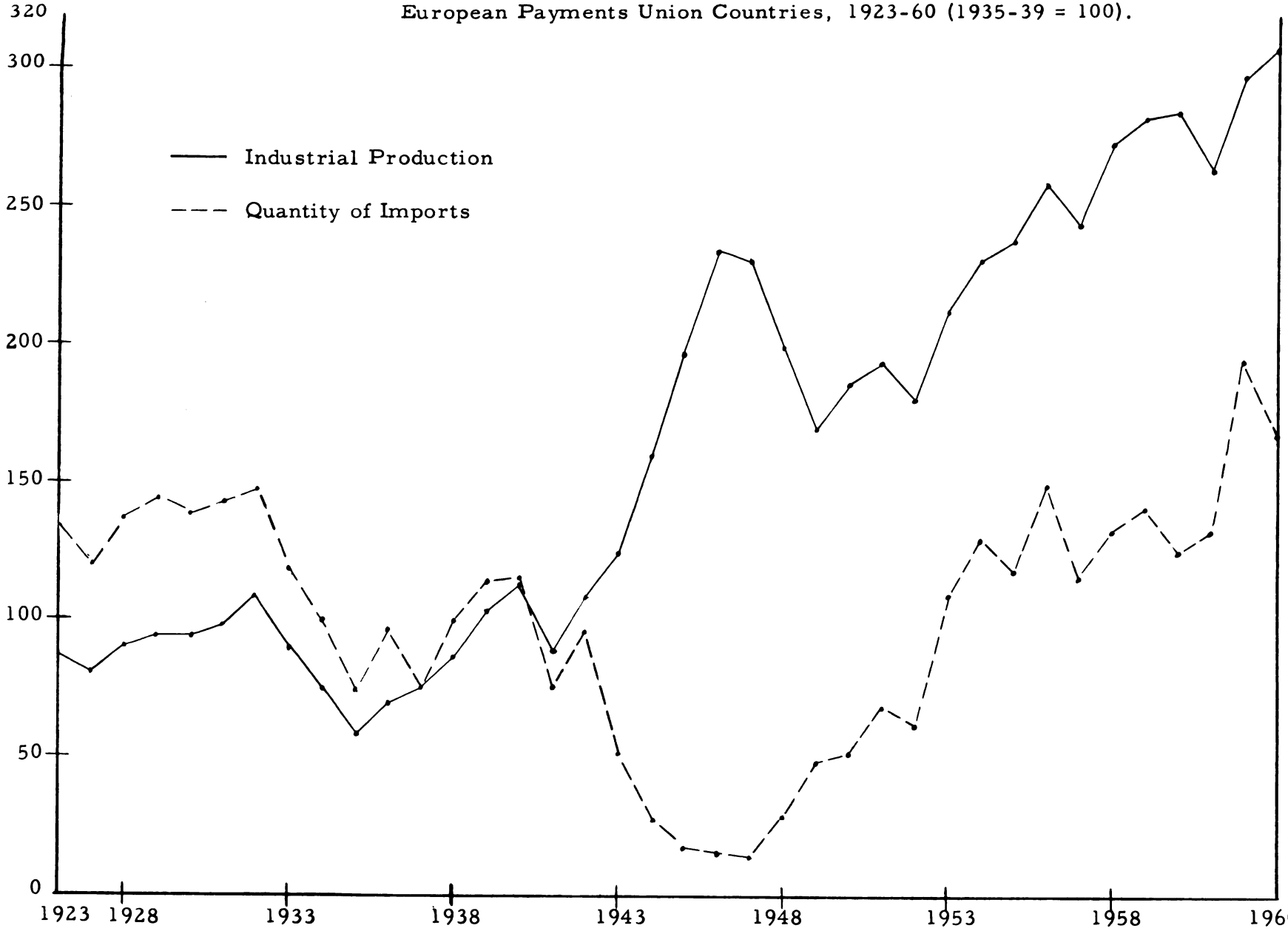


Table 6. Income and Price Elasticities for Imports of Materials from EPU Countries

Period	Equation Number	N_y	N_p	$N_{p'}$
Prewar	N2.2	+0.662	-0.557	-
Prewar	L2.2	+0.587	-0.916	-
Postwar	N2.4	+1.118	-0.340	-0.007
Postwar	L2.4	+1.049	-0.403	(1)
Total	N2.6	+0.968	-0.623	-
Total	L2.6	+0.701	-0.830	-

N_y = Income elasticity
N_p = Competitive price elasticity
$N_{p'}$ = Price elasticity
(1) Indicates that the estimate carried an implausible sign

While it is true that domestic price appeared to have little influence on the quantity of materials imported from the EPU countries, it should be pointed out that the estimates of the competitive price elasticity, while less than one, were relatively high. This would indicate that prices of imports from various alternative foreign sources of supply do influence the geographical pattern of United States imports of materials.

As might be expected the results obtained for total Europe were quite similar to those obtained for the EPU countries, although both the income and competitive price elasticities were slightly lower. This too could be expected since many imports from other European countries come from the Communist block countries, and imports from these countries are frequently governed by factors other than income and prices.

Imports from Canada

The demand for imports of materials from Canada is characterized by an extremely close relationship between the quantity of imports and United States industrial production. In fact the simple correlation (r)

between the quantity of imports and industrial production turned out to be .994. This close relationship is also indicated in graphical form in Chart 5. This close relationship is probably due to the fact that many U. S. firms look to Canada as a major source of supply of raw materials and in many instances the Canadian firms supplying materials are either owned or controlled by United States corporations.

The elasticities derived by the least-squares regression analysis are given below in Table 7.

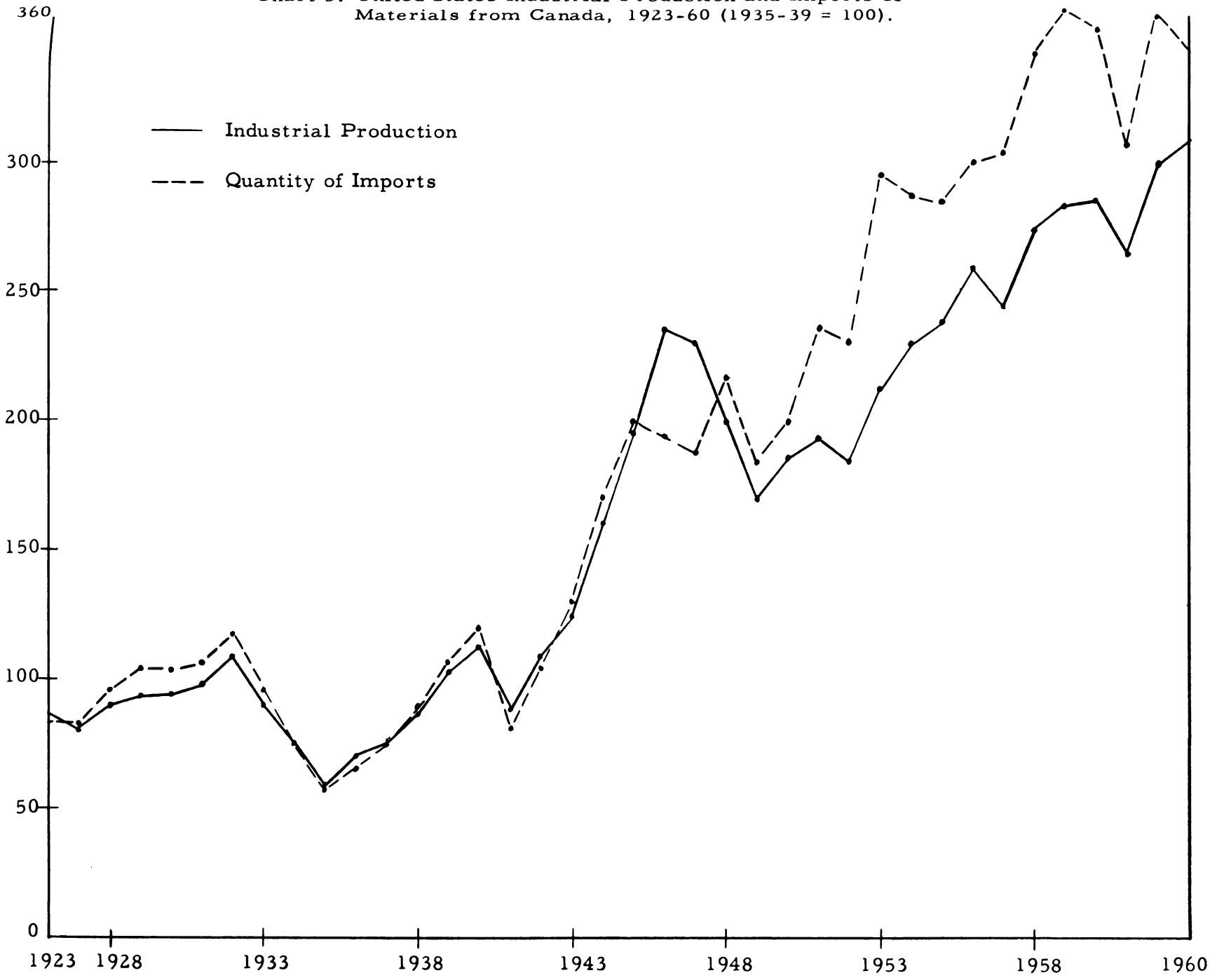
Table 7. Income and Price Elasticities for Imports of Materials from Canada

Period	Equation Number	N_y	N_p	$N_{p'}$
Prewar	N4.2	+1.229	-0.021	-
Prewar	L4.2	+1.031	-0.169	-
Postwar	N4.4	+0.906	-0.105	-0.128
Postwar	L4.4	+0.926	-0.084	-0.258
Total	N4.6	+0.942	-0.043	-
Total	L4.6	+0.956	-0.213	-

All of the estimates of the income elasticity are quite close to one with the estimates for the prewar period slightly higher than those derived for either the postwar or total period.

In comparison to the estimates derived for Europe, the competitive price elasticity for imports from Canada is very low. This is probably due to the fact that the bulk of U. S. imports of materials from Canada are composed of newsprint, logs, lumber, and semi-manufactures made of lumber and virtually all imports of this nature come from Canada, with the exception of some pulp wood from the Scandinavian countries and a small amount of lumber from Latin America. It would appear that only a small amount of wood and wood products are available from other

Chart 5. United States Industrial Production and Imports of Materials from Canada, 1923-60 (1935-39 = 100).



parts of the world and hence the low competitive price elasticity. The coefficients of determination adjusted for degrees of freedom ($\bar{R}^2$) for most of the estimating equations for imports from Canada were quite high with values of .990 and .994 being derived for equations N4.6 and L4.6 respectively.

The price elasticities derived for the postwar period are also quite small, which is probably also due to the ownership and managerial relationships which exist between U. S. and Canadian firms.

Imports from Latin America

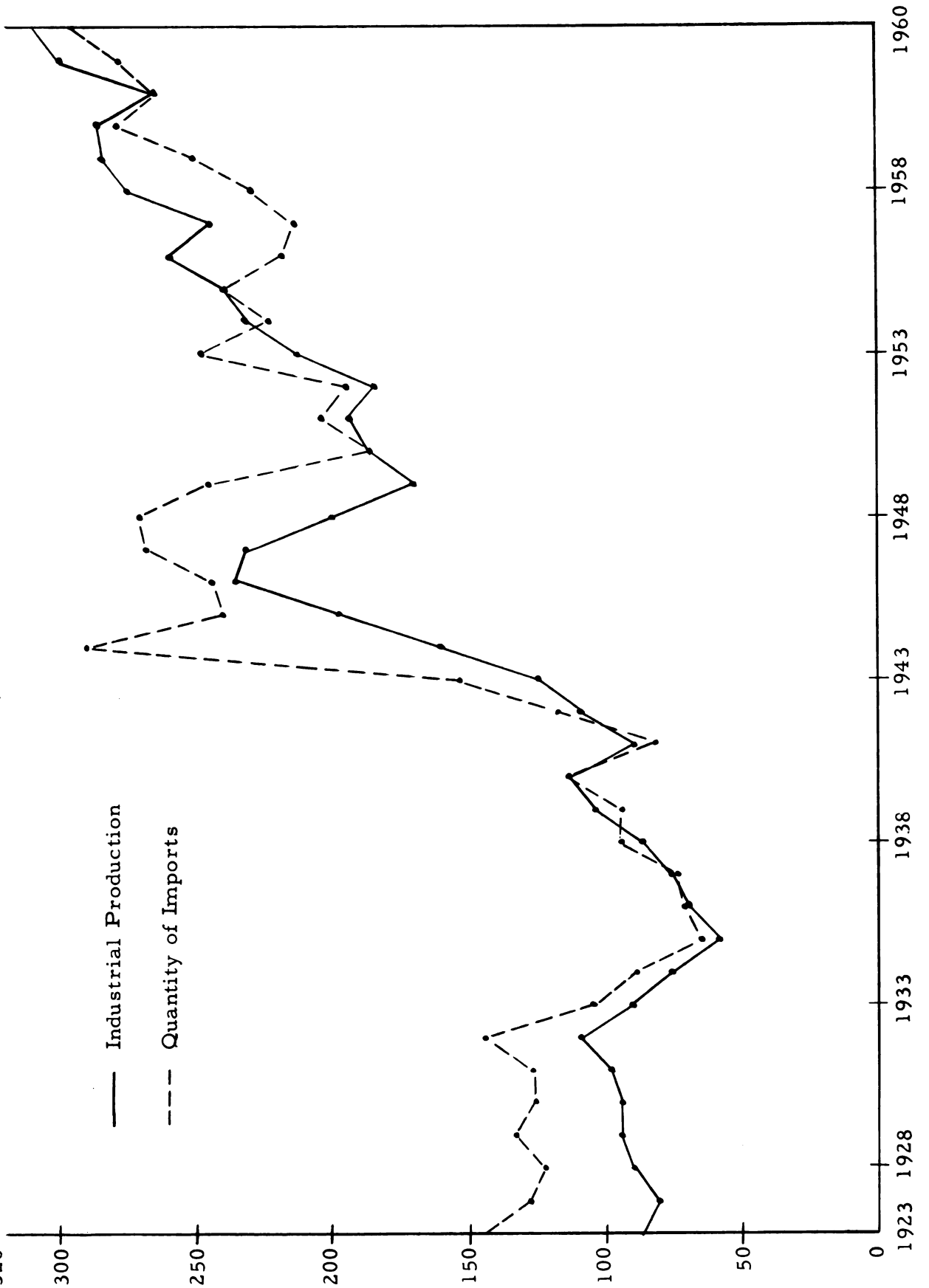
Imports of materials, as measured by the quantity index, from Latin America have risen substantially during and since World War II, although not quite as much as imports from Canada. However, like Canada the relationship between imports and industrial production in the United States (see Chart 6), is quite close. It would appear, therefore, that income elasticities quite close to one could be expected for imports from Latin America. The results of the regression analysis, which are given in Table 8, would tend to confirm this hypothesis.

