

Problems of Trade Indices for Latin America

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SPECIAL EFFORTS to produce and to maintain currently good indices of the quantum and unit value of trade would be of great practical importance for those Latin American countries whose exports are not dominated by a single commodity, because knowledge of changes in the quantum and unit value of trade is of even more importance in studying Latin American economic problems than it is in studying the problems of either the United States or Europe.¹ Knowledge of such changes is also of importance to those Latin American countries—such as Venezuela, Cuba, and El Salvador—whose exports are dominated largely by a single commodity, but for them studies of the commodity terms of trade for their principal exports are probably of greater usefulness than indices of the average price and average quantity of total exports and imports.

Importance of Trade Index Numbers in Latin America

Ratio of exports to money supply

Trade is a more important determinant of the level of economic activity in Latin America than it is in the United States or in Europe. When ratios of exports to national income in Latin America and in the United States and Europe are compared, the differences are found to be small (Table 1). But when ratios of exports to money supply are compared, the Latin American ratios—with the exception of that for Brazil—are found to be considerably above the ratios for the United States and the European countries (Table 2).²

If the central bank of a country does not attempt to offset the monetary effects of foreign transactions, exports increase the money supply

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² The data are necessarily limited to those countries for which satisfactory trade and money supply data are available in national currency. The ratios are based on data from International Monetary Fund, *International Financial Statistics*.

TABLE 1. RATIO OF EXPORTS TO NATIONAL INCOME¹

Latin America	Ratio	U.S. and Europe	Ratio
Mexico	13	United States	4
Colombia	14	Germany	11
Peru	22	France	14
Dominican Republic	37	United Kingdom	20
Cuba	39	Ireland	27
		Netherlands	35

¹ Based on data for various years, 1946 to 1950.

by an amount equal to or greater than the value of the exports. The exporter directly or indirectly sells his proceeds to the central bank and receives an equivalent amount in national currency, thus increasing the money supply. The funds received by the exporter, however, are in the form of currency or central bank deposits, either of which constitutes reserve money for the commercial banking system. Consequently, the export not only brings about an increase in the money

TABLE 2. RATIO OF EXPORTS TO MONEY SUPPLY, 1938 AND 1950

Latin America	1938	1950	U.S. and Europe	1938	1950
Brazil	45	35	United States	10	9
Colombia	102	80	France	16	34
Costa Rica	111	95	Ireland	18	23
Ecuador	93	93	Italy	26	30
El Salvador	112	116	Netherlands	42	76
Guatemala	127	105	Norway	53	40
Honduras	201	196	Portugal	19	21
Mexico	88	67	Sweden	63	68
Peru	122	128	Switzerland	28	36
Venezuela	194	247	Turkey	40	36
			United Kingdom	34	43
Unweighted average..	120	116	Unweighted average..	32	38

supply equal to the export, but it increases the ability of the commercial banking system further to increase the money supply through an expansion of its assets and liabilities. Imports have the opposite effect³ since the importer surrenders national currency to the central bank for the purchase of exchange, reducing the money supply by the amount of the import and reducing the total of currency or central bank deposits available to serve as reserves for the commercial banks. Through this channel as well as others, exports and imports affect the money supply and, through the money supply, affect economic events.

³ While the effects of import transactions are opposite to those of exports, they are of equal magnitude only in this aggregative sense. See below.

From the fact that the ratio of exports to money supply is higher in Latin America than in Europe while the ratio of exports to national income is not especially different in the two areas, the conclusion can be derived that the ratio of national income to money supply (i.e., the income velocity of money) is relatively high in Latin America. This conclusion was indeed to be expected for a number of reasons. Money is one of the forms in which individuals hold wealth, and in underdeveloped countries the ratio of wealth to income is low. In those countries, the distribution of wealth is more unequal than in developed countries, and preferences for money as a form in which to hold wealth are probably greater for the poor than for the rich. In some of the Latin American countries, moreover, the long-continued inflation must have reduced people's preferences for money as a means of holding wealth.

A relatively large ratio of trade to money supply and a relatively high income velocity of money mean, in combination, that the likelihood of changes in the money supply arising from shifts in trade are greater in Latin America than in Europe, and that the repercussions of any such changes upon the economy are greater. Hence, trade is a more important determinant of economic activity in Latin America, and the analysis of changes in trade in terms of changes in quantity and changes in average price is especially important.

