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# I

## AIMS AND METHODS

### INTRODUCTION

This preliminary report on the National Bureau's International Price Comparison Study presents a description of our aims and methods, together with some tentative results for iron and steel products. These will serve to illustrate our procedures and the types of information we seek rather than to set forth any firm conclusions, even for this particular group of products.

The overall purpose of the International Price Comparison Study is to develop improved methods for measuring changes in the price competitiveness of a variegated industrial economy in world trade in manufactured goods. An effort is made to apply these methods to trade in machinery, transport equipment, and other metal manufactures for the period 1953-64.

The main features of the methods employed are (1) actual prices or price offers are used rather than unit values derived from trade statistics; (2) world trade weights are employed rather than the trade weights of the United States or some other single country; (3) country-to-country price relations for different points in time are used to aid in the establishment of intertemporal movements in price competitiveness; and (4) price collection in terms of detailed pre-selected specifications is abandoned in favor of the collection of pairs of prices for specifications of the respondents' own choosing, each pair providing either a time-to-time or country-to-country price relative.

We hope that the outcome of this investigation will encourage government and international agencies to pursue the measurement of international price relations on a more comprehensive basis. Such measurements would add to our understanding of trade patterns and of changes in the balance of payments of industrial coun-

tries. Existing data cannot be relied upon to provide a satisfactory basis for gauging changes in world price relations.

#### THE NEED FOR A NEW MEASURE

The study was partly inspired by the balance-of-payments difficulties experienced by the United States in recent years. One explanation of these problems has been that the competitiveness of the United States economy has declined; that there has been a tendency for the United States to "price itself out of world markets."

While there has been disagreement over the causes of U.S. balance-of-payments deficits, few would deny that relative price movements should be examined whenever balance-of-payment problems are analyzed. Two measures of price change are usually drawn upon for the assessment of price competitiveness—foreign trade unit value indexes from customs data, and wholesale and consumer price indexes for the domestic economy.

The unit values are values per unit of quantity within detailed export or import classifications. However, since the classifications must in total cover every item of trade, they cannot be narrowly specified unless their number is increased far beyond any practical limit. As a result of the lack of close specification, there is never any certainty that a change in unit value represents a change in price; the unit value of a trade classification can change, even though all prices are constant, if there is a shift from one quality or type of item to another.

A few years ago, for example, foreign pressures to increase local production of components led to the reporting in export declarations of motor vehicles which contained smaller and smaller fractions of a complete car—some as little as 15 to 20 per cent by value.<sup>1</sup> The unit value series thus was biased downward from the standpoint of providing a measure of price movements. This problem is not too serious for many crude or agricultural commodities, but exact specification is extremely important for finished manufactures, which have accounted for more than half of the value of

<sup>1</sup> Cf. *The Price Statistics of the Federal Government*, New York, National Bureau of Economic Research, 1961, pp. 82–83. The Stigler Committee, which compiled this report, was established by the National Bureau of Economic Research at the request of the United States Bureau of the Budget.

United States exports for several decades and, in the last few years, one-third of imports.

The existing export and import unit value indexes suffer not only from the ambiguity of many of these unit value series but also from the fact that for many manufactured products quantities are not reported at all and unit values are therefore simply unavailable.<sup>2</sup> These faults, moreover, affect the corresponding quantity indexes, imparting a bias opposite to that which may characterize the unit value series.<sup>3</sup>

Even if the unit value indexes accurately reflected the price movements of actual exports and imports, they would still have drawbacks as indicators of price competitiveness in international trade. One disadvantage is that the weights differ from one country to another, owing to the differing composition of export trade; therefore it is not possible to say whether an apparent change in price relations results from differences in price movements or from differences in the weighting of identical price movements. Second, commodities which encounter severe foreign competition tend to disappear from a country's exports or, in the case of an index with changing weights, to undergo a lowering of their weights. Even if constant weights are used in the index of export unit values (or export prices), the worse the competitive position of a country in a commodity, the lower the weight of that commodity in that country's index.

Commodities produced domestically but not exported are omitted from export price indexes. Yet, as is pointed out below, these may have an important bearing on competitive strength. A fall in the domestic price for them might herald their entrance into a country's exports, or might enable them to replace foreign products previously imported.

