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V

THE WHOLESALE PRICE INDEX

1. CONCEPT AND STRUCTURE

The Original Concept.—The Wholesale Price Index has been published as a continuous series since 1890. It was originally intended as a measure of price movements taking place in primary markets (i.e., other than at the retail level). At the time it was first constructed economics was very much concerned with the concept of the price level, and it was believed that the Wholesale Price Index more correctly reflected the behavior of the price level—the purchasing power of the dollar—than did the traditionally more sticky retail prices. It was recognized, of course, that the index was only an approximation to price behavior at the wholesale or primary market level, since it was based on a relatively small sample of the many commodities which flow through these markets. Not only were many commodities excluded because price quotations were difficult to obtain, but it was recognized that there were some real price changes which could not be measured—for example, some improvements in quality, hidden discounts, differences in delivery schedules, etc. In spite of these difficulties, it was felt that the Wholesale Price Index did adequately represent the prices of all transactions in commodities taking place at other than the retail level.

Although the major emphasis of the wholesale price work in the early period was on the behavior of the aggregate price index, price series for specific commodity groups were also given, and considerable use was made from the start of the prices of these so-called leading commodities. The leading commodities were grouped into nine categories of a somewhat mixed nature, partly reflecting an industrial classification, partly classes of commodities bought by consumers, and partly goods at various stages of fabrication. These early categories were farm products, foods, cloth and clothing, fuel and lighting, metals and metal products, building materials, chemicals and drugs, house furnishings, and miscellaneous. This classification suggests that the Wholesale Price Index was intended to be a comprehensive, general purpose index reporting the general price behavior of the economy.

The Development of the Index.—Since the initiation of the Wholesale Price Index, many changes have been made both in the content and in the methods of calculating the index. Originally prices of some 250 commodities were collected, but this number has gradually increased until at the present time prices of some 1,900 commodities are included. As new commodities were added, they tended to be commodities with a higher degree of fabrication and generally more stable prices. The increased coverage of the Wholesale Price Index therefore had the effect of making the index, and hence the economy, appear to be more stable than it would have under the previous coverage. Increasing the size of the sample and increasing the proportion of more

stable items both contributed to minimizing the fluctuation of the index (see Staff Paper No. 8).

With the development of other kinds of price indexes, e.g., the cost of living indexes, Consumer Price Indexes, and most recently the gross national product deflator, the Wholesale Price Index has ceased to be a general purpose measure used to indicate the basic price behavior of the economy. More effort has been directed toward presenting price indexes by specific sectors of the economy and by stage of processing. For example, indexes of prices of crude materials for further processing are given for the food industry, for manufacturing, and for construction. Prices of intermediate materials, supplies, and components are reported for the same groups. As less emphasis has been placed upon the overall price index, more attention has been directed toward the calculation of subindexes which are useful to those concerned with specific sectors of the economy.

The Present Wholesale Price Index.—The present Wholesale Price Index complex consists of (1) a comprehensive monthly index, (2) a weekly index intended to represent what the monthly index would be if all the prices in the monthly index were collected and tabulated each week, and (3) a daily index based on prices of 22 commodities traded on organized markets or exchanges.

The monthly index, as already indicated, covers some 1,900 items from 2,000 companies who supply about 4,500 individual reports. Additional data are secured from trade sources and other governmental agencies. Mail questionnaires are generally used, and specification pricing is used insofar as possible. In those instances where specifications change or new commodities are introduced, elaborate effort is made to see that only price changes affect the index.

The monthly index still contains the type of subgrouping which was used in the 1890 index, but the number of categories has been increased to 16. There has been some redefinition of categories, e.g., foods have been changed to processed foods, and cloth and clothing to textile products and apparel; and new categories reflecting specific industries have been added, e.g., tobacco and bottled beverages, rubber and rubber products, lumber and wood products, pulp, paper and allied products, machinery and motive products, and nonmetallic minerals (structural). These changes reflect a movement toward a more purely industrial classification system. Behind these subgroup indexes, there are indexes for product classes and individual commodities, with a total of 1,340 item series. As already indicated, the indexes have also been classified by stage of processing. The indexes are further amplified by classifications showing the durability of goods and the economic sector for which the goods are destined, e.g., consumers, producers, etc. Finally, there are a series of special wholesale price indexes which are of special interest: thus fish, soaps, detergents, steel mill products, industrial valves, abrasive grinding wheels, and construction materials are all represented by special indexes.