Variation of exports

The exports of Latin American countries are not only larger relative to their money economies than are the exports of the United States and Europe, but they are more subject to change. For example, during the U.S. recession of 1938, the value of exports of 10 Latin American countries dropped 11 per cent below the 1937 level, while that of 11 European countries fell by only 5 per cent. In 1939, the value of Latin American exports was 8 per cent, and that of the European countries 4 per cent, below the 1937 level.⁴

The fact that the variation in the total value of exports can be larger in Latin America constitutes the second reason why trade indices are of more importance to the study of Latin American problems than they are to the study of economic problems in other coun-

⁴ The figures are based on unweighted averages of indices of national currency export data for all those countries in each group that had no change, or no important change, in their exchange rates during the three years, 1937-39. For Latin America the 10 countries covered are Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Uruguay, and Venezuela; for Europe, the 11 countries are Belgium, Denmark, Ireland, Finland, Italy, the Netherlands, Norway, Portugal, Sweden, Switzerland, and the United Kingdom.

tries. The larger the changes in a country's exports, the more important are fluctuations in trade as sources and focal points of its economic problems.

Relative changes of quantity and price

Not only are the exports of Latin American countries larger relative to their money economies and more subject to changes in value than are those of European countries, but the differences in the behavior of the quantity and the average price of exports, relative to each other, are also greater in Latin America than in Europe. The purpose of trade index numbers is to provide measurements whereby the effects upon the value of trade of changes in quantities and of changes in average prices can be distinguished. The importance of making this distinction is clearly greater, the wider the variations in quantity and in average price, whether from month to month, from year to year, or over longer periods of time. Latin American exports are largely foods and other raw materials. For all Latin American countries, changes from year to year in average export prices tend to be large relative to the average change in quantity of exports; for those countries whose exports are agricultural products, changes in quantities from month to month also tend to be large relative to changes in average prices.

The tendency for average prices to vary more than average quantities from year to year, and for average quantities to vary more than average prices from month to month, means that both over very short periods and over longer periods the variation of average quantities relative to average prices is greater in Latin America than in Europe. The extent of the difference on this account is indicated by the ratio of the index of quantum to the index of unit value for the few countries for which these indices can be calculated (Table 3).

In 1938, a depression year in the United States, the prices of Latin American raw materials fell, and their quantities exported remained relatively stable; hence the 1938 ratios for Latin America rose. In that year, the prices of Europe's industrial products remained relatively stable and the quantities of its exports fell; the European ratios therefore declined. In 1950, a boom year in the United States, the behavior of the Latin American and European ratios was reversed. In both years, however, the Latin American ratios tended to change more than those for Europe.

Only one Latin American country, Brazil, has monthly indices of quantum and unit value which make it possible to estimate how

much more important seasonal changes in the ratio of quantum to unit value are in Latin America than in Europe. The seasonal changes in the ratio for Brazil are clearly much greater than those in the ratios for European countries.

TABLE 3. RATIO OF INDEX OF QUANTUM OF EXPORTS TO INDEX OF UNIT VALUE OF EXPORTS

	1938	1939	1950	2nd quarter 1950	3rd quarter 1950
	(1937 = 100)		(1949 = 100)	(1950 = 100)	
Latin America					
Brazil	148	151	60	86	125
Ecuador ¹	115	85	79
Nicaragua ¹	125	133	66
Europe					
United Kingdom ...	86	82	100	96	98
Belgium	85	106	119	98	82
Italy	97	100	131	86	94
Switzerland	119	88	98

¹ The price indices for Ecuador for 1937, 1938, and 1939, the quantum indices for Ecuador for all years, and the quantum and unit value indices for Nicaragua were computed by the International Monetary Fund.