Table 8. Income and Price Elasticities for Imports of Materials from Latin America

Period	Equation Number	N_y	N_p	$N_{p'}$
Prewar	N5.2	+1.001	-0.192	-
Prewar	L5.2	+1.063	(1)	-
Postwar	N5.4	+0.736	-0.273	-0.663
Postwar	L5.4	+0.705	-0.246	-0.693
Total	N5.6	+0.986	-0.458	-
Total	L5.6	+0.977	-0.206	-

(1) Indicates the elasticity coefficient had an implausible sign.

Chart 6. United States Industrial Production and Imports of Materials from Latin America, 1923-60 (1935-39 = 100).



The estimates of the competitive price elasticity, while smaller than those derived for imports of materials coming from the EPU countries, do indicate some substitutability with other foreign sources of supply. More significant, however, are the relatively high price elasticities derived for the postwar period, equations N5.4 and L5.4. Since a large proportion of the materials imported from Latin America are comprised of various ores and petroleum, it would appear that U. S. manufactures do substitute between domestic and foreign materials when the imports are nearly homogeneous to domestically produced materials.

As in the Canadian case most of the values obtained for $\bar{R}^2$ were quite high with values as large as .959 and .973 for equations N5.6 and L5.6 respectively.

Imports from the Overseas Sterling Area

The analysis of the demand for imports of materials from the Overseas Sterling Area proved to be particularly difficult, due to what appeared to be a structural shift in demand during and following World War II. As is indicated in Chart 7, imports of materials from the Overseas Sterling Area appear to have actually increased relative to U. S. industrial production during the prewar period. As might be expected the quantity index fell during the war, and then rose slightly immediately after the war. However, from 1948 to 1960 the index actually declined by 15.6 points. The reasons for this apparent reversal in the import function are discussed in the following chapter entitled Structural Changes in the United States Demand for Imports of Materials.

The results of the least-squares analysis were somewhat disappointing, particularly for the postwar and total periods. The estimates derived for the prewar period, see Table 9, appear to be quite reasonable.

Chart 7. United States Industrial Production and Imports of Materials from the Overseas Sterling Area, 1923-60 (1935-39 = 100).

Table 9. Income and Price Elasticities for Imports of Materials from the Overseas Sterling Area

Period	Equation Number	N_y	N_p	$N_{p'}$
Prewar	N6.2	+1.074	-0.233	-
Prewar	L6.2	+1.093	-0.281	-
Total	N6.5	+0.495	(1)	-
Total	L6.5	+0.508	(1)	-

(1) Indicates that the elasticity coefficient had an implausible sign.

However, for the postwar period the regression with P' included resulted in extremely small values for the regression coefficients of the Y's, 0.024 and 0.036, and in positive values for the regression coefficients P's. Furthermore, the R^2 for the linear equation, number N6.4, turned out to be .127 and for the logarithmic equation, number L6.4 the coefficient was only .088, all of which would tend to invalidate the estimates derived for the postwar period.

As was mentioned earlier the quantity index for imports from the Overseas Sterling Area dropped from 159.9 in 1948 to 144.3 in 1960, which would indicate a declining trend for imports from this area, however, after including time as a variable the regression coefficient for time, although negative, turned out to be statistically nonsignificant. Furthermore the regression coefficient for time during the prewar period was positive thus indicating a reversal of the trend during the postwar period. This in turn made it impossible to include time as simply another variable in the regressions using both prewar and postwar data. In fact, including either time or the "dummy" variable or both resulted in implausible signs for the regression coefficient for the price variable and extremely low, although, positive values for the income regression coefficients. Thus, the only regression that is

presented for the Overseas Sterling Area for the total period, includes only industrial production and the competitive price as variables. Even here the regression coefficients for the price variable carry a wrong sign and the income elasticity turns out to be rather low so that both the linear and logarithmic equations appear to be of doubtful validity and little or no confidence can be placed in the estimates of the income elasticity.

Imports of Materials from the Rest of the World

As is indicated in Chart 8, imports of materials from the Rest of the World, while generally moving in the same directions as the level of U. S. industrial production, have not increased as rapidly as might be expected, given the increased industrial production. In fact, since 1948 the quantity index has increased only from 100.4 to 136.8 while the index of industrial production has increased 193.6 to 308.3. This would indicate the presence of either a strong declining trend in the propensity to import or else an extremely low income elasticity. The results of the least-squares regression analysis, while not conclusive do point to the former.

Including time in the equation for the prewar period resulted in a relatively high income elasticity (see Table 10, equation N7.2), and a statistically significant negative regression coefficient for the time variable. However, for the logarithmic equation, L7.2, a relatively low income elasticity of +0.463 was obtained and the value for the time variable was positive and statistically significant at the 5 per cent level. However, the estimates derived from the logarithmic equation are subject to some suspicion since the regression coefficient for the price variable turned out to be positive. The results for the total period were quite similar which would indicate that in this case the linear equation, more nearly expresses the true relationship between the quantity of imports and income and prices.

Chart 8. United States Industrial Production and Imports of Materials from the Rest of the World, 1923-60 (1935-39 = 100).

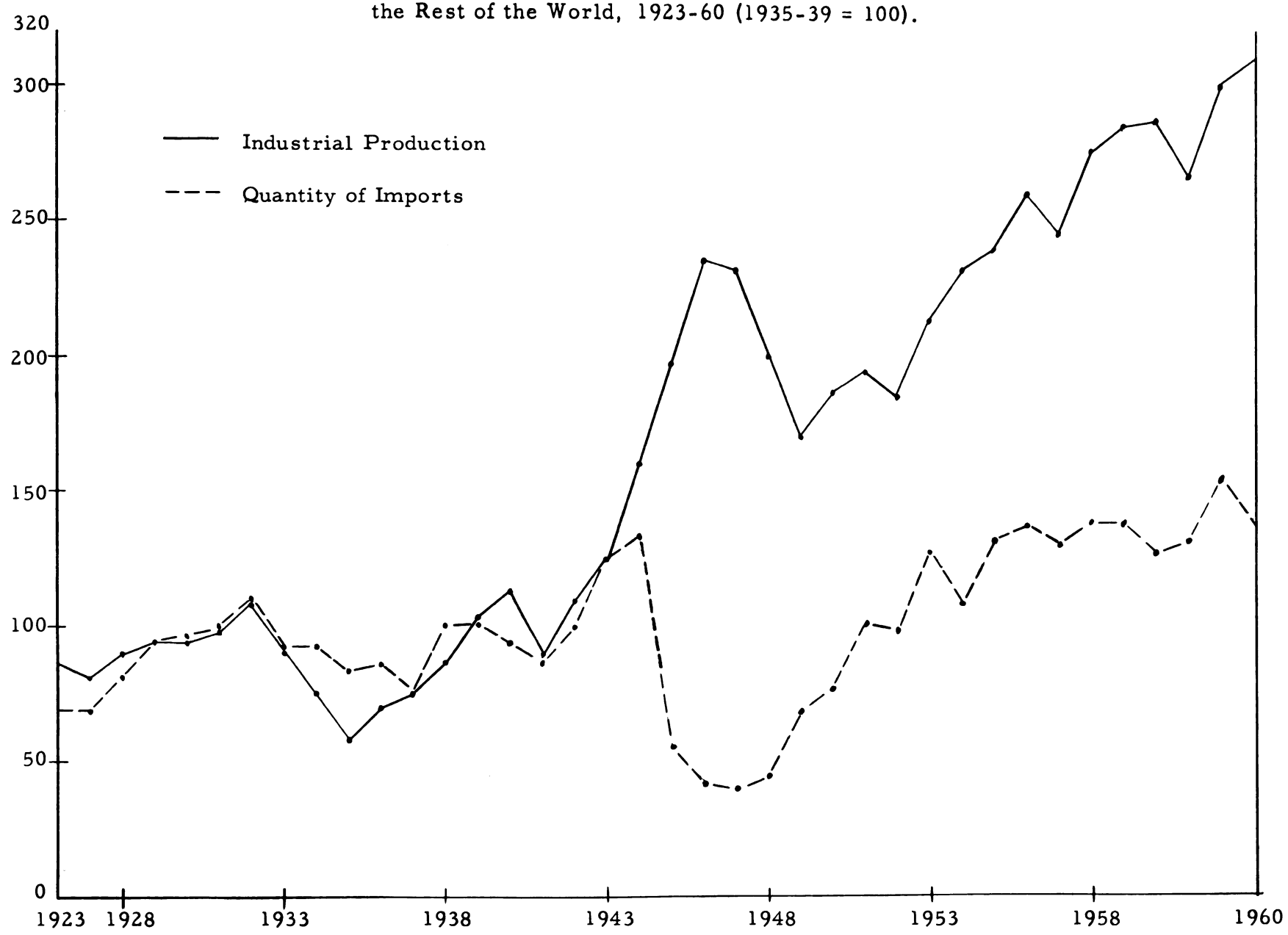


Table 10. Income and Price Elasticities for Imports of Materials from the Rest of the World

Period	Equation Number	N_y	N_p	$N_{p'}$
Prewar	N7.2	+0.859	-0.635	-
Prewar	L7.2	+0.463	(1)	-
Postwar	N7.4	+0.663	-0.270	-0.094
Postwar	L7.4	+0.683	-0.262	-0.111
Total	N7.6	+1.007	-0.408	-
Total	L7.6	+0.504	(1)	-

(1) Indicates that the elasticity coefficient had an implausible sign.

Summary

A number of conclusions can be derived from the results of the regression analysis presented above. First of all a close relationship does exist between the level of United States industrial production and total imports of materials. This relationship is particularly close for imports from Canada and Latin America. A second conclusion is that the price of materials imported into the United States relative to the domestic price has had little affect on the quantity imported during the past. There is, however, some evidence that indicates that the price of imports relative to the domestic price is becoming more important and may well become an important determinant in the future.

While it is true that price of imports relative to the domestic price has had little influence on the total quantity of imports of materials or for that matter on the regional pattern of imports, there is strong evidence that the price of imports from one region relative to the price from other regions does influence the quantity imported from the various regions.

A third conclusion based on the results of the analysis is that since 1923 there has been a steady downward trend in the quantity of materials imported into the United States relative to the U. S. level of industrial production. The regional analysis does indicate that this trend has not been uniformly downward for all of the regions; the most noticeable exceptions being the Overseas Sterling Area during the prewar period, both Canada and Latin America during World War II and Canada again during the postwar period. It is to these structural changes in the demand for imports that attention is focused in the following chapter in an attempt to explain the reason for this phenomena.

CHAPTER V

STRUCTURAL CHANGES IN THE UNITED STATES DEMAND FOR IMPORTS OF MATERIALS[1]

The results of the regression analysis which are discussed in the previous chapter indicated that in addition to industrial production and price, two other variables, time and the "dummy" variable were statistically significant determinants of the quantity of materials imported by the United States. The negative regression coefficients obtained for the time variable indicates that during the period covered by the regression analysis, 1923-38 and 1948-60, there has been a steady declining trend in the quantity of materials imported relative to the level of U. S. industrial production. At the same time the negative regression coefficient obtained for the "dummy" variable indicates that a substantial downward shift in the import function occurred during World War II which was not reversed during the years immediately following the war.

It could be argued that these two changes are actually one. The b value for the "dummy" variable (equation N1.6) was -11.9, which indicates that the value of the dependent variable would be that much lower during the postwar period, given the same values for the independent variables. Since the b value for time was -1.0, this trend if continued for the nine "war" years excluded from the analysis would have resulted in a decrease of an additional 9 points in the value of the dependent variable, which is only slightly lower than the value obtained for the

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[1]Structural changes in the demand for imports are defined in this study as those changes which are not explained by variations in industrial production and prices and at the same time cannot be considered as simply random shifts in the import function.

regression coefficient for the "dummy" variable.[2] However, regardless of whether this shift was merely a continuation of a trend or not, the fact remains that imports of materials have not increased as rapidly as might be expected in view of the estimates of the income elasticities that were derived.

This decline in imports relative to national income also appears to be occurring in Western Europe. A. K. Cairncross and J. Faaland point out that foreign trade for Western European countries was 26 per cent as great as national income in 1913, but by 1949-50 this ratio had dropped to 17 per cent.[3] They list two reasons for this decline: (1) restrictive commercial policies, (2) technological factors. Restrictive commercial policies may have been particularly important in the case of Europe immediately after the war, but since then the tendency has been for a gradual decrease in the barriers to international trade.

This decline in imports of materials is itself perhaps a reflection of the decreasing use of materials in industrial production. E. S. Mason cites the projections of the Paley Commission which estimates that Gross National Product in real terms will double from 1950 to 1975, but that the materials requirement will increase by only 60 per cent, and then continues by giving three reasons for this decline: (1) less emphasis in the future on the production of durable goods which are heavy users of materials, (2) a trend toward a higher degree of fabrication of materials which yields a higher national output per unit of material input, (3) a continuing trend towards tertiary employment.[4]

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[2]However, some important changes in the geographical pattern of United States imports of materials did occur as a result of World War II and these are discussed beginning on page 68.

