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5. PRICES USED IN ESTIMATING INVENTORIES AND INVENTORY CHANGE

In the national accounts, estimates of inventories and their change can be no better than the prices used to deflate and reflate inventories. Even if the book values of inventories, the methods by which inventories were valued, and the composition and turnover of inventories were known precisely, reliable estimates of constant dollar inventories and inventory change could not be made without appropriate price and cost indexes. Indeed it might be argued that lack of such high-quality indexes is as much an obstacle to careful measurement in this field as is the lack of high-quality book value data. The long-term price program initiated by BLS in 1977 is a major step toward improving needed price data.

Price indexes and the manner in which they are used must be scrutinized much more carefully today than in the past because the task of deflation has become more complex. It is more difficult to capture a given real component of inventory change when the rate of inflation is high than when it is low.[1] Also, it is more difficult to capture a given real component of inventory change when the rate of inflation is subject to pronounced shifts, such as those of the past few years. The increased variability of changes in wholesale prices in the 1973-75 period, compared to earlier years, is illustrated in figure 1.

Most of the discussion in this chapter pertains to the BLS Wholesale Price Index (WPI) and its use in making estimates of inventory change and the IVA. In connection with price measurement two points should be kept in mind. One concerns the monitoring aspect of price indexes or how well BLS wholesale prices portray price behavior in various markets. The second relates to use of wholesale price indexes in deflation. Even if BLS price indexes were faultless one would want to know how well BEA is able to match current dollar value variables like inventories or shipments with available price indexes, for example, in terms of commodity composition or timing.

SHORTCOMINGS OF THE WPI

The Wholesale Price Index has been a chronic concern to economists, statisticians, and other users. The Index was examined in 1976 by Richard Ruggles for the National Bureau of Economic Research and the Council on Wage and Price Stability (CWPS).[2] Ruggles observed that the WPI still suffers from a number of shortcomings noted in the 1961 Stigler Committee Report,[3] and he breaks new ground in calling attention to other weaknesses not fully appreciated until now.

In brief, among the main problems with the WPI are: (1) use of list rather than transactions prices; (2) lack of probability sampling in the panel of firms reporting price quotations to BLS; (3) lack of commodity detail and existence of coverage gaps; and (4) failure to distinguish between shipments and orders prices.

Perhaps the commonest criticism of the WPI is that premiums and charges for extras that sellers add to list prices when demand is strong and discounts from list that sellers offer when demand is weak are missed. This could lead to overstatement of real inventory change during booms and understatement during recessions. This problem, to the extent it exists, affects deflation work generally and is not confined to measurements of inventory change.

BLS collects information on conditions of sale in an attempt to correct for this deficiency. Ruggles presents results of a special inquiry about sources of BLS price quotations in March 1975. It was found that only one-fifth of items reported were list prices while the remainder were list prices adjusted by discounts or average unit realized selling prices. The discounts were of many types: quantity, trade, seasonal, cash, and other. Ruggles states that:

> There is, of course, no way of determining from the [BLS] questionnaire whether the producers are reporting all of the discounts which they actually give to their customers.[4]

BLS views the list price problem as one that should be improved but not a major priority. The problem, however, is probably more important than BLS believes. Customary discounts offered by sellers for large quantities, for certain recognized classes of customers, for seasonal purchases and for cash payment are all related to costs and exist at any given level of prices. These are not the kinds of discounts that are at issue. What is at issue is the possibility that selected customers get further discounts not available to all customers. Even though price

[1] This implies that the dispersion around the average price change is greater when the rate of inflation is high than when it is low. When inflation is high, sellers are more likely to conceal price increases by adding various types of extra charges, by dropping low-end items, by billing for freight charges, etc. Furthermore, under conditions of excess demand, shifts occur in the relative importance of regular and irregular sources of supply; spot purchases may become more important relative to contract purchases and domestic sources less important relative to foreign sources.

[2] Council on Wage and Price Stability, *The Wholesale Price Index: Review and Evaluation* (June 1977).

[3] The Price Statistics Review Committee, *The Price Statistics of the Federal Government* (New York: National Bureau of Economic Research, 1961).

[4] Council on Wage and Price Stability, *op cit*, p. I-18.

data reported to BLS are confidential, sellers tend to be unwilling to cite discounts that may be given only to a few buyers for fear of spoiling markets or hurting customer relations. During recessions and in the early stages of recovery it is common to find newspaper references to discounting, just as it is common to find references to extra charges when demand is very strong.

The Council on Wage and Price Stability conducted intensive investigations of price behavior in a few industries and found the WPI to be seriously deficient. In its study of the steel industry, CWPS compared wholesale prices reported by steel producers to BLS for the WPI with composite prices realized by producers for the four quarters of 1974. Results for sheet steel are shown below:[5]

Item	1974 quarters			
	1st	2nd	3rd	4th
BLS WPI.....	100.0	111.0	133.2	134.1
Company composite...	100.0	119.3	138.7	140.2

It is possible that the company composite includes prices of steel sold through brokers and steel service centers, neither of which are covered by the WPI. But it is also possible that the WPI was not representative of prices realized by mills in this period.

Since transactions prices are needed for deflation, the question arises as to the best source—buyers or sellers—for such prices. Stigler and Kindahl examined the prices of 1,300 transactions for 70 commodities during the 1957-67 period.[6] The data, which came primarily from purchasers, and in many instances from invoices, were compared with price indexes of the same commodities reported to BLS for the WPI. The authors concluded there was no evidence of a trend difference between the two sets of data when prices were stable or rising, but the WPI tended not to reflect the full extent of price declines.