Quality of trade data and other data

For two further reasons that are mainly statistical, trade indices are of greater importance to Latin American countries than to many other countries. The basic data of Latin American trade statistics are probably less reliable than those of the United States and most European countries. The prevalence of multiple currencies, the importance of foreign-owned companies, and numerous special problems, such as those of petroleum and bananas, make it difficult for Latin American countries to produce statistics on the value of trade that are as accurate as those of some other countries. Trade indices provide a means of testing the accuracy of the value statistics, and a means by which some of the important totals can sometimes be improved by substituting data from other sources for those parts that are found to be in error. If the effects of changes attributable to quantity and those attributable to unit value could be distinguished, it is likely that most of the principal problems would be definitely associated with the unit value index and a more careful study would then be possible of the sources of error and of their effects upon the totals.

Lastly, trade indices are of greater importance for Latin America than elsewhere, because for Latin America so few other economic statistics are available. Of the twenty Latin American countries, only two have national income data extending through 1950, only two have

employment indices through 1950, only four have wage indices through 1950, only five have industrial production indices through 1950, and only ten have wholesale price indices through 1950. While Latin America is largely agricultural, only one of the twenty countries has an agricultural production index through 1950. The estimation of national income and the measurement of employment, wages, production, and wholesale prices require the assembly of a large volume of current data. To be of maximum usefulness, current figures would have to be fitted into time series extending some years back, and this would require the more difficult or perhaps impossible assembly of very large amounts of data for the past. The data for the construction of trade indices, however, are at hand for the current period and for many years in the past. The data with which they may be checked, and where necessary corrected, are at hand in the trade statistics of partner countries. Therefore the calculation of trade indices is a more feasible short-run project than the calculation of many other statistical series.

Methodology Appropriate to Latin America

While trade indices are of greater importance for Latin America than for Europe in a study of economic problems, the existing methodology for their construction is largely European and North American. The principal purpose of this paper is to examine this methodology with a view to determining whether it is in all respects suitable for use in Latin America.

Greater importance of export indices

In European countries import indices are considered to be at least as important as export indices, or even more important. In Latin America, however, export indices are certainly the more important; in choosing an appropriate methodology and allocating effort between export and import indices, this fact should be taken into account.

For measuring movements in the terms of trade of a Latin American country, a good export index is more important than a good import index. Owing to the generally high degree of export specialization in a Latin American country, the greater variability of raw material prices compared with industrial prices, and the lack of any necessary relationship between the country's various export prices, the average prices of a Latin American country's exports can be determined only by a measurement specifically designed for that country. Sufficient information about the average prices of a Latin American country's imports can often be obtained from the export indices of the

United States and the United Kingdom or from the import indices of a number of other countries.

For a study of economic problems in Latin America, the measurement of the terms of trade, however, is not so important as the measurement of changes in the quantity and average price of exports. The economic consequences of a given change in export prices or in export quantities are greater than the consequences of a similar change in import prices or import quantities. A change in export prices immediately affects profits; therefore, its effects upon investment, its reactions upon the banking system, and its reactions upon the activity of the entire domestic economy are great. Profits are marginal incomes received by relatively few people. Hence a small change in export prices can produce a large change in the incomes of profits receivers, importantly affecting their behavior and necessitating changes in wage rates or other adjustments in the economy to redistribute the gain or loss through the community. A change in import prices, on the other hand, primarily affects real wages and its repercussions upon the activity of the economy are much less. Imports are consumed by a relatively large number of people, each of whom pays the full price of such imports as he consumes. A small change in import prices cannot produce a large change in the expenditure or consumption of import consumers which would importantly affect their behavior and, since the gain or loss resulting from changes in import prices is in the first instance widespread, no repercussionary changes are necessary to redistribute it.

For these reasons, the comments on methodology made below are limited to export indices, since it is to them that the Latin American countries should give most of their attention.

The Laspeyres and Paasche formulas

Most of the methodological problems of index numbers are problems of weights. Quantum indices of trade are weighted with prices, and average price indices are weighted with quantities. Every period of time provides a pattern of price and quantity weights that may be used for this purpose, and many index number problems arise from the choice of the period from which the weights shall be selected. Since the weight pattern is likely to be different for each period, two problems arise. First, if the same period is used for the pattern of price weights and for the pattern of quantity weights, the product of the quantum and unit value indices will differ from the index of the value of trade. Second, any period chosen for the weights is selected, presumably, because of its representativeness, but with the passage of time it must become less representative.