Weights for the monthly index are based upon value of shipments data from the Industrial Censuses for 1954, but interplant transfers are excluded from these weights where possible. Each commodity price series is considered to be representative of a class of prices, and is assigned the weight proper to the whole class. The class of commodities in turn is usually defined in terms of similarity of manufacturing processes, thus embodying the assumption that prices of com-

modities produced under similar conditions behave in the same way. The assumption that prices reflect conditions of cost more closely than they do conditions of demand is presumably more accurate over long periods than in the short run.

The Uses of the Wholesale Price Index.—The utilization of the Wholesale Price Index as a general price index has changed with the passage of time, as we have noted. The preference that has developed for the use of the Consumer Price Index and the deflators of the national income accounts to measure changes in the value of the dollar had several causes. One major cause of the shift was the realization that the Wholesale Price Index was not a true sample of prices in the system, and that it was not particularly pertinent to any particular group of consumers or businesses in the economy. In contrast, the Cost of Living Index and later the Consumer Price Index had a more exact frame of reference in terms of the market basket of goods purchased by a given class of consumers.

Just as the development of the Cost of Living and Consumer Price indexes replaced the Wholesale Price Index as a general measure of the value of the dollar from the viewpoint of consumers, so also did the development of the implicit price deflators in the national income accounts replace the wholesale price index as an overall measure of price behavior. The implicit deflator of gross national product has the advantage that it is considerably more comprehensive than the Wholesale Price Index, and the weighting system refers to a definable universe of final goods and services.

The factor of timing has prevented the abandonment of the aggregate Wholesale Price Index, however. The implicit price deflators of the gross national product are available only on a yearly and quarterly basis. The monthly Wholesale Price Index together with the Consumer Price Index is therefore still used as an indicator of how prices in the economy are moving on a current month-to-month basis. The weekly and daily Wholesale Price Indexes are still widely used as economic indicators which may help to show how the economy is moving over shorter periods of time. In this context, however, they are used in the same manner as freight car loadings, stock prices, and other short-term indicators.

Manufacturers and trade associations are interested mainly in the group indexes, product class indexes, and individual commodity indexes. A survey made by the Department of Labor indicated that 75 percent of the users wanted the price indexes by commodity groups, and that half of all users considered the prices for individual commodities essential. One-third of the manufacturers questioned used the index to adjust materials contract prices, and one major industry adjusts all its materials contracts on the basis of changes in the index. There can be little doubt but what the considerable amount of detail provided within the Wholesale Price Index is found to be very valuable by businesses which are concerned with the price behavior that is taking place in those markets in which they are producing goods or buying materials. For these users, the general Wholesale Price Index aggregate is not useful, but the highly detailed and specific information on individual industries, product classes, and commodities is very valuable.

One of the major uses of wholesale price data is in the production of other basic economic data by government agencies. Thus, the implicit price deflators of the gross national product lean heavily upon the product and commodity price data contained in the Wholesale Price Index. Any improvement in the Wholesale Price Index aimed at more comprehensive coverage and better price reporting would substantially aid the deflation of gross national product by final product. Two examples may be cited. At the present time it is not possible to provide deflations of gross national product by industry of origin; improvement in the Wholesale Price Index coverage would make this extension possible. The price data necessary to value changes in inventories are notably deficient.

The Census Bureau, the Bureau of Labor Statistics, and the Federal Reserve Board use the wholesale price data to estimate output by industry and to analyze productivity on an industry basis. These are, of course, different aspects of the same problem, and are directly related to the implicit price deflators by industry. Adequate wholesale price data are therefore the basic information on industrial activity and commodity output required for a large number of different uses.

Thus the use of the general price index as an aggregate has declined except in those instances where it is used as a short term economic indicator (see below). At the same time, however, there has been a demand by industry, by other parts of the statistical system, and by the academic world for more detailed and comprehensive wholesale price data on industries and commodities.