[3]A. K. Cairncross and J. Faaland, "Long Term Trends in Europe's Trade," Economics Journal, Vol. LXIII (1952), pp. 25-34.

[4]E. S. Mason, "An American View of the Raw Materials Problems," Journal of Industrial Economics, Vol. I (1952-53), pp. 1-20.

Eugene R. Schlesinger in a discussion of the long-run outlook for United States imports uses the projections of the Paley Commission and suggests that from 1950 to 1975 imports of the materials specifically dealt with by the Paley Commission will increase by 96 per cent while imports of other materials will increase by only 64 per cent, even though Gross National Product in real terms is expected to double during the same period.[5] Schlesinger points out that total imports as a percentage of GNP have been declining steadily for some time. In 1929 imports were 4.4 per cent as large as GNP, 3.8 during 1936-38, 3.1 in 1950. He predicts that this decline will be somewhat slower in the future and then estimates that by 1975 total imports will be 2.7 per cent of GNP.

In order to determine the possible causes for this declining trend in the United States, some of the individual commodities that are included in the materials category were singled out for closer examination. The relationship between industrial production and the quantity imported of five separate commodities is given in Table 11. The five commodities are; crude rubber, unmanufactured cotton, wool, raw silk, and tin. The commodity classification tin, includes ore, bars, block and pigs and includes virtually all imports of tin.

It will be noted that for four of the five commodities listed, the quantity imported actually declined during the period under consideration and, during the same time period, the index of industrial production rose by more than 3.5 times the 1923 level. Imports of the fifth commodity, crude rubber, increased during the prewar period, fell off sharply during the war, rose substantially immediately following the war and have since declined. In 1923, these four commodities comprised 30.4 per cent of the total value of U. S. imports of materials and by 1960 they made up only 7.0 per cent.

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[5]Eugene R. Schlesinger, "The Long-Run Outlook for U. S. Merchandise Imports," IMF Staff Papers, Vol. III (1953-54), pp. 387-415.

Table 11. United States Imports of Five Selected Commodities, 1923-60

Year	Crude Rubber Mill.#	Cotton 500# Bales in Thous.	Wool Mill.#	Raw Silk Mill.#	Tin Mill.#	Index of Ind. Production 1935-39 = 100
1923	692	470	388	49	72	86.5
1924	735	292	269	51	65	80.8
1925	888	313	305	64	77	90.2
1926	926	326	298	66	77	94.0
1927	955	401	265	74	71	94.0
1928	978	338	242	75	78	97.7
1929	1,263	458	272	87	87	109.0
1930	1,090	378	154	74	81	90.2
1931	1,124	108	159	84	66	75.2
1932	929	132	58	74	35	58.3
1933	938	130	151	67	64	69.5
1934	1,036	148	108	56	40	75.2
1935	1,045	107	200	68	64	86.5
1936	1,091	155	253	60	76	103.4
1937	1,339	253	322	58	88	112.8
1938	917	159	103	55	50	88.3
1939	1,114	150	243	52	71	109.0
1940	1,825	168	357	45	128	124.1
1941	2,294	193	816	23	140	159.8
1942	620	274	859	(1)	56	197.4
1943	117	178	678	(1)	34	235.0
1944	239	135	620	(1)	49	231.2
1945	312	193	808	(1)	42	199.2
1946	840	349	1,054	13	54	169.2
1947	1,587	284	641	2	54	186.1
1948	1,646	244	758	6	87	193.6
1949	1,480	173	435	3	99	184.2
1950	1,800	254	717	8	109	212.4
1951	1,642	189	557	5	58	231.2
1952	1,804	79	545	8	107	238.7
1953	1,450	195	449	5	111	259.4
1954	1,337	145	304	7	88	244.4
1955	1,423	150	355	8	85	274.4
1956	1,297	137	345	8	79	283.8
1957	1,243	137	274	6	56	285.7
1958	1,063	141	258	4	47	265.0
1959	1,285	137	395	7	54	298.9
1960	920	140	309	5	53	308.3

(1) Not available or less than 500,000 pounds.

Source: The series presented above were taken from various sources including; Bureau of the Census, Historical Statistics of the United States Colonial Times to 1957, Wash., D.C., 1960; Bur. of the Census, Statistical Abstract of the United States, Wash., D.C., 1961; Bur. of the Census, Cotton Production and Distribution, Bull. 196, Wash., D.C., 1960; Bur. of Mines, Minerals Yearbook, Wash. D. C., 1923 through 1959; Agricultural Marketing Serv., Wool Statistics and Related Data Through 1957, Wash., D.C., 1959 and Supplement, 1961; Federal Reserve Board, Federal Reserve Bulletin

The decline in the imports of raw silk is perhaps the most spectacular of the four commodities listed. During the prewar period, silk imports held fairly steady, fluctuating with changes in industrial production; however, during the war they dropped to virtually nothing and, compared to the prewar period, only minute quantities of raw silk have been imported since then. Imports of unmanufactured cotton have also declined during the period under consideration, although to a much lesser extent. Imports of cotton, however, have behaved somewhat differently with a major decline occurring during the prewar period, and an increase during the first part of the postwar period, followed by another decline.

Actual imports of wool, depending upon which particular years are used for a comparison, have not declined significantly. However, relative to the level of industrial production, the decline has been considerable. Actual imports of wool dropped throughout the twenties and early thirties, reaching a low of 58 million pounds in the recession year of 1932, then rose sharply until 1938 when industrial production again fell off sharply. With the advent of World War II, imports of wool increased rapidly reaching a peak of 1,054 million pounds in the postwar year 1946. Since then, imports of wool have fallen off quite steadily with some exceptions corresponding to fluctuations in industrial production.

Table 12 lists the consumption of cotton and wool for selected years since 1923. It will be noted that although consumption of both cotton and wool has increased slightly, it has by no means kept pace with the increase in industrial production. The most apparent reason for this relative decline in imports and consumption of cotton and wool, and absolute decline in the imports and consumption of silk is the introduction of the various synthetic materials such as rayon, nylon, orlon, etc.

Table 12. Consumption of Raw Cotton and Unmanufactured Wool for Selected Years 1923-60

Year	Raw Cotton, bales (in thousands)	Wood (million pounds)
1923	7,312	422.4
1928	7,614	333.3
1933	6,898	317.1
1938	6,463	284.5
1943	12,401	636.2
1948	10,510	693.1
1953	10,783	494.0
1958	9,075	331.1
1960	10,471	404.2

Source: For 1923-53, Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1957, (Washington, D.C., 1960), pp. 414-415. For 1958-60, for 1958 and 1960, Bureau of the Census, Statistical Abstract of the United States (Washington, D.C., 1961), pp. 805 and 809.

Imports of crude rubber, also appear to have been affected a great deal by technological developments. During the prewar period, increased use of rubber tires and increased use of rubber in manufacturing generally resulted in an increase of rubber imports. This increase was especially noticeable during the twenties, however, even during the thirties, when the level of industrial production was much lower, imports of rubber continued at a level almost as high as that of the late twenties.

During the war, supplies of crude rubber were almost entirely cut off and it was at this time that synthetic rubber first appeared on the market. The new synthetic rubber, however, was not entirely satisfactory and with the cessation of hostilities in 1945, rubber imports increased rapidly. However, improvements in synthetic rubber continued, with the result that soon synthetic rubber became to be used in place of natural rubber in many cases. The continued expansion of synthetic rubber production resulted not only in a halt to increased imports of

crude rubber, but actually in decrease of imports. By 1960, production of synthetic rubber had increased from nothing, prior to the war, to 1,436,442 long tons.[6] Imports of natural rubber during the same year totaled 410,767 long tons, or approximately 22 per cent of the total quantity of rubber consumed, including reclaimed rubber.

Another case where imports have not kept up with increasing industrial product is that of tin. In fact, like cotton and silk, imports of tin have actually decreased over the 38 year period. During the pre-war period, imports of tin appear to have fluctuated with changes in industrial production and, like so many other commodities, actually declined during the war. Following the war, imports started to increase, but not as much as might be expected in view of the increase in industrial production. Imports of tin reached a peak in 1953 when 111,000 tons were imported. Since that time, a fairly steady downward trend has been in evidence.

The decrease in imports of tin should not, however, be lead to the conclusion that the demand for metals in general has declined. Quite to the contrary, imports of semi-manufactured steel as well as bauxite and aluminum and various other metals have increased substantially. It would appear, therefore, that what has occurred in the case of tin is simply a shift in demand from tin to various other metals.[7]

In addition to the five commodities listed in Table 11, decreases in imports have also occurred for furs as well as for hides and skins.

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[6]Bureau of the Census, Current Industrial Reports, (May 24, 1961, Washington, D.C.), p. 2.

[7]If this interpretation is correct, then total imports of materials would not have been affected since the decrease in tin imports would have been offset by increased imports of other metals. This does, however, have important implications for the geographical pattern of imports and is discussed in more detail on page 68.

In the case of fur, the decrease in demand appears to be partly the result of changes in tastes, which have resulted in a decrease in the use of fur in wearing apparel as well as the introduction of new materials which are used as substitutes for fur. New technological developments, such as the introduction and increased use of rubber, along with changes in taste, are probably the principle reasons for decline in imports of skins and hides.

Another factor which might influence the quantity of materials imported is a change in tariff rates. The import price indexes computed in the present study are based on the presumed U. S. dollar value of the commodity in the exporting country. Thus any changes in tariffs would not be reflected on the price indexes. Tariffs on materials are quite low and for that reason even substantial tariff changes would have only slight effect on import prices. Nevertheless, changes in tariffs have occurred almost continuously throughout the period included in this study. Generally, tariffs were increased throughout the twenties and reached a peak in 1930. In 1934 a sharp reversal of the protectionist policy occurred with the enactment of the Reciprocal Trade Agreements Act. Since then tariffs have been gradually reduced with a sharp reduction occurring in the early fifties as a result of the 1950-51 Torquay conference of the participants of the General Agreement on Tariffs and Trade (GATT) countries.

Adler, Schlesinger and Van Westerborg[8] have estimated that, as a result of the agreements reached at the Torquay conference, import prices of crude materials declined 4.9 per cent while import prices of semi-manufactures declined 3.8 per cent, Assuming a decline of 4.3 per cent for all materials and using the price elasticity estimates obtained for the postwar period of -.155 and -.169 (see Appendix B), it would

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[8]Adler, Schlesinger and Van Westerborg, op. cit., p. 55.

appear that the quantity of materials imported into the United States would have increased by approximately 0.7 per cent. On the basis of 1952 imports, this would have resulted in an increase in imports of materials of approximately 43.3 million dollars. However, this assumes that the price of domestic substitutes would have remained constant and since this certainly would not have been the case, it must be assumed that the increase in imports on materials that resulted from the Torquay tariff reductions, was much less than the 43.3 million dollar figure.

Regional Structural Changes

The results of the regression analysis, Appendix B, equations N6.2 and L6.2, indicated the presence of an increasing trend in the quantity of imports with respect to time for the prewar period for the Overseas Sterling Area. Three reasons can be given for this trend, two of which indicate that the trend may have been more apparent than real.

The first of the reasons is a decline in imports that were shipped by the producing country to the commodity markets of Europe and then shipped to the United States without undergoing any processing. According to Adler, Schlesinger and Van Westerborg, shipments of this type declined rapidly during the prewar period and they cite as an example the fact that in 1925, "the United Kingdom, France and the Netherlands shipped more than 95 million pounds of rubber to the United States, but in 1934 rubber imports from these sources amounted to less than one-half million pounds, although the total quantity of rubber imports had risen by 17 per cent between the two years."[9]

A second apparent reason for the increase in imports from the Overseas Sterling Area countries was a change in the statistical reporting methods used by the United States. Prior to January 1, 1937, imports were credited to the shipping country but after that date, they were credited to the country of origin when known. That both of these

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[9]Ibid., p. 30.

factors resulted in an apparent increase in imports from the Overseas Sterling Area and at the same time a decrease in imports from the EPU countries is brought out in Chart 9. This chart clearly shows how imports from the United Kingdom declined steadily throughout the pre-war period, while imports from the Overseas Sterling Area remained fairly constant despite a decrease in the level of U. S. industrial production.

A third factor that may have caused an actual increase in imports from the Overseas Sterling Area is the increase in imports of crude rubber during this period, since approximately one-third of our imports of rubber come from the Overseas Sterling Area. By itself, this factor would probably not be enough to give rise to the positive regression coefficient derived for time in the Overseas Sterling Area regressions, but when taken together with the decline in transit shipments and the change in reporting methods, it does offer an explanation for this apparent contrary trend in the case of imports of materials from this region.

The fact that the quantity index for imports from the Overseas Sterling Area did not increase during the postwar period can also be traced to the behavior of imports of a few commodities, namely, crude rubber, tin, and wool. As mentioned earlier, approximately one-third of the crude rubber imported comes from the Overseas Sterling Area, and the quantity of rubber imports has actually declined during the postwar period. Similarly, imports of tin have also actually declined during the postwar period and just over one-half of our imports of tin originate from the Overseas Sterling Area, mostly from the Federation of Malaya. According to Table 11, total wool imports have also declined considerably during the postwar period. As in the case of tin, over half, 50 to 60 per cent of our wool imports originate from the Overseas Sterling Area with the bulk of these coming from Australia and New Zealand.

Chart 9. Effect of Declining Transit Trade on Imports of Materials from the Sterling Area Countries, (1935-39=100).

Source: John H. Adler, Eugene R. Schlesinger, and Evelyn Van Westerborg. The Pattern of United States Import Trade Since 1923, Federal Reserve Bank of New York (1952), pp. 100, 103 and 136.