These problems are common to all index numbers, but the peculiarity and special advantage of trade index numbers are that all of the weight patterns and all of the corresponding value aggregates are known. A wholesale price index is made with quantity weights determined at one period of time by a special survey. Corresponding data on quantities are not available for each period, and the value aggregate of all goods sold at wholesale is not computed—and if it were computed its meaning would be unclear. Hence a wholesale price index must usually be a Laspeyres index, i.e., an index with base year weights; the effect upon it of the period selected for the weight pattern is not immediately apparent; and the corresponding indices of quantities sold and of the value of all sales are not available to raise the problem of the relationship between the product of the price and quantity index and the value index. The materials available for trade indices include all these elements and the meaning of the total value aggregate (the value of exports or imports) is not only clear, but is one of the most important of economic data. Trade index numbers must therefore provide a solution for problems that remain out of sight and unsolved in most systems of index numbers.

Most European countries resolve the first of these problems by calculating the quantum index with the Laspeyres formula and the unit value index with the Paasche formula, i.e., as an index with current year weights. Because the product of the Laspeyres quantum index and the Paasche unit value index necessarily equals the index of the value of trade, this procedure has the additional advantage (which for European countries is appreciable) that the unit value index can be derived from the quantum index and the index of the value of trade. The second of the problems is resolved by shifting the base year at five- or ten-year intervals and by linking the new series to the old.

Use of these solutions implies that the weights do not behave in such a way as to cause large differences between Paasche and Laspeyres indices or large differences between Laspeyres indices calculated with the weights of one period and those calculated with the weights of a period a year or two earlier or later. If the behavior of the weights were such as to cause large differences between Paasche and Laspeyres indices, the solution to the first problem would result in a price index whose movements from year to year would have very little relationship to the true price movement from year to year. The Paasche price index measures for each year the price of the collection of goods exported in that year compared with the base year. If the collection changes from year to year, the index can rise from one year to the next even though all individual prices fall. The index would there-

fore be valueless. If the behavior of the weights were such as to cause large differences between Laspeyres quantity indices calculated with the weights of one period and those calculated with the weights of a period a year or two earlier or later, the use of the second solution would result in quantity indices whose calculations could not be defended against the significantly different calculations that other base year choices would have provided.

Whether differences between Laspeyres and Paasche indices (and between Laspeyres indices calculated with different base periods) will be large or small depends upon the extent of the correlation between changes in the individual p 's and q 's between the base and current year (or between the Laspeyres base years) and upon the variances of the p 's and q 's. If there is no correlation—either positive or negative—between the p 's and q 's, there cannot be any differences between these calculations. That is, if there is no systematic relationship between the changes in the prices of the various commodities and the changes in the quantities of those commodities exported, then no bias can be introduced by using the weights of the base year on the one hand, or the weights of the current year on the other. In that case, the extent to which either selection weights some commodities whose quantity has increased more than the average with prices that have increased more than the average is exactly offset by the weighting of other commodities whose quantity has increased more than the average with prices that have increased less than the average. If the p 's and q 's are correlated either positively or negatively, this offset will not take place and the Paasche and Laspeyres indices will differ. There are, however, two situations in which the failure of the offset will not matter. If the changes in prices and the changes in quantities of the commodities are related in such a way that the points when plotted on a scatter diagram would be parallel to either the horizontal or the vertical axis, there cannot be any difference between the Paasche and Laspeyres calculations. That is, if the percentage changes in all the q 's have been more or less equal, so that the pattern of the scatter is parallel to one axis of the diagram, the average of the q 's will be the same however they are weighted; and if the percentage changes in all the p 's have been more or less equal, so that the pattern of the scatter is parallel to the other axis of the diagram, the weights available for the q 's will be the same however they are selected.

Hence, whether the problems of weights in trade index numbers are more serious in Latin America than in Europe depends upon whether the correlation of the p 's and q 's and the variance of the p 's and q 's are greater.

No attempt has been made to measure and compare the correlation of the p 's and q 's in Europe and Latin America, but it seems safe to assert that the correlation would be greater for Latin American exports than for European exports owing to the small number of commodities included in the exports of any Latin American country. For every Latin American country the two largest exports account for a substantial proportion of its trade, and the p 's and q 's of any two commodities are necessarily perfectly correlated.