The Structure of a Wholesale Price Index.—The behavior of the Wholesale Price Index is highly dependent on the universe of transactions it covers. It is somewhat paradoxical, then, that the universe of the WPI has never been clearly defined, and that ease of collection has been a major determinant of which prices to include. In reviewing the requirements for a Wholesale Price Index, therefore, it will be useful to examine (1) what the Wholesale Price Index as an aggregate should measure; (2) what universe of prices should be covered; (3) what the substructure of the index should be; and (4) what kind of weighting system should be employed.

From the viewpoint of economic analysis, the Wholesale Price Index does not appear to be a meaningful economic construct. The transaction coverage is not descriptive of any definable set of producers or purchasers in the economy. Nor does the present WPI universe have a logical structure of subclasses which are appropriate to the analysis of economic developments: for example, indexes of buying and selling prices of industries, which would allow analysis of changes in "value-added." There is no principle to determine how many steps in the fabrication of a raw material should be included.

The Committee believes that the structure of the wholesale price area should be revised to meet several objectives. The basic objective is comprehensiveness: there is need for price information on every important sector of the economy dealing in commodities, and a good structure will reveal gaps in our price information. A second objective is maximum detail in price reporting: the individual prices are the basic need for most business and scientific uses. And a third objective is the development of price indexes for the subgroups of commodity transactions which are most useful in economic analyses.

The framework for the universe should consist of the total sales and purchase of commodities other than at the retail level. Care should be taken to see that no important commodity class is omitted from the coverage. This suggests that commodities should be priced at a number of different points in the distribution system, and to the extent feasible separate indexes constructed for the pricing at these different points. Thus, coal of a type sold to power companies may be different in its price behavior from coal of a type sold to dealers for retail distribution. An attempt should be made to cover pricing of every major body of commodity sales in the economy. It is recognized of course that in some areas price information may be very difficult to obtain, and substitute kinds of pricing may have to be developed in order to represent such areas fully. Other areas may be very much better covered because it is relatively easy and inexpensive to obtain price quotations on even quite minor categories.

From the point of view of completeness of price data, it is important that the Wholesale Price Index coverage be integrated with other price measurements. At the present time, the Wholesale Price Index covers agriculture and mining as well as manufacturing. Although construction materials are covered as a part of manufacturing, construction itself is not included, nor is transportation. As further noted in Appendix A, exports and imports are partly covered by the Wholesale Price Index, but they are not systematically segregated. It should be recognized, of course, that on our comprehensive view of the Wholesale Price Index universe, portions of the universe will lie in areas in which data are now collected by other agencies. This is also true at present; however, the agricultural and mineral prices now in the WPI are collected in part by other agencies. We do not attempt to decide whether all of the price data falling in our proposed universe for the Wholesale Price Index should be compiled or analyzed by the BLS or whether the integrated system of price indexes is achieved through interagency collaboration. Analytically and conceptually the same problems will have to be faced and the same price information will have to be collected.

The purpose of giving the Wholesale Price Index extremely broad coverage is to obtain price data which will be useful for the many purposes for which industry and other government agencies use such price data. To achieve maximum usefulness the system of subclassification should be such that it meshes with other kinds of information available about the economy. Thus it should be possible to integrate information available from the Census of Manufactures, from the OASI, and from the Internal Revenue Service, as well as from other parts of the Bureau of Labor Statistics. For this reason, it seems desirable that the subclassification should aim at fitting into the Standard Industrial Classification. At the present time BLS has joined with the Census Bureau to produce price indexes classified by 5-digit commodity groups and by broader SIC industry categories. This represents a very considerable step forward, and if it can be carried out to its logical conclusion would achieve the general structure of wholesale prices we recommend.

If adequate coverage of the economy at the Census 5-digit commodity level can be obtained, these commodity indexes could be combined in a large number of different ways to produce other meaningful

price measurements. Commodities could be grouped according to the industry which produces them, thus forming a price index covering the sales of that industry. Similarly the commodity price indexes could be combined so as to yield price indexes of inputs purchased by industries for use in production. Such input and output price indexes would be highly useful in studying productivity changes and in measuring product (value-added) originating by industry. Combination of commodity groups into economic classes would also be possible. Thus price indexes of goods purchased by the government or of goods purchased by producers as capital goods could be calculated. Price indexes could further be calculated according to the durability of commodities, or according to other characteristics which are desired for economic analysis. In other words, price indexes for a basic commodity classification at the Census 5-digit level could be used as building blocks to create a large number of useful and meaningful price indexes.