These deficiencies have often brought balance-of-payments ana-

<sup>2</sup> In recent years from 23 to 35 per cent of finished manufactured imports and from 20 to 25 per cent of finished manufactured exports were covered in unit value index calculations. Department of Commerce, *Overseas Business Reports*, OBR 64-43, May 1964, p. 2.

<sup>3</sup> For a fuller discussion of unit value indexes, see Robert E. Lipsey, *Price and Quantity Trends in the Foreign Trade of the United States*, Princeton University Press for NBER, 1963, Chapter 4.

lysts to turn to comparisons of the movements of domestic prices—both wholesale and consumer. Other things equal, the consumer price indexes are less relevant to international competition than the wholesale price indexes; they include service items,<sup>4</sup> few of which can be traded, and refer to the retail level of distribution.

Both types of indexes are usually constructed from prices for carefully specified commodities and are comparatively free of the problems of inadequate specification that raise doubt regarding unit value indexes. However, they suffer from a different set of deficiencies in respect to international comparisons of price competitiveness. The indexes of different countries vary widely in coverage, method of construction, and weighting, and reported prices include many list or other published figures which may not reflect transactions prices.<sup>5</sup> Most important of all, export prices may diverge from domestic prices for considerable periods. Several apparent examples of variance among steel prices appear in Table 2, below. Other cases, covering a wider variety of industries, can be found even in the published data for Germany and Japan.<sup>6</sup> Nor can the direction of the differential movements of export and domestic prices be inferred simply from domestic economic conditions. A booming domestic economy may in some circumstances lead a domestic industry to raise its home prices at times when keen international competition may constrain it from increasing export prices. In other circumstances, especially where export trade is marginal, export prices may rise as home prices are kept constant or limited to smaller increases. Transportation costs; government interventions, such as tariffs and rebates on exports; and general

<sup>4</sup> Services account for over one-third of the expenditure weights in the Bureau of Labor Statistics Consumer Price Index, for example. See U.S. Bureau of the Census, *Statistical Abstract of the U.S. 1964*, Washington, 1964, p. 358. Indexes of consumer commodity prices (excluding services) are available for the U.S. and for some, but not all, other countries.

<sup>5</sup> *Price Statistics of the Federal Government*, pp. 69-71, 373-458.

<sup>6</sup> For Germany, see *National Institute Economic Review*, February 1964, p. 48. As regards Japan, see, for example, the differences between "wire rod of ordinary steel" and "wire rod of ordinary steel (for export)," between "sheets" and "sheets (for export)," and similar differences for "medium steel plates," "heavy thick steel plates," and "tin plates" in the Japanese wholesale price data. See Bank of Japan, *Wholesale Price Index Annual*.

market imperfections also make it possible for home prices to move differently from export prices.

Of course, if export unit value indexes were consistently in agreement with the wholesale price indexes, we could set aside these objections as valid in principle but of little quantitative significance. However, the two sets of data sometimes diverge just at the times when it is most important to know what is happening to relative prices. For example, between 1959 and 1961, the U.S. wholesale price index, reweighted to reflect the composition of exports, fell slightly, while the total export unit value index rose by 3 per cent. Within manufactures the reweighted wholesale price index fell by 0.2 per cent, while the export unit value index for finished manufactures increased by 5 per cent and that for finished manufactures and semimanufactures rose by 4 per cent.<sup>7</sup>

#### NEW PRICE INDEXES FOR INTERNATIONALLY TRADED GOODS

The deficiencies of the indexes we have been considering suggest a number of specifications for a more appropriate price index for internationally traded goods: (1) It should be based on actual prices or price offers, not unit values. (2) For goods which the country actually exports, the prices should refer to export rather than domestic transactions. (3) The indexes for different countries should refer to the same set of goods. (This requires that domestic prices should be taken for goods which a particular country does not export.) Our new price indexes for internationally traded goods, which we shall refer to as *international price indexes*, are designed to meet these requirements.