There are also reasons to expect that the variance of the p 's is greater for the exports of Latin American countries than for those of European countries. European exports are the product of an industrial price and wage system; and, owing to their diversification, to the size of the home market for most export goods, and to the shiftability of labor and resources from the production of one export good to the production of another or to the production of goods for home consumption, changes in world demand for individual European exports work themselves out mostly in changes in quantities while relative prices remain tied to the common price and wage system. Latin American exports, on the other hand, are few in number for any one country; the uses to which they are put in consuming countries are highly specialized; and production or home consumption cannot easily be increased or decreased by amounts that are large, compared with exports. Changes in world demand for individual Latin American exports therefore produce large changes in prices which need have no relation to the prices of the other export commodities of the country.

It is difficult to obtain data for a comparison between the behavior of the p 's and q 's of European and of Latin American countries; the trade statistics of Italy and Switzerland, and of Brazil and Ecuador, however, are available in a form that permits comparison between these two samples of Europe and of Latin America. The p 's, q 's, and v 's for each of the important exports of Brazil and Ecuador, and for several important classes of manufactured exports for Italy and Switzerland,⁵ have been expressed as index numbers, with 1938 as base for the years 1948, 1949, and 1950; and the data for 1949 and 1950 have also been expressed as index numbers, with the preceding year as the base. The standard deviations of the p 's, q 's, and v 's for each country for each year were calculated and adjusted by the ratio $\frac{\sigma}{\text{average}} \times 100$ (Table 4) to eliminate the differences arising from the

⁵ For Brazil, the important exports are coffee, cotton, cacao, leather, soft wood, carnauba wax, and castor beans; for Ecuador, rice, cacao, coffee, straw hats, ivory nuts, and woods; for Italy, textiles, chemicals, machinery other than electric, electric machines, and vehicles; for Switzerland, clocks, instruments, silk fabrics, cotton fabrics, chemicals, and machinery.

different orders of magnitude of the data (primarily to eliminate the effects of different degrees of inflation on the p 's and v 's).

If these countries are representative of their areas and if no bias has been introduced by the selection of these years, Table 4 would seem to demonstrate that in Latin America the variance of the p 's is twice (or more than twice) that in Europe. Whether or not the variance of the p 's in Europe is sufficient to cause serious weight prob-

TABLE 4. STANDARD DEVIATIONS OF V 'S, Q 'S, AND P 'S ADJUSTED BY $\frac{\sigma}{\text{AVERAGE}} \times 100$

Latin America	Value	Quantity	Price	Europe	Value	Quantity	Price
	(1938=100)				(1938=100)		
Ecuador				Italy			
1948	66	46	34	1948	55	55	18
1949	43	45	39	1949	69	56	19
1950	40	31	64	1950	56	49	17
Brazil				Switzerland			
1948	65	50	42	1948	27	43	22
1949	24	31	24	1949	26	34	23
1950	58	50	41	1950	27	39	29
Unweighted average .	49±15	42±8	41±12	Unweighted average .	43±17	46±8	21±10
Ecuador				Italy			
	(1948=100)				(1948=100)		
1949	34	36	29	1949	21	9	14
	(1949=100)				(1949=100)		
1950	42	25	29	1950	12	21	6
Brazil				Switzerland			
	(1948=100)				(1948=100)		
1949	29	38	24	1949	12	20	14
	(1949=100)				(1949=100)		
1950	26	21	30	1950	11	13	11
Unweighted average .	33	30	28	Unweighted average .	14	16	9

lems in European trade indices, their variance in Latin America is so much greater that Latin American methodology must make allowance for it.

Given the greater likelihood of correlation between the p 's and q 's and the probability of greater variance of the p 's, the methodology of trade index number construction suitable for Latin America is in several respects different from that used in Europe.