This drastic decline in imports of materials coming from the Overseas Sterling Area was predicted by Eugene R. Schlesinger in the study mentioned earlier and for the exact reasons given above.[10] Schlesinger estimates that imports of materials from the Total Sterling Area (which includes the United Kingdom) will increase by only five per cent from 1950 to 1975. Schlesinger based his prediction on the fact that imports of crude rubber and tin, both coming mainly from the Federation of Malaya, were expected to decline, which is precisely what has happened thus far. Schlesinger also estimated that imports of wool, which come mainly from Australia and New Zealand, also would not keep pace with the increase in U. S. national income, but would grow with the increase in U. S. population, which the Paley Commission estimated would increase by 27 per cent from 1950 to 1975. On this score Schlesinger appears to have been overly optimistic, since imports of wool have actually declined from 717 million pounds in 1950 to 309 million pounds in 1960, see Table 11.

That the start of the Second World War would result in some drastic changes in the pattern of United States imports of materials could have been expected, however, the fact that many of these wartime changes were carried over into the postwar period, long past the reconstruction days and even into the sixties, is somewhat surprising. The principle change to occur during the war was a drastic drop in imports from Europe and the Rest of the World. In the case of Europe, virtually no materials were imported during the war from Germany, Italy or any of the countries occupied by the two Axis powers. Similarly, the occupation of large areas of Asia and many of the Pacific Islands by Japan, cut sharply into the quantity of imports from the Rest of the World. On the other hand, imports of materials from both Canada and Latin America increased sharply during the war. The fact that this shift in

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[10]Schlesinger, op. cit., p. 393.

the geographical pattern of United States imports continued into the immediate postwar years is indicated by the regression coefficients of the "dummy" variable for the various regions (see the last equation for each of the regions, except for the Overseas Sterling Area, Appendix B).[11] Negative coefficients of 86.8, 72.7, and 44.2 were obtained for EPU countries, Total Europe and Rest of the World, respectively, and indicate the extent of the decrease in the index of the quantity of imports that occurred during the war. On the other hand, the estimates obtained for the increase in the quantity index during the war for Canada and Latin America were 43.9 for the former and 36.6 for the latter.

The fact that during the postwar period the quantity index of imports from Europe has risen only slightly faster than the Canadian and Latin American indexes, while the quantity index of imports from the Rest of the World hasn't increased as much, would indicate the change which occurred during the war has been a more or less permanent one.

One final disturbance in the geographical import pattern that needs to be mentioned is the effect of the steel strike in 1959. Latin American countries ordinarily supply approximately 60 per cent of the total United States imports of iron ore and concentrates, and only a small amount of semi-manufactured iron and steel. On the other hand, approximately 60 to 70 per cent of all semi-manufactured iron and steel imported by the United States comes from Europe while only a minute amount of iron ore originates in Europe. Thus it could be expected that a disturbance such as a prolonged steel strike would influence the volume of imports from these two areas quite differently.

The changes that occurred in the composition of imports of materials during the 1958-60 period, with respect to iron ore and semi-manufactures of iron and steel are shown in Tables 13 and 14.

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[11]Reference is made only to the linear equations, however, similar results were obtained for the logarithmic equations.

Table 13. United States Imports of Iron Ore and Iron and Steel Semi-Manufactures, 1948-60

Year	Iron Ore and Concentrates (millions of dollars)	Iron and Steel Semi-Manufactures (millions of dollars)
1958	232	251
1959	312	624
1960	346	506

Source: Bureau of the Census, Report No. FT 120, United States Imports of Merchandise for Consumption, Calendar Years 1958, 1959, 1960.

Table 14. Quantity Indexes of United States Imports of Materials for Total Imports, Imports from Europe, and Imports from Latin America, 1923-60. 1935-39 = 100

Year	Total 1935-39=100	Europe 1935-39=100	Latin America 1935-39=100
1958	185.4	121.5	264.6
1959	217.5	176.4	278.6
1960	204.4	153.3	295.6

Despite the steel strike in 1959, imports of iron ore in dollar terms did rise somewhat above the 1958 recession year value. At the same time imports of semi-manufactured iron and steel increased by approximately two and one-half times the 1958 value. With the end of the steel strike in 1960, imports of iron ore continued to increase; however, imports of iron and steel semi-manufactures fell by over $100 million, while imports of iron ore increased by $34 million. Naturally, fluctuations of this size can be expected to exert a strong influence on the

quantity indexes for total imports and imports from Europe and Latin America for the years 1958-60. Extreme care must be used in interpreting the table, since it is difficult to determine the extent of the influence of iron ore and iron and steel semi-manufactures imports on the indexes. However, imports of iron ore do comprise approximately 10 to 15 per cent of all materials imported from Latin America in dollar terms. At the same time, imports of semi-manufactured iron and steel from Europe amounted to approximately 20 per cent of all materials imported from Total Europe in 1958 and approximately 30 per cent in 1959. Thus it can be assumed that the increase in iron ore imports in 1959 and 1960 did contribute to the increase in the quantity index of imports from Latin America during the period. At the same time the sharp increase in imports of iron and steel semi-manufactures in 1959 and subsequent decrease in 1960 certainly was an important factor in the movement of the Total European quantity index. Again, it should be pointed out that not all of the changes in the indexes can be attributed to changes in imports of iron ore and iron and steel manufactures, however, the fact that the indexes moved in the same direction as the imports of these commodities did is indicative of the fact that the 1959 steel strike did influence the composition and origin of imports during the 1959-60 period.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In attempting to analyze the United States demand for imports of materials, this study has not only sought to derive import functions for total imports, but for various regions of the world as well. The regions for which separate import functions have been derived include; the European Payments Union Countries, Total Europe, Canada, Latin America, Overseas Sterling Area, and the Rest of the World.

One of the advantages of a study emphasing regional imports is that the quantity of imports from any one region may vary quite differently from the quantity of total imports or of imports from the other regions. This is due, at least in part, to the fact that changes in technology may affect the quantity imported from various regions quite differently, depending on the particular innovation taking place. Furthermore, even within the classification of materials, many of the commodities comprising the group will have different price and income elasticities so that a study based on indexes, as this one is, may result in biased estimates of relevant elasticities because commodities with high price elasticities will be substituted against as prices rise, thus overweighting the index with low price elastic commodities. Similarly as income rises those commodities with high income elasticities will carry a greater weight in the indexes which in turn may also bias the results. However, it can be assumed that the commodity classification, materials, will be much more homogeneous for imports from one particular region so that this problem is alleviated to some extent.

The index numbers used in the least-squares regression analysis were first computed by John Adler, Eugene Schlesinger, and Evelyn Van Westerborg for the years 1923-50. Since then the indexes have been revised for the years 1949-50, and carried forward through 1953 by Adler and Charles Goor. As part of this study they were carried forward through 1960. The index numbers are computed from the so-called "ideal" index number formula.

For the years 1923-48 a fixed 1935-39 base period is used. Starting in 1949, Adler, Schlesinger and Van Westerborg gound that the original sample no longer provided the degree of coverage deemed desirable and for that reason the index was placed on a moving base and "chained" to the 1948 index, thus providing for greater ease in adding additional commodities to the sample. Additional commodities have been added to the sample throughout the 1949-60 period and occasionally a few commodities have been dropped, either because imports of these commodities had declined to where they had become insignificant components of the material classification or because of changes in commodity classifications their identity had become lost.

A comparison of the import quantity indexes with the index of United States industrial production does give some indication of the close relationship which exists between the quantity of imports and industrial production. However, in order to obtain some more precise estimates of the actual relationship as well as an estimate of the influence of relative prices, least-squares regression analysis was used to obtain estimates of the price and income elasticities. The least-squares method was used despite the fact that the estimates may be subject to a bias. In the case of price elasticities it has been shown that the bias in the estimates will usually result in underestimating the elasticities. The least-squares method rather than some alternative econometric technique such as the limited information method was used because of the difficulties that would be

encountered in specifying a system of economically meaningful equations when dealing with a study which involves some 2,000 different commodities coming from over 150 different countries. Furthermore, for many countries the necessary statistics would either be unavailable or unreliable. Recently a number of studies have appeared which indicate that the bias resulting from the use of least-squares in comparison with some other method may not be as large as was first thought, and that perhaps a much more important factor in deriving accurate estimates is that of including the relevant explanatory variables in the analysis.

As might be expected in the case of imports of materials the single most important factor in determining the quantity of imports proved to be the level of United States industrial production. In fact, in the case of total imports of materials the simple correlation coefficient for the total period between the quantity of imports and the level of industrial production was .967 for the linear equation and .963 for the logarithmic equation. However, the use of the data for the entire time period resulted in lower estimates of the income elasticity than those that were obtained for either the prewar or postwar period. Examination of the data indicated that a downward shift in the import function had occurred during the war and that therefore the regression line passing through both the prewar and postwar data would be less steep than for a regression line passing through only the prewar or postwar data. To allow for this shift a (0-1) or "dummy" variable was introduced into the analysis. The "dummy" variable had a value of zero during the prewar period and a value of one during the postwar period. The regression coefficient obtained for the "dummy" variable indicated the extent to which the dependent variable is decreased (or increased) during the second period given the same values for the independent variables. Preliminary investigation indicated that in addition to the shift in the import function, there also appeared to be evidence of a declining trend in the quantity of

imports with respect to the level of industrial production. After including both the "dummy" variable and time in the analysis the estimates obtained of the income elasticity for total imports turned out to be .807 for the linear function and .827 for the logarithmic function. The estimates of the income elasticity obtained for imports for the various regions varied from .581 for imports from the Rest of the World to .986 for imports from Latin America. Generally the estimates derived from both the linear and logarithmic equations were quite similar for each area. Including both the "dummy" variable and time as additional variables and then using the data for both prewar and postwar periods proved to be quite satisfactory except in the case of imports from the Overseas Sterling Areas. Here because of a change in the relationship among the variables the coefficients that were derived appeared to have either implausible signs or the magnitudes of the coefficients were such as to cast doubt on their validity.

The close relationship which was found to exist between the quantity of materials imported by the United States and the level of industrial production does have some important implications for those countries where exports to the United States comprise a substantial part of their national income. Not only is it possible for recessions to be transmitted from the United States to the primary producing countries, but even worse, any attempt by the primary producing country to cure the recession caused by external forces, by increasing the effective demand may result in a further deterioration in their balance of payments position and depending upon the monetary system of the country this may result in a worsening of the recession. A similar situation would exist in the case of an externally generated inflation. Here attempts by the authorities to dampen the inflation would result in decreased imports which in turn might result in a surplus in the balance of payments. If this surplus takes the form of increased reserves with the resulting increase in the money supply one would expect that the inflation might well become worse.

The results of the regression analysis also indicated the presence of a declining trend in the quantity of materials imported by the United States relative to the level of industrial production. This trend appeared to be partly caused by the actual decrease in the quantities imported of a few important commodities during part or all of the period. Included among these commodities were natural rubber, skins and hides, furs, tin and textiles, namely silk, cotton, and wool. It was felt that the decline in the quantities imported were generally due to the introduction of synthetic materials as in the case of rubber and textiles or to a change in tastes as in the case of hides and skins and even furs.

The apparent shift in the import function during the war might simply have been a continuation of the trend that started prior to the war or it may have actually been due to the fact that many commodities were unavailable in the foreign market during the war and thus domestic purchasers either found a domestic source of supply or became accustomed to using a substitute commodity.

With respect to trends for the various regions, the apparent increasing trend found for imports from the Overseas Sterling Area during the prewar period may have in part been due to increases in rubber imports and partly because of a decrease in transit shipments going first to the markets in Europe and then to the United States and lastly because of a change in the statistical reporting methods of the United States in 1937. Prior to this time imports were credited to the shipping country, but since then they have been credited to the country of origin, where known.

The only other case where there was no indication of a declining trend was for Canada. Here the regression coefficient obtained for the time variable carried a negative sign for the linear equation and a positive sign for the logarithmic form with neither of them being statistically significant.

While it might be argued that the relative decline in imports of materials during and immediately after the war was simply a continuation of a long run trend, the war did have an important effect on the geographical pattern of imports. Thus from 1938 to 1948 the quantity imported from all regions except Canada and Latin America showed a relative decline. However, in the case of Canada and Latin America, possibly because of their proximity to the United States and the fact that these areas did not experience the devastation of the war, imports increased, not only in absolute terms, but also relative to the increase in United States industrial production.

The decrease in total United States imports of materials relative to the level of industrial production does have some important implications for many of the less developed countries of the world which supply a large proportion of the materials imported by the United States. Many of these countries even today find themselves quite short of dollars needed to purchase the desired equipment.

If this apparent declining trend is also evident for the other industrial countries of the world, it would mean that the less developed nations could not expect to share equally in an expanding world trade. This in turn would mean;that without increased exports which are needed to pay for the industrial equipment necessary for economic development, the problem of the developing nations becomes even more serious.

In most cases price of imports relative to the domestic price level turned out to be a nonsignificant factor in determining the volume of imports, in fact, for both the prewar period and for the regressions combining the prewar and postwar data, most of the regression coefficients turned out to have implausible signs. However, for the postwar data most of the regression coefficients did carry a negative sign, although still statistically nonsignificant except for imports from Latin America. However, the price of imports from one region relative to the price of

imports from all other regions did effect the volume of imports from that particular region during both the prewar and postwar period.

As was indicated earlier, because of the statistical method used in estimating the elasticities, it is possible that the estimates derived may be biased toward zero, which would mean that price might be a more important factor than the results of this study indicate.

The fact that the price of imports relative to the domestic price appeared to have little effect on the quantity of imports, except in the case of imports coming from Latin America, would lead to the conclusion that in most cases the remaining relatively low tariffs on materials could be entirely eliminated for most commodities without causing any damage to competing domestic industries. The relatively high estimates of the price elasticity obtained for imports coming from Latin America is probably due to the fact that a large proportion of the imports coming from this region is made up of oil and various ores and most of these commodities already enter the United States duty free. While elimination of tariffs on materials could be expected to have only a small effect on the quantity of imports, it would lower the price of imports at least on those commodities where substantial tariffs still exist. To the extent that the cost of imported materials comprise an important component of the total cost, this would result in a decrease in costs and a possible lower price of the final product.