The basic point of departure for these indexes is that the universe of prices considered relevant to an evaluation of price competitiveness is not limited to export and import prices. For an industrial country that produces the whole gamut of manufactures, such as the U.S., the U.K., Germany, or Japan, the relevant universe consists of prices of all those manufactured goods that enter world trade. For example, changes in the U.S. prices of *all* of these goods—

<sup>7</sup> Hal B. Lary, *Problems of the United States as World Trader and Banker*, New York, NBER, 1963, pp. 62-63.

whether they are imported, exported, or even produced but not imported or exported—affect the U.S. competitive position. If the U.S. price of a good neither imported nor exported rises sufficiently relative to foreign prices, the U.S. will begin to import the good; if the relative price falls enough, the product will be exported. This last class of goods might be small under free trade, but it may be substantial in a world of tariff and other trade barriers.

The selection of this universe of prices also leads to the choice of a weighting system based on the relative importance of commodities in world trade.

It might be argued that the logic underlying the use of world trade weights leads ultimately to the use of world production or consumption as weights. After all, the potential market for the producers of a given good in a given country is not merely the volume of that good which is internationally traded, but includes all those markets currently being supplied by domestic producers. However, the use of world production or consumption weights as a guide to price competitiveness has its drawbacks. Chief among these is that the relative importance of goods is often substantially different in world trade and in world production. Some goods—because they are in universal demand, homogeneous, valuable in relation to their bulk or available only from one or a few sources—move more extensively in world trade than others. If, as a practical matter, we expect these differences in the “tradability” of goods to change only slowly, world trade weights will yield a more sensitive and more reliable indicator of price competitiveness in international trade than world consumption or production. Another way of putting nearly the same thing is to say that the elasticities of substitution tend to be higher, as between different country sources of supply, for goods already traded internationally than for goods not traded.

On a more practical level, it may be pointed out that at present there are no world consumption or production data sufficiently detailed for weighting fairly narrow commodity groups. Accordingly, the weights for our new indexes have been derived from world trade data. In principle, a price is included in the index for each country for every manufactured good that enters world trade—an

export price if the country exports the good, a domestic price if it does not. Such an international price index will enable us to trace changes in the price competitiveness of a given country through comparisons with similar indexes for the other major industrial countries.

We use the term *index of price competitiveness* to describe the index of change in a country's prices relative to those of its competitors. The index can be derived in two different ways.

One is by dividing the international price index for one country (computed with world trade weights) by the corresponding index for another country. Dividing the U.K. international price index by that of the U.S., for example, yields an index of relative price competitiveness for the two countries. A rise in this index indicates that U.K. prices have risen relative to U.S. prices and, therefore, that U.S. price competitiveness has improved while that of the U.K. has declined.<sup>8</sup>

The other method uses a country-to-country comparison of price levels of internationally traded goods at a given moment in time.<sup>9</sup> Changes over time in these place-to-place indexes measure, in the same manner as the comparison of time series indexes, changes in price competitiveness, and the index of price competitiveness may be derived by dividing the country-to-country international price relative for one year by the corresponding figure for the preceding year. If, for each individual specification on which we had place-to-place comparisons, we also had a set of time-to-time comparisons covering the same countries and years, the place-to-place and time-to-time data would yield identical indexes of price competitiveness.<sup>10</sup> In practice, of course, the data do not match perfectly. How-

<sup>8</sup> In examining the tables in Section III, the reader should bear in mind that we have consistently placed the U.S. in the denominator in all calculations of the index of price competitiveness. A rise in the index therefore always indicates an improvement in price competitiveness for the U.S. relative to the country in the numerator.

<sup>9</sup> Such country-to-country relatives measure the level of a country's price competitiveness and should explain, to some degree, the current pattern of trade in individual categories of products.

<sup>10</sup> If we are comparing two countries, A and B, in two years, 0 and 1, the place-to-place comparisons for a single commodity can be described as

$$\frac{P_{B0}}{P_{A0}} \text{ and } \frac{P_{B1}}{P_{A1}}$$

ever, as we approach adequate coverage in both types of comparison, the two indexes of price competitiveness should converge.