The ability to combine the basic commodity indexes into meaningful groups depends upon the availability of adequate weighting schemes. In order to build a price index for the output of a given industry from commodity price indexes, it is necessary to know precisely what commodities an industry produces and how much of each commodity is produced. This information is given in the industrial censuses and presents no very great problem. For the input price indexes, however, it is necessary to know what commodities are used by each industry, and the amount of each commodity used. This information is not readily available at the present time, and would require an additional collection program. What is required is a knowledge of the commodity input and the commodity output of each industry, preferably at the Census 4-digit level. This would involve the creation of a large input-output table to provide the basis for weighting. The input-output table would have to be revised periodically (say, at 5-year intervals) to keep the weighting system up to date. If an input-output table were available, the commodity price indexes could be used for deflating the input-output relations to yield the volumes of inputs and outputs of each industry.

The underlying schemata can be illustrated with the following simple input-output table:

| Sectors Producing Commodities | Sectors Purchasing Commodities | | | | Total |
|----------------------------------|--------------------------------|--------|---------------|---|-------|
| | Agriculture | Mining | Manufacturing | Other, e.g., Retailers Government Export | |
| Agriculture | A → A | A → E | A → M | A → O | A → T |
| Mining | E → A | E → E | E → M | E → O | E → T |
| Manufacturing | M → A | M → E | M → M | M → O | M → T |
| Total | I → A | I → E | I → M | I → O | I → T |

(WPI)

In this table the sectors producing commodities are shown as rows. Sectors purchasing commodities are shown as columns. The commodities produced by agriculture may be sold either to agriculture itself, to mining, manufacturing, or others such as retailers, government, or exports. The price index of total agricultural goods sold would be an average of these price indexes weighted by the relative amount of goods sold to each purchaser, i.e., $A \rightarrow T$. Similarly, the goods which agriculture buys from agriculture, from mining, and from manufacturing constitute the commodity inputs to agriculture, and a price index of these purchases (i.e., $I \rightarrow A$) yields the input price index of agriculture. Both the output and the input price indexes referred to above are gross, in that they cover transactions between firms in the same industry. It would be quite possible to compute a net output price index and net input price index by omitting the intraindustry transactions (those enclosed in the boxes in the table). In effect, the present BLS weighting procedure for the 4-digit manufacturing industries yields a net output price index since it excludes the interplant transfers within the industry. Probably both gross output and net output price indexes are needed. For the process of deflation, a gross output price index is often more pertinent, since in collecting data on manufacturers' sales it is often not feasible to collect the additional information required to obtain net sales to purchasers outside the industry.

The general Wholesale Price Index in such a scheme would be constructed with the weights resulting from combining the columns or rows, i.e., the corner of the table, $I \rightarrow T$. A Wholesale Price Index so defined would meet the definition of an index of prices of commodities bought and sold other than at the retail level, and the prices of these commodities would be weighted by their relative importance in total sales. Such a definition would give the Wholesale Price Index a definite universe and a specific form of weighting, so that changes in scope and weighting would not be so important in the future in affecting the behavior of the index as they have been in the past. It should be recognized of course that the industrial organization of the economy itself will affect the number of transactions taking place in the various industrial sectors, and this in turn will bring into the index either more or fewer price observations, with proportionally more or less weight being given to each area of the economy. Vertical integration, for example, would transform what previously were purchases and sales of commodities between previously separate companies into transfers between departments within the same company with no price indicator attached. Conversely, increased vertical specialization might result in the sale of intermediate goods which before had entered no distinguishable market. There is no way of insulating the Wholesale Price Index from such changes in industrial organization, as long as it is supposed to be a fairly complete representation of the universe of commodity transactions. Changes in growth and in the industrial structure of the economy will therefore be important determinants which alter the behavior of the Wholesale Price Index.