The estimates of the competitive price elasticity (price of imports from one region divided by the price of imports from all other regions) that were derived for the various regions varied from -.043 for imports from Canada to -.830 for imports from the EPU countries.

The low competitive price elasticity derived for Canada was considered to be at least partly due to the fact that many Canadian plants and mills are owned or controlled by U.S. interests and that because of this Canadian prices relative to prices in the other regions have very

little influence on the quantity of imports coming from Canada. Another factor which might cause the low price elasticity is the fact that a large proportion of the materials that are imported from Canada are made up of lumber and newsprint and very little of either of these two commodities is imported from any other region, thus allowing for little substitution.

The comparatively high competitive price elasticity derived for imports of materials from the EPU countries is probably due to the fact that many of these imports are semi-manufactures and substitution does occur between regions.

The elasticity coefficients derived in this study should not be considered as the elasticities, but rather estimates of the relationships which actually exist. Reliability of the estimates is enhanced by the fact that the estimates derived for the postwar period were generally similar to the ones for the prewar period or for the regressions using both prewar and postwar data. The estimates are also well within the range indicated by economic theory. To the extent that these estimates are approximations of the true relationship, this study has achieved its purpose--to add to our empirical knowledge concerning the relationship between national income, relative prices of imports and the quantity of imports and to make an appraisal of other factors affecting the quantity of imports such as war and technological change.

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APPENDICES

APPENDIX A

THE USE OF LEAST-SQUARES IN DEMAND ANALYSIS

Estimates of price elasticities in international trade which are derived by the use of least-squares regression analysis have been subject to numerous criticisms during recent years. One of the first of these criticisms was made by Guy Orcutt in an article published in 1950.[1] In this article, Orcutt, speaking of the data available for the prewar period, makes the claim that only a limited range of relevant experience is available (i.e., only small changes in relative prices, after correcting for income changes, have occurred during the period), and then gives five reasons why even this limited amount of information is misleading and that the statistical estimates derived from it are substantially too low.

In discussing this point Orcutt makes the following statement, ". . . the range of relevant price variation (i.e., after correcting for income changes), has been narrow. The range of relative price variation by itself is not large, and the only relevant part of this variation is that which is independent of income. In many cases it is only 5 or 10 percent."[2] Orcutt then illustrates this by drawing a scatter diagram such as Chart 10 and states that the range of relative prices would be very small relative to the range over which prediction would be desired and relative to the errors likely to be present in the data. If the relative

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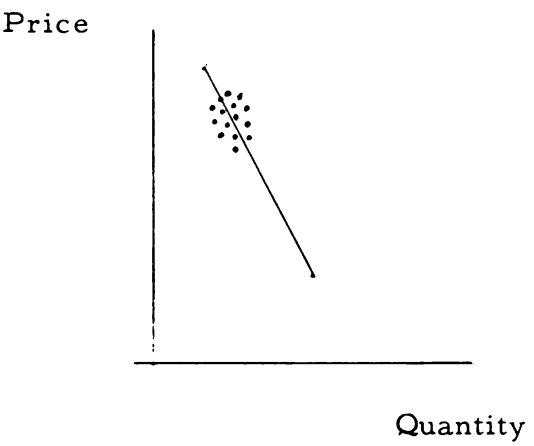
[1]Orcutt, op. cit. Orcutt specifically mentions the deVegh study of 1940 and the early Adler study in 1945. See pages 3 and 4 respectively.

[2]Ibid., p. 121.

Chart 10. Scatter Diagram Showing Hypothetical Price and Quantity Relationships



price variations were as small as Orcutt seems to think, his criticism would be quite valid. However, the available evidence seems to indicate that the relative price variation has been quite substantial. During the prewar period the relative price index varied from 89.2 to 152.0 (see Table 15). Now, a 70 per cent price increase can scaracely be called a minor fluctuation. Even when allowing for income changes substantial price changes have occurred. For instance in both 1923 and 1935 the index of industrial production stood at 86.5, however, the index of relative prices dropped from 122.4 to 92.8, which is substantially more than the 5 to 10 per cent variation Orcutt thought likely.

On the other hand the situation envisioned by Orcutt appears to have been approximated more cloely during the postwar period. However, here too substantial price variations have occurred. For instance, from 1952 to 1954 the index of industrial production rose by 6 points, while the index of relative prices dropped by 13 points. Also, from 1957 to 1959 the index of industrial production rose by 13 points while the index of relative prices dropped by 8 points.

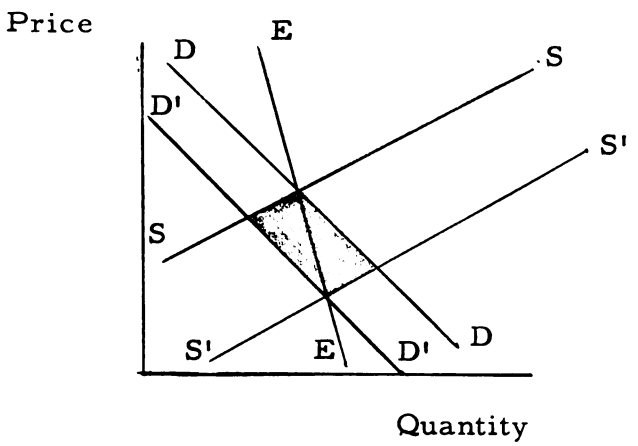
Table 15. Index of United States Industrial Production and Relative Prices of Imports of Materials (Price Index of Imports Divided by the Domestic Price Index of Intermediate Materials, Supplies, and Components), 1923-38, 1948-60 (1935-39 = 100)

Year	Industrial Production	Relative Prices
1923	86.5	112.5
1924	80.8	122.4
1925	90.2	146.3
1926	94.0	152.0
1927	94.0	148.6
1928	97.7	138.2
1929	109.0	134.5
1930	90.2	123.4
1931	75.2	108.4
1932	58.3	96.3
1933	69.5	89.2
1934	75.2	92.8
1935	86.5	92.4
1936	103.4	99.4
1937	112.8	101.7
1938	88.3	103.4
1948	193.6	106.9
1949	184.2	105.5
1950	212.4	104.2
1951	231.2	126.6
1952	238.7	118.5
1953	259.4	109.6
1954	244.4	105.6
1955	274.4	109.2
1956	283.8	109.4
1957	285.7	107.7
1958	265.0	100.0
1959	298.9	99.1
1960	308.3	101.8

Source: See Appendix B, p. 104.

Following his discussion of relative price changes Orcutt lists five reasons why the least-squares estimates will be biased and in each case the bias will be such that an underestimate of the coefficients will be derived. Three of these reasons are: (1) the errors of observations will be greater for prices and incomes than for quantities, (2) estimates of elasticities based on year to year changes are really short run elasticities and the long run elasticity is likely to be much greater, (3) because of the assumed small price changes, the estimates derived will relate to small price changes while the demand elasticity of imports is probably much larger for large price changes. A fourth reason why least-squares estimates are biased downward is that shifts in the demand and supply schedule are likely to occur in the same direction.[3] Chart 11 is similar to Orcutt's Chart 3. If both the demand and supply curve have shifted downward then the actual observations will lie within the shaded parallelogram and a least-squares regression line fitted so as to minimize the sums of squares of deviations in a horizontal direction will appear as is illustrated by the EE' line.

Chart 11. Import Demand Curve Derived by the Use of Least-Squares Regression Analysis



[3]Orcutt's fifth criticism deals with the use of index numbers in estimating elasticities and is discussed in Chapter II, page 17.

It should be pointed out that Orcutt's demand is a derived demand (total demand less total supply) in the importing country and likewise his supply curve is derived by subtracting the domestic demand from the domestic supply in the exporting country. This assumes that the product is completely homogenous and abstracts from the exchange rate and transportation costs so that only one price exists in the two countries. Given these assumptions a world-wide change in tastes so as to increase the demand for a commodity will shift the import demand curve upward while at the same time also shifting the supply curve upward. Similarly an advance in technology will shift the import demand curve downward while shifting the supply curve downward also.

In a discussion of this problem Ta-Chung Liu has shown that the shifts in the demand and supply curves are also quite likely to occur in opposite directions in which case the estimates of elasticities would be overestimated.[4] It would appear therefore, that the estimates might be biased in either direction thus complicating the situation even further.

In a more recent article Arnold Harberger agrees with the Orcutt argument and then continues by stating that the shifts in demand are actually quite substantial and for that reason the estimates derived by the least-squares method are only lower limits to a whole range of possible values.[5] Both Orcutt and Harberger base their arguments concerning shifts in the demand curves and their expected value of import demand elasticity on the assumption mentioned earlier, namely,

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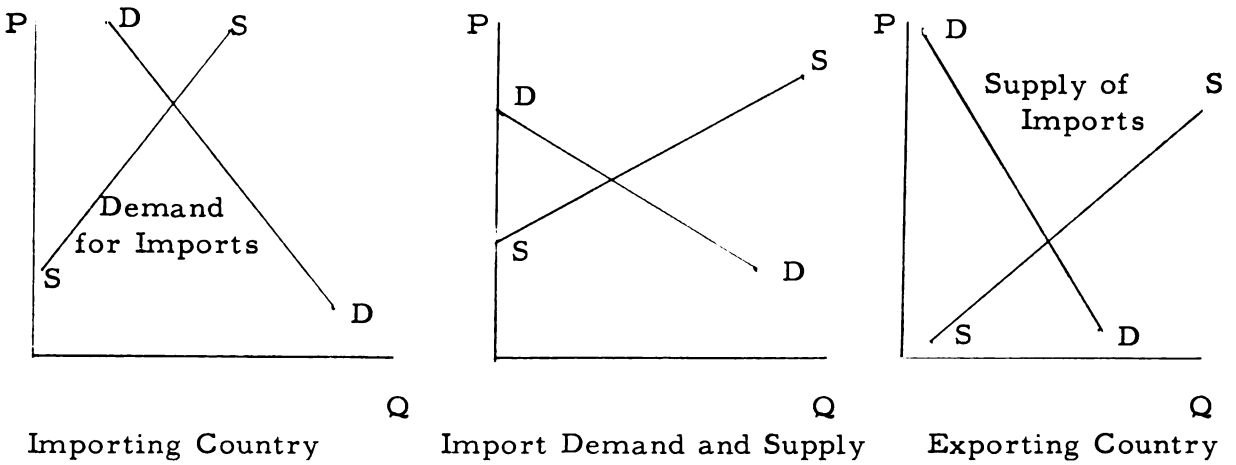
[4]Ta-Chung Liu, "The Elasticity of U. S. Import Demand: A Theoretical and Empirical Reappraisal," IMF Staff Papers, Vol. 3, 1953-54, pp. 416-41.

[5]Arnold C. Harberger, "A Structural Approach to the Problem of Import Demand," American Economic Review, Vol. 43, (May 1953, Papers and Proceedings of the 65th Annual Meeting of the American Economic Association), pp. 145-57.

that the demand for imports is the difference between total demand and domestic supply and that the supply of imports is the difference between the total supply in the foreign country and the foreign country's home demand. The derivation of the import demand and supply curves under assumptions is illustrated in Chart 12.

Chart 12. Derivation of Import Demand and Supply Curves.



Under these conditions any shift in either the domestic demand or supply curve would cause a shift in the import demand curve, thus lending support to Harberger's argument concerning the instability of the demand curve. This concept concerning the import demand also appears to be the underlying basis for both Harberger and Orcutt's skepticism concerning the relatively low price elasticities derived by the least-squares method. If, as Harberger and Orcutt claim, the import demand is a derived demand then the formula for the import price elasticity is:

$$N_m = X \cdot N_d + (X-1)\, N_s,$$

where X is the reciprocal of the share of imports in the total home

demand and all the elasticities (N) are absolute numbers.[6] Thus, if the import share of the total demand is one-fourth of the total demand and the total demand elasticity and the supply elasticity are both equal to one then the import demand elasticity will be equal to seven.

However, the concept of a derived import demand has been sharply criticized by John Adler.[7] Adler argues that the concept of a derived demand or the marginality of imports is only the limiting case at one end of a whole range of possibilities. He continues by pointing out that until some empirical evidence is presented, this case is no more important than the opposite case where domestic producers are the marginal suppliers. In this case domestic production would occur only when the foreign supply was unable to meet the demand. Adler also points out that the most interesting and not improbable case is where shifts in total demand are absorbed in the same proportion by domestic production and imports. This may actually be the case for imports of many materials where a large proportion of domestic and foreign sources of supply is controlled by identical ownership interests as in the case of petroleum and other commodities.

Adler then sums up the case for the validity of the least-squares estimates as follows:

> . . . I cannot avoid the impression that for numerous institutional reasons similar to those given above and because of market imperfections of a geographic and institutional nature, the 'true' elasticities are very close to the lower limits, i.e., to the results of the least-squares derivations, if we mean by elasticities those parameters which reflect not only initial impulses but also the complicated action-reaction of price setting between importers and competing domestic producers of homogeneous, near homogeneous, and heterogeneous commodities.[8]

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[6]Ibid., p. 156.

[7]John H. Adler, "The United States Demand for Imports--Discussion," American Economic Review, Vol. XLIII (May 1953, Papers and Proceedings of the 65th Annual Meeting of the American Economic Association), pp. 160-63.

[8]Ibid., pp. 162-63.

Another criticism which has been made of the use of least-squares analysis in attempting to obtain estimates of price elasticities in general, and not only with reference to international trade studies, involves the interdependence of demand and supply. In order to discuss this point it is necessary to examine carefully what is involved in determining the demand for a single commodity or a group of commodities.