For reasons that will be elaborated, only the first approach is feasible in some product areas and only the second in others. In addition, each provides some information not given by the other. The temporal changes in the country-to-country price relatives do not tell to what degree the observed changes are attributable to price movements in one country or the other. The differential movements in the time-to-time indexes, on the other hand, tell us nothing about the absolute spread of prices between the two countries. Knowledge about absolute price differences may lead to further insights into nonprice aspects of competition, such as financing, servicing, and the like. Both approaches are being followed in the International Price Comparison Study.

For some commodities, only time-to-time data can be obtained. One such case is that in which two countries produce machines which compete with each other but differ greatly in design or other characteristics. For other commodity groups—notably those sold on a “turn-key” basis (i.e., installed and ready to operate), such as large electrical generating equipment and communications systems—it is easier to obtain place-to-place than time-to-time price comparisons. Time-to-time price comparisons for such intricate, large, custom-made equipment are difficult because the specifications vary from one job to another.

In other indexes, this problem is often met by pricing major components of the equipment rather than the finished product itself. While the same technique can be used for our indexes relating to internationally traded goods, an index of price competi-

and the time comparisons as

$$\frac{P_{B1}}{P_{B0}} \text{ and } \frac{P_{A1}}{P_{A0}}$$

The measure of the change in price competitiveness from place-to-place data is then

$$\frac{P_{B1}}{P_{A1}} \text{ — } \frac{P_{B0}}{P_{A0}}$$

and from time-to-time data

$$\frac{P_{B1}}{P_{B0}} \text{ — } \frac{P_{A1}}{P_{A0}}$$

Thus the two forms of the index of price competitiveness are identical. They can also be shown to be identical for groups of commodities.

tiveness can be computed directly owing to the circumstances under which this kind of equipment is purchased. Heavy electrical installations and communications systems are sometimes purchased by public authorities under a system of bidding in which both domestic and foreign bids are made public at the time the award is announced. These bids, and similar bids received by private entities, when they can be obtained, provide a good basis for direct price comparisons between firms in different countries.

It is our plan to compare, wherever possible, measures of change in competitiveness derived by one of these methods with measures derived from the other. This comparison will be significant as a test, of course, only in groups where the two types of data were derived from different sources.

Our place-to-place comparisons and indexes of price competitiveness are, in a way, parallel to the absolute and relative versions of the purchasing power parity concept. However, we have not sought to achieve a measure suitable for the calculation of equilibrium exchange rates, and our system of weighting (world trade weights) does not correspond with those usually discussed in connection with purchasing power parities.<sup>11</sup>

#### THE SUBSTANTIVE SCOPE OF THE STUDY

In view of the lack of any centrally collected and publicly available body of price data for internationally traded goods, it was necessary to start with a program of data collection. Ways had to be found to fit this potentially formidable task into the resources available for the study. One means of reducing the volume of field work was to limit the commodity coverage. Since the study was largely methodological in objective, it was thought desirable to put the proposed approach to the most rigorous test by including products that were likely to offer the greatest difficulty for the purpose at hand. Thus it was decided to study machinery and transport equipment. In order to cover relatively homogeneous products as well as custom-designed products, we included the whole range of manu-

<sup>11</sup> See "The Interpretation of the Index of Price Competitiveness" in Section II. For a recent discussion of purchasing power parity theory, see Bela Balassa, "The Purchasing Power Parity Doctrine," *Journal of Political Economy*, December 1964, pp. 584-596.

factured metal products, beginning with pig iron and its nonferrous equivalents.

The precise commodity coverage of the study may be set out in terms of the Standard International Trade Classification,<sup>12</sup> which has been used as a framework for organizing the data collection and constructing the index numbers:

<i>Division</i>		<i>Weight</i>
67	Iron and steel	13.2
68	Nonferrous metals	6.3
69	Manufactures of metals, n.e.s.	5.5
71	Machinery, other than electric	32.3
72	Electrical machinery	12.9
73	Transport equipment	23.0
Selected items from		
Section 8		6.7
Total		<u>100.0</u>

These products accounted for 48 per cent of total exports by the main industrial countries<sup>13</sup> in 1962, 46 per cent of total United States exports, and 64 and 68 per cent of the exports of products other than food and raw materials of the industrial countries and the United States, respectively. The final report of the study is expected to include indexes for all the two-digit SITC divisions included above, many of the three-digit groups contained in them, and possibly some of the more important four-digit subgroups.