Implementation of the Proposed Revision of the WPI.—The present BLS program for the expansion of the WPI and its reclassifica-

tion on a 5-digit commodity basis seems definitely in the correct direction. Priorities for adding new items should probably be determined largely by the needs of other statistical agencies in the government that require wholesale price data to compute deflators and to aid in the measurement of output. This strongly suggests that BLS should continue to work closely with the National Income Division of the Department of Commerce, the Bureau of the Census, and the Federal Reserve Board in making the Wholesale Price Index a better tool for their specific needs.

To implement the proposed weighting system, it will be necessary to utilize the 1958 industrial censuses to construct an input-output table. Experience gained in this effort should be directed toward obtaining better basic information at the time of the next industrial censuses. It may be necessary to approach a detailed input-output table through steps of progressively finer industrial classification.

Since the present Wholesale Price Index can be continued during the transition and in any event is not an important index, considerable flexibility is possible in the timing and sequence of the improvements. As soon as improvements are made they should be included in the index. In terms of analytic importance, it would probably be most useful if a first approximation could be made to the 5-digit commodity classification and the other consequent SIC industrial categories at an early date.

Not all parts of the full system of prices we propose will be available currently for the monthly index of wholesale prices. An abbreviated input-output system, with full industrial detail where the data permit, will suffice for the monthly reports, and a comprehensive report covering the entire system can then be published annually.

i. SENSITIVE PRICE INDEXES

The literature abounds with statements of the need for a sensitive price index which measures the immediately current or prospective movements of wholesale prices, as a guide in policy formation and in predicting business movements. This literature, however, is much less emphatic on the nature of "sensitivity." Often what seems to be implied is that the index number should be based upon prices which change often or by relatively large amounts, but these mechanical criteria have no direct relevance to the measurement of short-run business conditions. Even more often what seems to be sought is an index which will predict the future course of prices or of business.

The ambiguity of the discussions of sensitive price indexes, and the ambiguity of such indexes, is due to the failure to specify exactly what the index is to measure. If the index is to measure the current price situation, then presumably the full, regular Wholesale Price Index is what should be used. It is true that this index contains prices which do not change often (although in good part this is a defect in the price data; see Section V, 2), but to the extent that such prices are valid they are part of the current price situation which is to be measured. (The problem raised by mere delay in reporting prices is discussed below.) Sensitivity in this context means only exaggeration, and it is difficult to see any purpose in exaggerating current price movements.

If the index in question is to measure the impending movements of prices—and no one denies that such a measure would be useful—

mere volatility of prices is of course irrelevant. For this purpose those prices should be included in the index which reflect estimates of the state of the commodity markets (say) three or six months in the future. There are two important sets of prices which do attempt to estimate market conditions in the near future. The first set consists of futures prices on organized exchanges; they are at present excluded from the WPI. The second set consists of prices on goods to be produced and delivered a considerable time after the contract is made. The WPI index now contains a substantial number of such prices: many "built to order" items have fairly distant delivery dates; and a considerable number of prices cover contracts which run for specified periods.

We believe an index of this latter type has enough interest and potential usefulness to justify at least a serious experimental program. The basic data, namely, futures prices and identification of prices covering deliveries well in the future, are not now collected, but certainly could be. The experimental work, and given its success the continuing program, might well be undertaken by the Federal Reserve System in cooperation with the BLS.

So far as the currency of price information is concerned, the present delay is not great: prices as of the middle of one month are published by the second week of the following month. The weekly index of the WPI provides a more current estimate of the entire index. The present weekly index does not perform especially well as a predictor of the monthly index, but this deficiency can probably be remedied by drawing a more appropriate sample.¹

2. THE QUALITY OF THE PRICE DATA

Some of the wholesale price quotations are collected from governmental bodies and exchanges, but in much the largest part from individual manufacturers or their trade associations, primarily by mail. The question that must be posed is: How good are these price quotations—how accurately do they measure the terms on which transactions actually take place? The answer is not readily given, for obviously if a comprehensive body of transaction prices were at hand, the BLS would use it. But several types of evidence suggest very strongly that the price quotations obtained from manufacturers do not faithfully measure the movements of prices, quite aside from the usual problems of quality change.