Elmer Working, in his pioneer study, states that each observation of price and quantity is actually an intersection of a given demand and supply curve and that if regression analysis is used on this type of data it is impossible a priori to determine whether least-squares regression analysis will yield a demand curve or a supply curve.[9] He continues by saying that this will depend on which of the two curves has shifted more during the time period being considered. If the supply curve has shifted more than the demand curve, then an approximation to the demand curve will be derived. Similarly, if the demand curve has shifted more, then an approximation to the supply curve will be derived. This is illustrated in Chart 13. Part A shows the price and quantity relationships which might ordinarily occur. In Part B the demand curve has remained relatively stable and the supply curve has shifted considerably. The use of least-squares analysis in this case would trace out a demand curve as indicated. In Part C the supply curve has remained relatively stable while the demand curve has shifted and the result is that a supply curve is derived. Thus, it would appear that to the extent that shifts in the demand curve can be eliminated it would be possible to derive a demand curve. Major shifts in demand can perhaps be eliminated by selecting appropriate time periods for the analysis of by including some "demand shifters" in the regression equation. Two such "demand shifters" might be income and a time or trend factor. However, if these "demand shifters"

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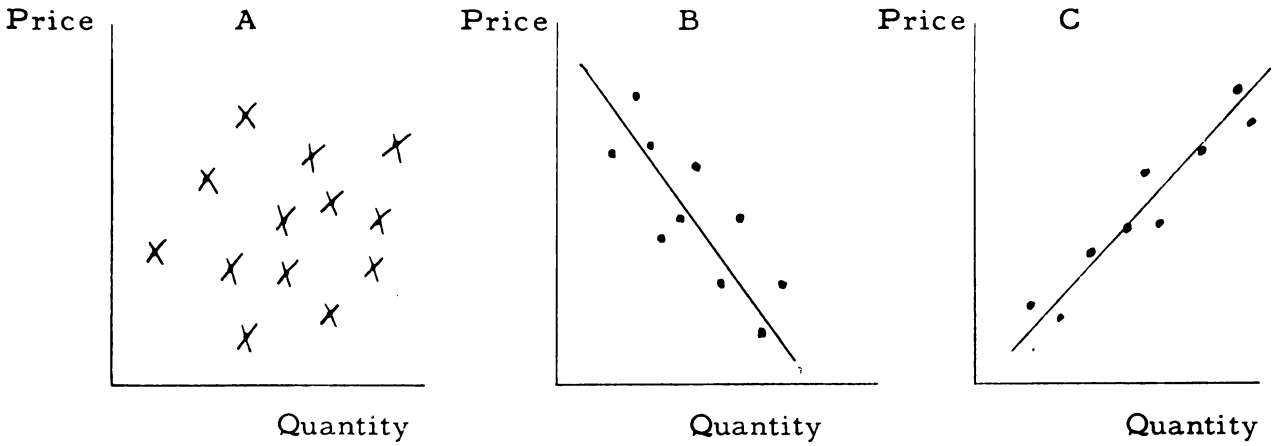
[9]Elmer Working, "What Do Statistical 'Demand Curves' Show?" Quarterly Journal of Economics, Vol. IV (1927), pp. 212-235.

Chart 13. Price and Quantity Relationships.



can be isolated one other problem still exists, which may be briefly explained as follows: The usual regression equation has the following form:

$$Y = a+b_1X_1+\ldots+b_nX_n,$$

where Y is the estimated value of Y, or the dependent variable and where the $X_1, \ldots X_n$ are independent variables. However, if we specify the import demand equation as follows:

$$Q = a+b_1Y+b_2P,$$

where Q is the quantity of imports, Y is some measure of income and P is the price of imports, it is not true that P is independent of the quantity of imports. Thus we have not one unknown and one equation, but rather two unknowns and one equation. Or in other terms we have two endogenous variables which are determined within the system. And the system in this case is only one equation. Therefore in order to make the system determinant another equation is needed. It is as a result of these limitations that the Limited Information and Theil-Basmann methods were developed.

Before continuing, it might be helpful to define various terms which are frequently used to describe the properties of estimates which are derived by the use of various estimating procedures. Estimating procedures which result in estimates of regression coefficients that are different from the true parameter value are said to be biased estimators. Estimators which have the smallest limiting variance are called efficient estimators. For consistent estimators, the probability of the estimate approaching the true parameter value approaches one as the number of observations approaches infinity.[10]

Mood makes the following comment regarding the meaning of the terms unbiased and consistent; for consistent estimates, "the estimate becomes near the true parameter value with probability approaching one as the sample increases without limit. . . . A consistent estimator is obviously unbiased in the limit (that is as the sample size approaches infinity), but for finite sizes it may be biased, though in such a way that the bias approaches zero as n becomes large. An unbiased estimator may or may not be consistent depending on whether or not its distribution becomes concentrated near its mean as the sample size increases."[11]

Estimates of elasticities of demand derived by the least-squares method will be unbiased, efficient and consistent if the price and demand shifters can be truly classified as exogenous variables. These conditions are actually met under certain conditions. The individual consumer when selecting his food purchases is faced with a set of fixed prices and these prices will not change as a result of his purchase decisions. Thus, use of a single equation least squares regression analysis is quite appropriate for estimating an individual consumer's demand elasticities. In this case the quantity purchased would be the dependent or endogenous

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[10]Alexander McFarlane Mood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Company, Inc., 1950), p. 150.

[11]Ibid., p. 150.

variable and price and a demand shifter such as income, would be classed as independent or exogenous variables.

In the case of international trade estimates of the elasticity of demand for imports will also have these properties under certain conditions. If the foreign supply of a commodity is perfectly elastic, the price will not be effected by the quantity imported and price will then be an exogenous variable. This is actually quite likely to be the case for many manufactured articles, at least in the relevant range of present day imports. This situation is also quite closely approximated in the situation where the quantity imported by the United States is only a small fraction of the total amount produced so that even though the supply may not be perfectly elastic, the relatively small amount imported by the United States will not affect the price so that here also, price may be treated as an exogenous variable. Again, this might be the case for many manufactured commodities, some semi-manufactured commodities, but probably not for too many crude materials. A third case where the least squares method would be quite appropriate would be where the analysis indicated that the quantity of imports was related not to this year's prices, but rather to last year's prices so that the price variable becomes a lagged endogenous variable. With regard to the present study it is probably true that while the conditions necessary for unbiased estimates do exist for some of the commodities included in the indexes this is not true for all of the commodities in the economic classification, crude materials and semi-manufactures. In situations of this type, Carl Christ makes the following statement concerning the least squares method versus the limited information method.

> The least-squares method is relatively easy computationally, and the estimates it yields have relatively small variances about their expected values. The trouble is that when it is applied to equations that are part of a simultaneous system, it typically yields biased estimates, that is, estimates whose expected values are different from the true values. Thus the least-squares method in a system

> of equations can be likened to a shotgun that scatters its shot (i.e., its estimates) fairly close together, but not centered on the bullseye.
>
> The limited-information method is relatively burdensome computationally, and its estimates have larger variances about their expected values than do least-squares estimates. Its estimates are biased too, except that under the assumptions made by model-builders, these biases become smaller and approach zero as the sample size (number of observations) approaches infinity. Thus, the limited-information method can be likened to a shot-gun that scatters its shot (i.e., estimates) less close together than the least-squares shotgun goes, and not centered right on the bulls-eye either, but becoming better centered and approaching perfect centering as the sample size approaches infinity.
>
> Thus the question of which method to use for any finite size is still open, for we do not know how to tell whether the bias of the limited information-method at a given sample size is smaller than that of the least-squares method by enough to compensate for its larger variance.[12]

Christ then turns his attention to some empirical evidence on the question of which estimating procedure to use. There are two types of empirical evidence on this point. The first of these two types is what is termed the Monte Carlo method. This method consists of taking a large number of samples of data from a synthetic world that has been constructed with known equations and parameters. Then each sample is used to estimate a known parameter by alternative estimating procedures and the result is compared with the known value. One such study and which Christ mentions is by H. M. Wagner, and is a comparison of the estimates of the marginal propensity to consume derived by the least-squares and limited information methods. A brief summary of the results of the study is given in Table 16.

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[12]Carl F. Christ, "Aggregate Economic Models: A Review Article," American Economic Review, Vol. 46, 1956, pp. 397-398.

Table 16. Summary of Wagner's Estimates of the Marginal Propensity to Consume Obtained by Two Estimating Methods

	Synthetic World I		Synthetic World II	
	Least-Squares	Limited Information	Least-Squares	Limited Information
True Value	.5000	.5000	.5000	.5000
Ave. of 100 Estim.	.5137	.4955	.5087	.5049
Estimated Bias	.0137	-.0045	.0087	.0049
Est. Stand. Deviation	.0107	.0174	.0453	.0460
Root Mean Sq. Error	.0174	.0179	.0462	.0463

Source: H. M. Wagner as quoted by Carl F. Christ, "Aggregate Economic Models: A Review Article," American Economic Review, Vol. 46, 1956, p. 399.

This study would appear to confirm Christ's earlier shotgun simile, since in each case the estimates derived from the least-square method have a greater bias than those derived from the limited information method, but the estimated standard deviation for the least-squares method is smaller by enough to bring the root mean square below that of the limited information method.

In a more recent article Christ summarizes three Monte Carlo Studies: the one by Wagner already mentioned, and two others by Basman and Summers. For every one of five parameters estimated by Basman the least-squares estimates had smaller root mean squares than the limited information estimates and for four out of five estimates the least-squares estimates had smaller root mean squares than the two-stage-least-squares estimates. Also, the least-squares had the largest biases in most cases, but relatively small variances.

In Summers' work, least-squares was usually somewhat poorer than the other three methods (full-information, limited-information and two

stage-least squares), but it was best of all in those experiments where an incorrect model was used, and it usually ranked better when the exogenous variables were highly, intercorrelated than when they were not.

A second type of empirical evidence is that obtained from real world studies where different methods have been used for the same or similar data. One such comparison has been made by Wallace and Judge.[13] The tabulation, which gives different estimates of the price and income elasticities for beef and pork indicates that the estimates of the price elasticity of beef varied from .76 to .96 with the least-squares method and from .77 to 1.36 for the other methods. The income elasticity estimated by the least-squares varied from .33 to .73 while the estimates of the income elasticity using the other methods varied from .58 to .97. The estimates obtained for the price and income elasticities for pork are similar and the results from any of the methods appear quite plausible. The empirical evidence cited above would indicate that even where simultaneity does exist the least-squares method is in many cases almost as satisfactory and in some cases even better than the computationally more complex methods.

In summary, there are certain types of demand studies where least-squares regression analysis is quite appropriate. With particular reference to demand studies in international trade, least-squares is appropriate where, when using quantity as the dependent variable, price can rightly be classed as exogenous. This would be the case where the supply curve is perfectly elastic, at least in the relevant range. In such situations changes in price can be interpreted as shifts in the supply curve rather than movements along the curve. While this may actually

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[13]Thomas D. Wallace and George G. Judge, Econometric Analysis of the Beef and Pork Sectors of the Economy, Oklahoma State University Experiment Station Technical Bulletin T-75, 1958, pp. 46-47.

be the case for some studies involving particular commodities this would probably not be the case in the present study.

However, even in situations where the particular situation may imply that simultaneity of variables does exist, least squares may be satisfactory even though the expected bias of the estimates may be larger than the expected bias of alternative methods. This is true because the least-squares estimates will usually have a smaller variance so that for any given estimate it is impossible to determine which is better. Another problem and one which is particularly important in the present study is that of specifying economically meanful supply equations. The fact that the present study involves some 2,000 different commodity classifications coming from over 150 different countries is indicative of the magnitude of the problem involved in specifying economically meaningful supply equations. In addition, it should be pointed out that for many countries the necessary data is either not available or else not reliable.

Therefore, because of the relatively small bias that can be expected in least-squares analysis and in view of the difficulties which would be encountered with other methods, the least-squares method has been chosen as the appropriate method for this study.

APPENDIX B

A SUMMARY OF THE RESULTS OF THE LEAST-SQUARE REGRESSION ANALYSIS

A summary of the results of the least-squares regression analysis is presented below, following the explanation of the symbols used.

Y = Revised unadjusted index of industrial production. Source: For 1923-58, Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, Vol. XLV (1959), p. 1467. For 1959-60, Ibid., Vol. XLVII (1961), p. 210.

P = Ratio of the index of import prices of materials from one region divided by a price index of imports of materials from all other regions. Source: For price index of imports from the various regions see Appendix B, page 120. Price indexes of imports from "all other" regions for the years 1923-38 were furnished by John H. Adler of the International Bank for Reconstruction and Development. Indexes for the years 1948-53 were supplied by Adler and Charles G. Goor, also of the International Bank. The indexes for the years 1954-60 were computed as part of this study.

P' = Ratio of the price index of total imports of materials or the price index of imports from one region, divided by the United States price index of intermediate materials, supplies, and components. The source for the latter index was: 1923-57, U. S. Bureau of the Census, Historical Statistics of the United States, Washington D. C. (1958); 1958-59, U. S. Bureau of Labor Statistics, Bulletin 1295, Washington D. C. (1960); 1960, U. S. Department of Labor, Wholesale Prices and Price Indexes, Washington, D. C. (1961).

t = Time.

D = "Dummy" or (0-1) variable.

The five symbols described above are the various independent variables that were used in the different estimating equations. The coefficient that appears below each symbol on the same line as the equation number is the regression coefficient for that variable. The number immediately below the regression coefficient, and which is enclosed in parenthesis is the standard error of the regression coefficient. The figure in brackets which appears below the standard error of the "Dummy" variable of the logarithmic equations indicates, in percentage terms, the extent to which the estimate of the dependent variable (the quantity index of imports of materials) will be larger or smaller during the postwar period given the same values for the independent variables.