An important technical feature of the study is the decision to abandon the usual practice of organizing the price collection effort around a set of product specifications selected in advance. In the area of machinery, which is the most important in our study, it would have been impossible in most commodity groups to select any specifications applicable to all or even to most sellers. Each firm buys or sells products with slightly different specifications, and it would not be sensible, even if much greater price collection re-

<sup>12</sup> United Nations, *Standard International Trade Classification, Revised*, Statistical Papers, Series M, No. 34, New York, 1961.

<sup>13</sup> EEC, EFTA, United States, Canada, and Japan. These countries accounted for 82 per cent of 1962 world exports in SITC Section 7, Divisions 67 and 68 (less Group 681), and Groups 691-695, 698, and 812 (UN, *Monthly Bulletin of Statistics*, March and April 1964), and we have taken them as providing a suitable approximation to world trade weights.

sources were available, to discard genuine information because it did not refer to a particular set of predetermined specifications.

Our solution to this problem was to place the burden of determining comparability on the respondent, asking him to select the most important items in each group about which he had knowledge and to provide comparable quotations either over time or between exporting countries. Ideally, we would wish to have both place-to-place and time-to-time comparisons for each individual commodity for all countries and all years. In practice, however, such complete comparisons are rarely possible. Even with a relatively simple commodity such as nails, we might find that a company bought one type of nail in 1953 and can compare U.S. and German prices for it, but bought a different type in 1957 and can compare the U.S. and German prices only for that type. A comparison of the U.S. and Japan might be possible only for a third type, and time-to-time price changes might be available only for a fourth. As was mentioned earlier, any unit of information is useful to us provided that it compares, for a precisely specified commodity, at least two countries' prices at one date or one country's prices for at least two dates. In addition, we required sufficient specification to make possible the assignment of each price relative to the appropriate four-digit SITC category.

The dates of reference for price quotations are mid-years 1953, 1957, and 1961 through 1964. It would have been preferable to construct the indexes for a longer period of time and for each year within the period; however, even these six years of data proved to be too much for many business firms, and it was felt that keeping the length of the period down and omitting some of the intervening years would improve the chances for getting the necessary cooperation.

The price index of internationally traded goods will be prepared not only for the U.S. but also for the U.K. and the European Economic Community. An effort will also be made to prepare such indexes for Germany, France, and Japan and possibly, in particular commodity groups, for some other countries. The weights used in the study are based on 1962 exports of industrial countries.<sup>14</sup> That

<sup>14</sup> See previous footnote.

year was chosen because it was the only one for which exports of the major industrial countries by the present four-digit Standard International Trade Classification (SITC) were available.

Although most of the results of the study will be based on this set of weights, it is expected that indexes using conventional export weights will also be calculated. These are important for the deflation of the value of exports and imports. For these indexes, as well as for indexes of price competitiveness, the collection of actual export and import prices should bring an improvement in quality. The whole set of comparative prices and price changes we collect can be weighted by the pattern of the export trade of the United States or any other country. We hope also to be able to experiment with some other weighting patterns.

#### SOURCES OF PRICE DATA

The comparative prices used in the study are being gathered from a variety of sources. Approximately 250 American companies that buy or sell in international markets were asked to supply information, and over 60 per cent actually furnished data. Almost all the companies were visited at least once by one of the authors, and many more often. Follow-up inquiries were often necessary to clarify the nature of the price data or to gather additional information necessary to assign an item to its proper four-digit SITC category. The amount of information provided by individual companies varied from as little as one price relative to literally hundreds. Respondents were assured that the information they provided would be kept confidential.

U.S. sellers of machinery and metal products were asked to provide their own export prices for our reference dates and to compare these prices with those charged by foreign subsidiaries, licensees, or competitors for identical or equivalent products. Companies involved in international markets through their purchasing activities were asked to compare offers from the U.S. and foreign countries for specific items of equipment or metals, and also to trace the prices of purchased machinery and metal products over a period of years.