¹ The data for the following comparison of the monthly WPI with the closest corresponding weekly index cover the years 1954 and 1955:

| Category | Monthly index | | Errors in weekly index | | | |
|-------------------------------|---------------|---------------|------------------------|---------------------|----------|-----------------|
| | January 1954 | December 1955 | Positive | Less than ± 0.1 | Negative | Median absolute |
| All commodities..... | 110.8 | 111.3 | 3 | 7 | 14 | 0.1 |
| All except farm and food..... | 114.5 | 119.7 | 4 | 4 | 16 | .1 |
| Farm products..... | 97.9 | 83.4 | 13 | 1 | 10 | .2 |
| Processed foods..... | 106.2 | 98.2 | 7 | 5 | 12 | .2 |

The median errors are considerably larger than the average monthly change in the monthly index, and in the three year period, 1953-55 inclusive, the weekly index reported no change for three declines and three rises in the monthly index, and reported one rise as a fall. Large movements of the monthly index are consistently predicted correctly.

(1) Weighty evidence of a spurious short-run rigidity in the behavior of BLS prices is afforded by Staff Paper No. 9. When frequency of price change is tabulated against number of reporters from whom the prices are collected, it is found that the frequency of price change for intermediate and finished manufactures is twice as great if there are three or more price reporters than if only one price report is collected. Yet more than 400 price indexes in the WPI are based upon single reports.

It is impossible to believe, therefore, that the extreme short-run rigidity of many WPI prices represents the true behavior of even the quoted prices in the market. This rigidity introduces a systematic lag in the index relative to changes in average price quotations.

(2) When average receipts of producers are compared with price quotations, there are important and unexpected differences in trend. Thus the WPI index of steel prices rose 101.5 percent from 1947 to 1957, whereas the index of receipts per ton (calculated from numerous subclasses of steel products, with constant weights), rose only 89.3 percent.² One must make allowance for minor differences in coverage but the main source of difference (changes of the product mix within the subclasses of steel) should probably have led to a greater rise of unit values because better qualities of steel were being used. A variety of such examples are reported in Staff Paper No. 8; no one is very convincing but the ensemble sheds doubt on the validity of the price quotations, particularly with respect to their lack of responsiveness to cyclical fluctuations.

(3) There exists one large body of publicly available price data which has not been used on any scale to test the BLS quotations: the bids on government purchase orders. A sample of such prices during the past decade has been compared with BLS quotations, and the comparisons are fairly consistent in showing that the BLS prices are both higher and more rigid than the average of bid prices (Staff Paper No. 9). The following example will illustrate this evidence (dollars per gallon).³

| Date of bid opening | Bid prices on gasoline | | | WPI price |
|---------------------|------------------------|----------|----------|-----------|
| | Low | Mean | High | |
| Nov. 6, 1954..... | \$0.0933 | \$0.0996 | \$0.1033 | \$0.105 |
| May 4, 1955..... | .0948 | .0991 | .1075 | .105 |
| Aug. 3, 1955..... | .0992 | .1038 | .11 | .105 |
| Oct. 25, 1955..... | .0844 | .0855 | .0875 | .105 |
| Apr. 25, 1956..... | .099 | .105 | .11 | .105 |
| Oct. 9, 1956..... | .09585 | .0997 | .10495 | .105 |

(86+ octane gasoline, gulf coast, f.o.b. refinery, for bids; WPI, 87 gulf coast, f.o.b. refinery, minimum of 20,000 barrels.)

In summary, the evidence that the BLS company price quotations are not valid transaction prices is highly persuasive. The quotations now collected are at best the initial base for negotiation in many cases, and often represent only the hopes of sellers or the snares of inexperienced buyers.

² Unpublished study by Martin Bailey.

³ A substantial body of similar material, comparing WPI prices and prices paid by large buyers, is presented in Staff Paper No. 8.

We recommend that a major shift be made to the collection of buyers' prices. Large and continuous buyers of manufactures should be able to supply prices which truly represent the effective terms on which transactions are made. We do not believe that this shift to buyers' prices will be simple or free of new difficulties, but it is the most promising source of comprehensive, continuous, and reliable price quotations.

Where buyers' prices are not available, we recommend extensive use of unit values, at least as benchmarks to which the monthly prices are adjusted. Unit values are inferior to specification *transaction* prices, but when unit values are calculated for fairly homogeneous commodities, they are more realistic than quoted prices in a large number of industrial markets.