$\bar{R}^2$ = Coefficient of determination adjusted for degrees of freedom which indicates the percent of the variation in the dependent variable that can be explained by the variation in the independent variables after an adjustment is made for the degrees of freedom in the analysis.

d = Durbin-Watson statistic which is used to test for autocorrelation in the disturbances. Those equations where the Durbin-Watson test was inconclusive are marked with as asterisk. Two asterisks indicate that the null hypothesis of independence in the disturbance was rejected. The von Neumann-Hart test was also applied and those equations where the null hypothesis is rejected are marked with the symbol #. Both tests were made at the 5 per cent significance level.

N_y = Income elasticity.

N_p = Competitive price elasticity, the elasticity of import demand with respect to the price index of imports from one region divided by the price index of imports from all other regions.

$N_{p'}$ = Price elasticity, the elasticity of import demand with respect to the price index of imports divided by the U. S. price index of intermediate materials, supplies, and components.

TOTAL IMPORTS OF MATERIALS

Equation Number	Constant Term	Y	P'	t	D	$\bar{R}^2$	d	N_y	$N_{p'}$
Prewar Period									
N1.1	+10.6	+0.976 (0.110)				.838	0.916**o	+0.889	
N1.2	+16.8	+0.987 (0.085)		-0.833 (0.256)		.838	1.554	+0.899	
Postwar Period									
N1.3	+48.6	+0.520 (0.062)				.854	2.527	+0.729	
N1.4	+79.8	+0.508 (0.065)	-0.258 (0.342)			.848	2.300	+0.712	-0.155
Total Period									
N1.5	+50.8	+0.515 (0.018)				.965	1.764	+0.621	
N1.6	+46.4	+0.671 (0.061)		-1.031 (0.393)	-11.939 (8.973)	.972	1.938	+0.807	

TOTAL IMPORTS OF MATERIALS

(All variables in logarithms)

Equation Number	Constant Term	Y	P'	t	D	$\bar{R}^2$	d	N_y	$N_{p'}$
Prewar Period									
L1.1	+0.282	+0.875 (0.102)				.829	1.059*#	+0.875	
L1.2	+0.321	+0.872 (0.094)		-0.038 (0.020)		.854	1.340*	+0.872	
Postwar Period									
L1.3	+0.511	+0.727 (0.084)				.860	2.565	+0.727	
L1.4	+0.892	+0.710 (0.088)	-0.169 (0.214)			.855	2.359	+0.710	-0.169
Total Period									
L1.5	+0.788	+0.613 (0.023)				.962	1.573	+0.613	
L1.6	+0.409	+0.827 (0.064)		-0.040 (0.018)	-0.086 (0.031) [-18.0]	.975	2.022	+0.827	

IMPORTS OF MATERIALS FROM EUROPEAN PAYMENTS UNION COUNTRIES

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N2.1	+205.1	+0.520	-1.440				.915	2.249	+0.393	-1.148	
		(0.147)	(0.172)								
N2.2	+120.0	+0.876	-0.699		-1.925		.927	2.398*	+0.662	-0.557	
		(0.246)	(0.463)		(1.126)						
Postwar Period											
N2.3	+31.9	+0.585	-0.507				.471	1.839	+1.120	-0.351	
		(0.255)	(1.815)								
N2.4	+31.6	+0.584	-0.492	-0.010			.395	1.840	+1.118	-0.340	-0.007
		(0.282)	(2.412)	(0.980)							
Total Period											
N2.5	+263.2	+0.159	-1.737				.706	1.950	+0.206	-1.298	
		(0.031)	(0.286)								
N2.6	+141.9	+0.749	-0.833		-1.688	-86.783	.786	1.828	+0.968	-0.623	
		(0.223)	(0.523)		(1.331)	(27.525)					

IMPORTS OF MATERIALS FROM EUROPEAN PAYMENTS UNION COUNTRIES
(All variables in logarithms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L2.1	+3.340	+0.493	-1.138				.903	2.734*	+0.493	-1.138	
		(0.124)	(0.162)								
L2.2	+2.753	+0.587	-0.916		-0.041		.903	2.822*#	+0.587	-0.916	
		(0.149)	(0.265)		(0.039)						
Postwar Period											
L2.3	+0.331	+1.045	-0.367				.502	1.889	+1.045	-0.367	
		(0.431)	(1.136)								
L2.4	+0.345	+1.049	-0.403	+0.024			.432	1.884	+1.049	-0.403	(1)
		(0.473)	(1.566)	(0.663)							
Total Period											
L2.5	+4.342	+0.216	-1.377				.762	(2.214)	+0.216	-1.377	
		(0.037	(0.199)								
L2.6	+2.368	+0.701	-0.830		-0.046	-0.226	.814	2.133	+0.701	-0.830	
		(0.178)	(0.323)		(0.049)	(0.078)					
						[-40.6]					

(1) Indicates that the regression coefficient had an implausible sign and therefore no elasticity was computed.

IMPORTS OF MATERIALS FROM TOTAL EUROPE

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N3.1	+136.8	+0.660 (0.120)	-0.935 (0.136)				.920	2.522	+0.539	-0.807	
N3.2	+97.2	+0.831 (0.226)	-0.595 (0.404)		-0.900 (1.004)		.919	2.659*	+0.679	-0.514	
Postwar Period											
N3.3	+17.2	+0.499 (0.251)	-0.223 (1.658)				.421	1.755	+1.031	-0.167	
N3.4	+14.7	+0.496 (0.271)	-0.131 (2.282)	-0.058 (0.896)			.338	1.764	+1.027	-0.098	-0.045
Total Period											
N3.5	+216.3	+0.146 (0.028)	-1.314 (0.248)				.676	1.864	+0.204	-1.066	
N3.6	+127.1	+0.602 (0.213)	-0.698 (0.475)		-0.900 (1.234)	-72.719 (26.556)	.753	1.746	+0.842	-0.566	

IMPORTS OF MATERIALS FROM TOTAL EUROPE
(All variables in logarhthms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L3.1	+2.388	+0.620	-0.797				.908	2.976*#	+0.620	-0.797	
		(0.111)	(0.140)								
L3.2	+2.102	+0.665	-0.687		-0.021		.902	2.824*#	+0.665	-0.687	
		(0.138)	(0.238)		(0.358)						
Postwar Period											
L3.3	+0.281	+0.935	-0.223				.434	1.631	+0.935	-0.223	
		(0.465)	(1.141)								
L3.4	+0.236	+0.932	-0.155	-0.042			.353	1.804	+0.932	-0.155	-0.042
		(0.499)	(1.646)	(0.675)							
Total Period											
L3.5	+3.816	+0.214	-1.125				.732	2.056	+0.214	-1.125	
		(0.036)	(0.188)								
L3.6	+1.829	+0.734	-0.613		-0.029	-0.253	.812	2.187	+0.734	-0.613	
		(0.172)	(0.299)		(0.046)	(0.075)					
						[-44.2]					

IMPORTS OF MATERIALS FROM CANADA

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N4.1	-2.3	+1.141	-0.073				.947	0.869*#	+1.106	-0.081	
		(0.116)	(0.067)								
N4.2	+19.0	+1.268	-0.019		-0.448		.951	1.068*#	+1.229	-0.021	
		(0.140)	(0.089)		(0.301)						
Postwar Period											
N4.3	+68.0	+1.087	-0.314				.854	1.687	+0.889	-0.031	
		(0.154)	(0.610)								
N4.4	+100.7	+1.108	-0.300	-0.361			.839	1.600	+0.906	-0.105	-0.128
		(0.180)	(0.642)	(1.388)							
Total Period											
N4.5	-14.7	+1.302	-0.073				.987	1.100**#	+1.118	-0.040	
		(0.029)	(0.127)								
N4.6	+5.4	+1.097	-0.077		-0.412	+43.881	.990	1.575*	+0.942	-0.043	
		(0.100)	(0.137)		(0.721)	(13.319)					

IMPORTS OF MATERIALS FROM CANADA
(All variables in logarithms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L4.1	+0.118	-1.074 (0.105)	-0.126 (0.078)				.955	0.959*#	+1.074	-0.126	
L4.2	+0.276	+1.031 (0.136)	-0.169 (0.115)		+0.011 (0.021)		.952	0.904*#	+1.031	-0.169	
Postwar Period											
L4.3	+0.542	+0.890 (0.115)	-0.094 (0.194)				.869	1.778	+0.890	-0.094	
L4.4	+0.963	+0.926 (0.138)	-0.084 (0.202	-0.258 (0.495)			.858	1.618	+0.926	-0.084	-0.258
Total Period											
L4.5	+0.109	+1.164 (0.019)	-0.098 (0.058)				.993	1.213*#	+1.164	-0.098	
L4.6	+0.507	+0.956 (0.067)	-0.213 (0.069)		+0.015 (0.019)	+0.098 (0.030) [+12.5]	.994	1.455*	+0.956	-0.213	

IMPORTS OF MATERIALS FROM LATIN AMERICA

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N5.1	+153.2	+1.051	-1.384				.531	0.384**#	+0.867	-1.300	
		(0.325)	(0.550)								
N5.2	+53.7	+1.212	-0.204		-3.920		.947	2.305	+1.001	-0.192	
		(0.111)	(0.221)		(0.391)						
Postwar Period											
N5.3	+181.9	+0.726	-0.893				.639	1.806	+0.760	-0.514	
		(0.152)	(0.693)								
N5.4	+289.0	+0.704	-0.474	-1.180			.708	1.997	+0.736	-0.273	-0.663
		(0.137)	(0.665)	(0.645)							
Total Period											
N5.5	+105.4	+0.989	-0.836				.932	1.104**#	+0.958	-0.588	
		(0.094)	(0.390)								
N5.6	+108.2	+1.018	-0.650		-3.065	+36.609	.959	1.537*	+0.986	-0.458	
		(0.120)	(0.385)		(0.860)	(20.318)					

IMPORTS OF MATERIALS FROM LATIN AMERICA
(All variables in logarithms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L5.1	+2.654	+0.945 (0.255)	+1.253 (0.516)				.583	0.455**#	+0.945	-1.253	
L5.2	+0.080	+1.063 (0.109)	+0.030 (0.276)		-0.223 (0.029)		.927	1.779	+1.063	(1)	
Postwar Period											
L5.3	+1.665	+0.715 (0.156)	-0.467 (0.395)				.621	1.752	+0.715	-0.467	
L5.4	+2.693	+0.705 (0.138)	-0.246 (0.368)	-0.693 (0.358)			.702	1.958	+0.705	-0.246	-0.693
Total Period											
L5.5	+1.699	+1.042 (0.094)	-0.850 (0.292)				.918	0.850**#	+1.042	-0.850	
L5.6	+0.706	+0.977 (0.090)	-0.206 (0.234)		-0.209 (0.030)	+0.055 (0.050) [+11.3]	.973	1.523*	+0.977	-0.206	

(1) Indicates that the regression coefficient had an implausible sign and therefore no elasticity was computed.

IMPORTS OF MATERIALS FROM OVERSEAS STERLING AREA

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N6.1	+13.1	+1.138 (0.187)	-0.268 (0.112)				.727	1.920	+1.145	-0.294	
N6.2	+9.2	+1.068 (0.192)	-0.212 (0.119)		+0.552 (0.445)		.738	2.201	+1.074	-0.233	
Postwar Period											
N6.3	+154.2	-0.009 (0.098)	-0.030 (0.305)				-.199	2.962	(1)	(2)	
N6.4	+115.3	+0.024 (0.101)	+1.357 (1.256)	-0.972 (0.845)			-.164	2.936	(2)	(1)	(2)
Total Period											
N6.5	+47.8	+0.353 (0.032)	+0.112 0.141				.814	1.650	+0.495	(1)	

(1) Indicates that the regression coefficient had an implausible sign and therefore no elasticity was computed.

(2) Indicates that although the regression coefficient had a correct sign, either the t value of the regression coefficient or the correlation obtained was so small that no confidence can be placed on the estimate.

IMPORTS OF MATERIALS FROM OVERSEAS STERLING AREA
(All variables in logarithms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L6.1	+0.359	+1.150 (0.199)	-0.331 (0.128)				.727	1.902	+1.150	-0.331	
L6.2	+0.341	+1.093 (0.201)	-0.281 (0.133)		+0.034 (0.028)		.737	2.195	+1.093	-0.281	
Postwar Period											
L6.3	+2.178	-0.002 (0.160)	-0.001 (0.204)				-.200	2.912	(1)	(2)	
L6.4	+1.808	+0.036 (0.166)	-0.680 (0.759)	-0.529 (0.569)			-.216	2.966	(2)	(2)	(2)
Total Period											
L6.5	+0.878	+0.508 (0.037)	+0.038 (0.097)				.871	1.892	+0.508	(1)	

(1) Indicates that the regression coefficient had an implausible sign and therefore no elasticity was computed.

(2) Indicates that although the regression coefficient had a correct sign, either the t value of the regression coefficient or the correlation obtained was so small that no confidence can be placed on the estimate.

IMPORTS OF MATERIALS FROM THE REST OF THE WORLD

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
N7.1	+47.3	+0.677	-0.105				.658	1.147**#	+0.658	-0.180	
		(0.140)	(0.031)								
N7.2	+101.2	+0.883	-0.370		-3.619		.761	1.487*	+0.859	-0.635	
		(0.141)	(0.106)		(1.406)						
Postwar Period											
N7.3	+90.5	+0.341	-0.474				.690	2.462	+0.675	-0.331	
		(0.064)	(0.408)								
N7.4	+89.3	+0.335	-0.332	-0.108			.659	2.283	+0.663	-0.270	0.094
		(0.071)	(0.642)	(0.362)							
Total Period											
N7.5	+81.7	+0.219	-0.075				.819	1.467	-0.330	-0.092	
		(0.024)	(0.039)								
N7.6	+110.1	+0.667	-0.331		-3.142	-44.238	.889	1.934	+1.007	-0.408	
		(0.118)	(0.092)		(1.175)	(10.570)					

IMPORTS OF MATERIALS FROM THE REST OF THE WORLD

(All variables in logarithms)

Equation Number	Constant Term	Y	P	P'	t	D	$\bar{R}^2$	d	N_y	N_p	$N_{p'}$
Prewar Period											
L7.1	+1.190	+0.598	-0.184				.532	0.907*#	+0.598	-0.184	
		(0.157)	(0.066)								
L7.2	+0.550	+0.463	+0.161		+0.189		.674	2.031	+0.463	(1)	
		(0.141)	(0.145)		(0.073)						
Postwar Period											
L7.3	+1.217	+0.694	-0.387				.724	2.540	+0.694	-0.387	
		(0.121)	(0.329)								
L7.4	+1.221	+0.683	-0.262	-0.111			.697	2.337	+0.683	-0.262	-0.111
		(0.131)	(0.502)	(0.326)							
Total Period											
L7.5	+1.632	+0.313	-0.136				.789	1.144**#	+0.313	-0.136	
		(0.038)	(0.062)								
L7.6	+0.645	+0.504	+0.092		+0.157	-0.150	.876	2.038	+0.504	(1)	
		(0.106)	(0.125)		(0.063)	(0.046)					
						[-29.2]					

(1) Indicates that the regression coefficient had an implausible sign and therefore no elasticity was computed.