First, Paasche indices of prices ought not to be used since, for the reasons described above, their movements from year to year can be

very different from the movements of prices from year to year. That this danger is real is evidenced by the Paasche price index of the Central Bank of Ecuador. Between 1944 and 1945, the prices of all items, except tropical wood, included in the index rose, but the index fell. There is no special value in having indices of quantum and of price whose product is equal to the value of trade if the indices cannot also be good measures of quantum and of price. Furthermore, for the Latin American countries there is no appreciable advantage in using the Paasche formula in order to be able to derive the unit value index from the quantum index and the value of trade index. The number of commodities involved is so few that very little economy is thereby achieved. Moreover, so many of the problems of trade statistics lie in declared values that the calculation, tabulation, and study of unit values in the form from which a Laspeyres unit value index could be made should be a regular practice in all countries. Any problems that lie in the values, and hence in the unit values, are in no way avoided when the Paasche index of unit values is derived instead of calculated.

Second, other index number formulas that involve the Paasche system should also be avoided. In particular the so-called Fisher "Ideal" formula, which is the geometric average of the Laspeyres and Paasche formulas, should not be used. The difficulties of correlation of the p 's and q 's and of the variance of the p 's that produce the differences between Paasche and Laspeyres calculations are in no way solved by making a geometric average.

Third, the Latin American countries should take advantage of the fact that the numbers of their export commodities are small, to calculate backward a few years and continue currently several Laspeyres indices of quantity and unit value. As noted above, the difference between Laspeyres indices calculated on one base and those calculated on a different base a year or two earlier or later can be large in Latin America. No method of averaging or linking can indicate satisfactorily how the prices of a country's exports have changed relative to its import prices or to world prices with respect to two very different patterns of exports. It is useful to know the answer separately with respect to the pattern of trade of every year in which the pattern was greatly different.

Fourth, since the numbers of export commodities of Latin American countries are small, those countries should approach the problem of the terms of trade differently from the way in which it is approached in Europe. For each of the major exports of a country, its commodity terms of trade—that is, the export price of each important export relative to U.S. prices or to some other measure—can be calculated. These

are of great value in themselves. When all, or a sufficient number, have been calculated, they can then be combined into an index of the terms of trade. This method would amount to postponing the index number problem until a later stage of the calculation, with the advantage of being better able to see the effects of any particular solution to the index number problem.

Coverage

A second major problem of trade indices is that of coverage. This problem arises from the facts that (1) some of the items that belong to the total which the indices are intended to measure cannot be included in the calculation of the index because they cannot be quantified separately in terms of p 's and q 's, because they are too numerous to make the calculations practical or for other reasons, and that (2) the ratio of the value of these omitted items to the total value of trade changes from period to period. If the importance of the value of the omitted items compared with the total value of exports or imports changes, and if both the Laspeyres quantum and the Paasche price index are independently calculated, it will be evident that one or both of the indices are in error, for the product of the two indices will be equal to the index of the value of the sample but not to the index of the total value of trade. If the quantity index is calculated with the Laspeyres formula, and the Paasche price index is derived from the ratio of the value of the trade index to the quantity index, the two indices will be wrong to a greater degree, for this method will attribute to changes in the average price of the uncovered portion responsibility for the entire difference between the change in the value of the covered and uncovered parts of trade.

This methodology is unsuited to Latin America. In Latin American countries, the variance of the p 's is large and the number of commodities is small. Consequently, it cannot be assumed that the prices of items omitted from the index have moved like the average of the prices of all the items included in the index, or like the prices of any subgroup included in the index. The great changes in coffee and cotton prices in recent years should, by themselves, provide sufficient evidence that a weighted average of the prices of items included in Brazil's export index could not provide a correct measure of the prices of items omitted from the index.

The solution to this problem for the export indices of Latin American countries follows from the facts that exports are few in number and that almost all Latin American export commodities can be quanti-

fied in terms of p and q .⁶ Consequently, Latin American countries ought not to have an important coverage problem. The effort and expenditure that would be involved in extending the coverage of export indices to include essentially all items would not be large, and the risk of error in using indices based on less than total coverage—in their original form or after adjustment for coverage on the assumption that the prices of uncovered items move like the average of the covered items—can be very large indeed.

⁶Certain commodities, like bananas and petroleum, cannot be meaningfully quantified in terms of price from the entries in trade statistics. But this is a different problem since the difficulty here is that the prices entered in trade statistics for these commodities are faulty rather than that the nature of the commodity makes it difficult to know what average price has been entered.