Another source of prices was the U.S. government. Most of these data consist of formal bids by U.S. and foreign firms to supply the

government's needs for electrical equipment, aluminum and steel products, scientific equipment, and so on. They were collected, with a great deal of help from the Bureau of Labor Statistics, from government-owned utilities, the military services, and other federal agencies.

The third major body of data is from foreign sources. Arrangements were made with several foreign research institutions for the collection of data in their own countries on U.S. and foreign prices. In countries where machinery and metal products are major exports, information was sought from both sellers and buyers, while in the less developed countries the emphasis was necessarily on purchase prices. Some purchasing countries have provided quite comprehensive data; others are represented in our data collection by much smaller numbers of returns, but at least some data will be included for purchases by each of about forty countries.

Other data have been collected in small quantities from state and local governments in the United States.

#### NATURE OF THE PRICE DATA

The study has involved the combination of a great many types of data, all of which reflect, in some way, the competitive position of the United States and the other major industrial countries. As has been mentioned, a large proportion of the data arises from formal competitive bidding. The documents recording such bidding usually provide elaborate specifications in terms of physical characteristics or performance (particularly in the case of machinery), notations of any deviations from advertised specifications, and the prices quoted by each bidder. For certain kinds of equipment there are frequently evaluations of quality differences in monetary terms, ending in an explanation of the basis for the final choice by the purchaser.

Other forms of purchase-price comparison include collections of price data or even price indexes maintained by large international firms which purchase throughout the world, particularly for their international operations. Some of these firms follow the prices of fifty to a hundred items in the main producing countries for their own internal use. Other firms collect price comparisons in the course

of more sporadic buying activity, such as is involved in the building of a factory abroad for the firm's own use or in the role of a consultant or adviser to a foreign firm.

The price for a country used in this analysis in any specific comparison, particularly in formal competitive bidding, is the lowest offered by a firm in that country for material meeting the buyer's specifications. Among the specifications have been requirements as to reliability of supplying firm, quality of the product, and the ability of the firm to supply the whole order or succession of orders required. Our main reason for discarding higher bids was that only the low bids were of interest to the purchaser for his decision whether to buy in that country; furthermore, it was felt that higher bids were often not serious attempts to obtain the order. Purchasers were also asked to provide time series data even where they could not compare U.S. and foreign prices, since many of them regularly bought particular items here or abroad for use in foreign countries.

The fact that several different types of data are available for at least some products provides opportunities for checking both absolute level and trends of prices supplied by companies. Sellers' reports of their prices can be compared with purchasers' reports and with bidding data. Using such comparisons, we hope, for example, to be able to detect at least the more serious divergences between list prices and transactions prices.

In order to focus on competitiveness as a feature of a country's own economy and to abstract from shifts in markets and differences in transport costs, we have collected prices f.a.s. port of export wherever possible.<sup>15</sup> Some data can only be secured on an f.o.b. factory basis, which we have considered acceptable, and other information is available only c.i.f. destination.<sup>16</sup> In the last case—fortunately infrequent—we have estimated tariff and international freight costs in order to adjust the prices to an f.a.s. basis.

Where the same f.a.s. price is charged by an exporter for every market, that price is the one we collect. Where different f.a.s. prices

<sup>15</sup> The alternative would have been to measure competitiveness in each different market of the world.

<sup>16</sup> f.a.s. = free alongside ship, including export packing and inland freight; f.o.b. = free on board; c.i.f. = cost, insurance, and freight.

are charged for shipments to different markets, our problems of measurement become more complicated. If it were possible, it might be best to treat each product at each destination as an individual commodity and to compare prices separately. In fact, we attempt in such cases to make the comparisons for a few of the chief markets and omit the less important ones.

In the case of an article that is produced but not exported by a given country, we have taken the f.o.b. domestic price. All of the major countries of concern in this study had some production in every three-digit SITC category within our scope.

Many other problems of definition or choice among different prices arise in the process of calculating these price indexes. Some of these will be taken up in Section III, where the indexes for iron and steel are discussed. Others, peculiar to the more complex products contained in other groups, will be discussed in the final report on the study.