APPENDIX C

VALUES, UNIT VALUE INDEXES, AND QUANTITY INDEXES FOR TOTAL UNITED STATES IMPORTS OF MATERIALS AND FOR IMPORTS OF MATERIALS FROM SIX DIFFERENT REGIONS

Source: For 1923-48, John H. Adler, Eugene R. Schlesinger and Evelyn Van Westerborg, The Pattern of United States Import Trade Since 1923. New York, Federal Reserve Bank of New York, 1952. For 1949-53, the indexes and value of imports figures were supplied through the courtesy of John H. Adler and Charles G. Goor, both with the International Bank for Reconstruction and Development, Washington, D. C. For the years 1954-60 the indexes and value figures were computed from: U. S. Bureau of the Census, Report No. FT 110, United States Imports of Merchandise for Consumption, Calendar Years 1954-60.

Total United States Imports of Materials, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$2,265,149	172.4	98.6
1924	2,057,379	171.9	89.8
1925	2,659,601	199.0	100.3
1926	2,797,469	196.2	107.0
1927	2,544,253	181.0	105.5
1928	2,448,970	168.6	109.0
1929	2,665,515	163.2	122.6
1930	1,796,387	130.4	103.4
1931	1,155,137	96.4	89.7
1932	676,919	73.7	68.9
1933	803,077	75.3	80.0
1934	871,664	87.2	75.0
1935	1,107,426	87.8	94.7
1936	1,355,335	97.4	104.4
1937	1,768,908	112.1	118.4
1938	1,091,212	100.7	81.3
1939	1,375,303	102.0	101.2
1940	1,739,582	111.3	117.3
1941	2,286,296	114.2	150.2
1942	1,850,535	124.0	112.0
1943	1,895,631	135.6	104.9
1944	1,963,948	145.3	101.4
1945	2,315,470	151.6	114.6
1946	2,976,828	175.9	126.8
1947	3,410,453	204.4	125.2
1948	4,265,136	219.1	146.1
1949	3,815,417	207.9	137.8
1950	5,129,314	214.3	179.7
1951	6,447,352	291.9	165.9
1952	6,186,842	265.3	175.2
1953	5,959,515	246.5	181.7
1954	5,382,690	239.0	169.2
1955	6,287,418	251.9	187.5
1956	6,861,869	263.3	195.8
1957	6,823,271	265.6	193.1
1958	6,090,925	247.1	185.4
1959	7,171,769	248.2	217.5
1960	6,913,870	254.8	204.4

United States Imports of Materials from European Payments Union Countries, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$569,823	153.9	134.0
1924	511,027	154.7	119.6
1925	621,729	165.1	136.3
1926	631,391	159.4	143.4
1927	597,476	156.1	138.5
1928	578,705	146.9	142.6
1929	583,159	143.4	147.2
1930	387,889	118.4	118.6
1931	261,232	95.5	99.0
1932	159,920	78.3	73.9
1933	217,383	81.9	96.1
1934	199,865	96.2	75.2
1935	250,487	91.1	99.5
1936	310,372	98.9	113.6
1937	350,762	110.0	115.4
1938	215,069	103.2	75.4
1939	257,119	96.7	96.2
1940	154,707	107.9	51.9
1941	105,297	132.8	28.7
1942	68,974	144.3	17.3
1943	67,965	152.8	16.1
1944	77,686	192.6	14.6
1945	161,246	202.6	28.8
1946	308,187	229.2	48.6
1947	329,316	231.4	51.5
1948	452,448	239.1	68.5
1949	388,699	228.8	61.5
1950	600,847	201.3	108.1
1951	955,412	264.7	130.7
1952	843,417	258.3	118.2
1953	976,851	236.9	149.3
1954	707,069	221.2	115.7
1955	839,811	229.1	132.6
1956	941,257	241.4	141.0
1957	816,298	235.5	125.3
1958	796,929	215.6	133.6
1959	1,158,979	215.2	194.7
1960	1,021,685	221.7	166.7

United States Imports of Materials from Other Europe, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$ 34,147	161.6	36.9
1924	37,290	142.7	45.6
1925	41,445	160.9	45.0
1926	55,578	159.9	60.7
1927	42,818	159.0	47.0
1928	46,202	126.4	63.8
1929	57,560	132.9	75.6
1930	45,641	129.4	61.6
1931	32,190	98.1	57.3
1932	22,887	82.5	48.4
1933	31,357	82.3	66.5
1934	34,127	99.4	59.9
1935	44,535	88.5	87.9
1936	56,119	94.4	103.8
1937	70,451	111.3	110.5
1938	57,421	108.8	92.2
1939	58,689	97.0	105.6
1940	34,323	106.0	56.5
1941	34,731	131.9	46.0
1942	26,153	132.0	34.6
1943	33,022	139.7	41.3
1944	50,667	139.6	63.4
1945	64,511	138.5	81.3
1946	124,519	195.4	111.3
1947	130,643	233.6	97.7
1948	135,743	255.1	92.9
1949	94,062	211.7	77.6
1950	110,023	214.2	89.7
1951	140,396	299.0	82.0
1952	119,131	273.9	75.9
1953	108,458	237.7	77.6
1954	95,417	229.5	70.8
1955	99,903	236.7	71.9
1956	111,662	237.6	80.0
1957	96,535	236.1	69.6
1958	81,659	213.0	65.3
1959	116,886	218.3	91.2
1960	120,011	224.4	91.1

United States Imports of Materials from Total Europe, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$603,970	153.1	118.2
1924	548,317	155.0	106.0
1925	663,174	162.9	122.0
1926	686,969	158.8	129.6
1927	640,294	156.5	122.6
1928	624,907	145.6	128.6
1929	640,719	142.5	134.7
1930	433,530	119.5	108.7
1931	293,422	96.2	91.4
1932	182,807	79.2	69.2
1933	248,740	81.7	91.2
1934	233,992	96.5	72.7
1935	295,022	90.8	97.4
1936	366,491	98.1	112.0
1937	421,213	110.1	114.6
1938	272,490	104.2	78.4
1939	315,808	96.9	97.7
1940	189,030	107.5	52.7
1941	140,028	100.1	31.7
1942	95,127	140.4	20.3
1943	100,987	148.3	20.4
1944	128,353	167.2	23.0
1945	225,757	179.0	37.8
1946	432,706	217.8	59.6
1947	459,959	232.1	59.4
1948	588,191	242.1	72.8
1949	482,761	225.6	64.1
1950	710,870	202.8	105.0
1951	1,095,808	268.3	122.3
1952	962,548	259.2	110.8
1953	1,085,309	236.9	136.7
1954	802,486	222.2	107.7
1955	939,714	230.0	121.8
1956	1,052,919	241.0	130.2
1957	912,833	235.7	115.4
1958	878,588	215.4	121.5
1959	1,275,865	215.4	176.4
1960	1,141,696	221.9	153.3

United States Imports of Materials from Canada, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$ 290,565	156.7	83.3
1924	284,308	155.1	82.4
1925	325,914	153.1	95.7
1926	344,659	149.0	103.9
1927	343,087	149.0	103.5
1928	351,163	149.3	105.7
1929	375,093	143.7	117.3
1930	305,438	143.2	95.8
1931	211,184	126.4	75.1
1932	139,559	110.1	57.0
1933	138,193	95.3	65.2
1934	151,570	91.5	74.4
1935	178,465	90.4	88.7
1936	220,560	92.8	106.8
1937	264,178	99.0	119.9
1938	197,621	110.1	80.7
1939	248,935	107.6	104.0
1940	317,254	109.8	129.8
1941	488,466	112.7	170.8
1942	507,255	114.2	199.6
1943	529,403	122.9	193.6
1944	553,117	132.7	187.3
1945	634,606	131.4	217.0
1946	653,613	160.0	183.6
1947	868,235	196.1	198.9
1948	1,104,037	211.0	235.1
1949	1,057,955	206.4	230.4
1950	1,369,303	208.1	295.8
1951	1,557,613	243.7	287.2
1952	1,629,517	256.9	285.2
1953	1,707,222	255.6	300.3
1954	1,725,560	255.4	303.9
1955	1,992,366	261.6	342.8
1956	2,186,208	270.9	363.0
1957	2,153,096	273.8	353.6
1958	1,835,856	268.2	307.6
1959	2,178,826	271.7	360.5
1960	2,071,751	271.4	343.2

United States Imports of Materials from Latin America, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$ 411,790	158.6	144.7
1924	378,087	165.3	127.5
1925	415,258	189.5	122.1
1926	413,321	173.0	133.2
1927	368,836	163.4	125.8
1928	374,381	165.2	126.3
1929	431,764	166.9	144.2
1930	281,125	150.1	104.4
1931	169,072	106.0	88.9
1932	91,090	78.5	64.7
1933	97,864	77.5	70.4
1934	114,826	86.7	73.8
1935	145,392	86.1	94.1
1936	169,087	100.3	94.0
1937	241,924	119.3	113.0
1938	148,134	101.5	81.3
1939	195,983	92.9	117.6
1940	297,429	108.3	153.1
1941	543,321	104.5	289.8
1942	520,717	121.2	239.4
1943	608,108	139.2	243.5
1944	694,949	144.6	267.9
1945	720,970	148.1	271.3
1946	740,031	168.1	245.4
1947	802,830	241.5	185.3
1948	961,859	263.8	203.2
1949	910,760	261.2	194.3
1950	1,141,788	256.5	248.1
1951	1,290,394	323.2	222.5
1952	1,412,410	329.0	239.2
1953	1,251,801	320.4	217.7
1954	1,202,762	313.7	213.6
1955	1,344,075	327.3	228.8
1956	1,551,352	346.2	249.6
1957	1,747,151	349.0	278.8
1958	1,528,335	321.7	264.6
1959	1,538,331	307.5	278.6
1960	1,684,403	317.3	295.6

United States Imports of Materials from Overseas Sterling Area, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$ 377,408	154.3	85.0
1924	322,204	158.9	70.5
1925	584,067	222.8	91.1
1926	659,769	268.8	85.3
1927	501,136	219.1	79.5
1928	437,970	181.4	83.9
1929	483,962	157.2	107.0
1930	304,792	116.2	91.2
1931	171,409	66.6	89.5
1932	78,543	41.9	65.1
1933	123,929	54.5	79.1
1934	182,019	81.9	77.2
1935	227,828	88.3	89.7
1936	295,765	99.4	103.4
1937	434,613	119.7	126.2
1938	213,569	93.4	79.5
1939	288,920	99.2	101.2
1940	483,706	111.3	151.1
1941	680,877	117.1	202.1
1942	518,625	120.6	149.5
1943	479,634	129.1	129.1
1944	409,001	139.9	101.6
1945	495,789	155.9	110.5
1946	673,463	153.4	151.4
1947	775,248	165.4	162.9
1948	901,611	196.0	159.9
1949	744,690	188.4	137.4
1950	1,007,014	207.1	169.0
1951	1,368,501	339.4	140.1
1952	1,116,582	251.2	154.5
1953	931,569	216.0	149.9
1954	752,706	199.1	130.4
1955	917,498	212.0	149.3
1956	924,787	215.2	148.3
1957	924,676	214.7	148.6
1958	823,081	195.1	145.5
1959	948,541	201.2	162.7
1960	888,282	212.4	144.3

United States Imports of Materials from Rest of the World, 1923-1960

Year	Value (in thousands)	Unit Value Index (1935-39 = 100)	Quantity Index (1935-39 = 100)
1923	$ 581,422	274.0	68.5
1924	534,451	245.7	68.9
1925	671,198	266.5	81.3
1926	692,754	237.2	94.3
1927	690,899	230.2	96.9
1928	660,550	213.9	99.7
1929	733,970	214.4	110.5
1930	471,504	164.7	92.4
1931	310,048	108.0	92.7
1932	184,918	71.5	83.5
1933	194,352	73.2	85.7
1934	189,256	80.5	75.9
1935	260,713	83.7	100.5
1936	303,422	97.1	100.9
1937	406,991	116.6	112.7
1938	259,395	96.8	86.5
1939	325,658	105.8	99.4
1940	452,164	117.2	124.6
1941	493,596	119.6	133.2
1942	208,911	121.7	55.4
1943	177,503	138.1	41.5
1944	178,522	144.8	39.8
1945	238,339	173.3	44.4
1946	477,018	225.5	68.2
1947	504,177	212.5	76.6
1948	709,434	228.1	100.4
1949	619,251	203.2	98.4
1950	900,339	227.6	127.7
1951	1,135,036	329.6	111.2
1952	1,065,785	262.7	131.0
1953	983,614	232.8	136.5
1954	899,176	224.3	129.5
1955	1,093,765	256.7	137.7
1956	1,146,603	269.2	137.6
1957	1,085,551	277.8	126.2
1958	1,025,065	252.6	131.1
1959	1,235,205	259.2	153.9
1960	1,127,738	266.1	136.8