Although most WPI prices are sellers' prices, a few are not. The basis for aluminum ingot prices was shifted from sellers to buyers by BLS in 1971 after it was discovered that the list price of 29 cents per pound reported by producers was far above the 22 cent price at which transactions were being made. From January to December 1974 prices reported by buyers (excluding purchases from the spot market) went up 50.9 percent whereas over the same period prices reported by producers rose 37.5 percent.[7]

For deflating purchases, price data obtained from buyers would appear to be more suitable than those obtained from sellers. However, we do not recommend that BLS make a general shift from sellers to buyers as the source of price quotations because it is not clear that the benefit would be worth the added cost. In manufacturing, for example, the number of suppliers of a typical material is very small compared to the number of purchasers. Hence, a much larger number of purchasing firms would have to be surveyed to attain equivalent sampling precision, although some of the added cost could be offset by obtaining price data for several materials from any purchaser. Nevertheless the problem of obtaining good price quotations continues to be serious and buyers should be sampled by BLS to verify the accuracy of sellers' quotations.

Sampling and Classification Problems

Another problem with the WPI is that its price quotations are not derived from a probability sample. The relative coverage of various industries and products shows wide variation, partly because there is no systematic framework for data collection and partly because the products included reflect "the organization and staffing of the price collection and data processing work within the Bureau of Labor Statistics."[8] As a result many important commodity areas are not adequately represented in the WPI. Furthermore, unlike most other economic statistics that are collected monthly or quarterly, there is no benchmarking of prices. This would permit, say, the calculation of annual price changes based on much larger samples and more reliable procedures than are used for calculating monthly price changes.

Ruggles calls for BLS to develop probability sampling in a cooperative effort with the Bureau of the Census. He also recommends that a larger sample of price data be collected annually for revisions in the WPI if more reliable annual figures differed from the changes derived from monthly data. Not only would such an approach permit use of a larger sample for the annual benchmark, but also more care could be taken in validating data reported annually because the pressure of meeting monthly reporting deadlines would be absent.

The Ruggles recommendation to collect annual data has great merit. Large companies with well-developed cost accounting systems periodically make projections of prices and quantities for planning and budgeting purposes and periodically evaluate their projections. Variances between projected and actual prices and differences in prices from one year to the next are basic ingredients of these ongoing accounting exercises. Consequently, an annual benchmark is not only feasible but would yield rich results.

In the division of labor among Government statistical agencies, inventory and wholesale price data are collected by different agencies. One consequence, given Census Bureau restrictions on access to its industry directory, is that the industry classification system used by BLS for wholesale prices differs both from the industry classification used by the Census Bureau and from the Standard Industrial Classification (SIC) system. The BLS system is organized around market groupings rather than industries. The coding system for commodities in the WPI was developed prior to the 7-digit commodity codes used in the SIC. On an overall basis this may seem like a trivial point in a procedure that essentially is rough. However, the classification

[5] *Ibid.*, IV-16.

[6] George J. Stigler and James K. Kindahl, *The Behavior of Industrial Prices*, (New York: National Bureau of Economic Research, 1970).

[7] Based on data shown in Council on Wage and Price Stability, *op. cit.*, pp. IV. 17-20.

[8] *Ibid.*, p. III-1.

problem can have significance for components of inventory change at the industry level.

The Dating of Prices: Orders v. Shipments

One aspect of prices that had received relatively little attention until the Ruggles report is the timing of BLS price quotations.[9] This has been a major concern from the very beginning of this inventory study, and the emphasis given to the subject in the Ruggles report was overdue.

The basic issue is whether BLS obtains price quotations that are orders prices or prices at which shipments are made. The WPI serves two basic purposes—deflation and monitoring. For monitoring current price conditions, orders prices are more suitable since they reflect what is happening at a point of time in the market. However, for purposes of deflation, the prices embodied in current shipments or sales or expenditures need to be known.[10] What is desired is a shipments price index, which may reflect orders placed some time in the past. This is especially true for capital goods, which require an extended production period and are often made to specifications of purchasers. The appropriate deflator for current shipments by capital goods producers is obviously not the price at which new orders are currently being taken. In addition to capital goods, raw materials are often purchased under contracts calling for recurrent deliveries over extended future periods. Clothing and shoes are bought by retailers well in advance of the selling season, and it is clearly inappropriate to deflate current shipments of clothing by an orders price.

Until recently there was no systematic information available about the kind of prices being collected by BLS. For the Ruggles study, however, BLS commodity specialists gave their evaluations, based upon contacts with price reporters, of the timing characteristics of the price quotations obtained by BLS for the WPI. Roughly half of price quotations were found to be based on orders prices and half on shipments prices. As might be expected, a majority of prices in durable goods manufacturing were orders prices. But, even for nondurables, orders prices constituted about one-third of all the quotations.

Few problems of practical importance arise when orders and shipments occur nearly simultaneously. However, this is not true when the difference between them can be measured in months, which is sometimes the case. For the Ruggles study, BLS commodity specialists made estimates of lags between receipts of orders and corresponding deliveries. These estimates appear in table 5.1.

Apparently shipments prices tend to be reported to BLS when the lag between orders and shipments is relatively short. When the lag is more than three months, orders prices apparently are reported, judging from table 5.1. According to BLS officials, estimates by their commodity specialists probably are reliable with respect to the kind of prices reported (orders v. shipments) but are speculative with respect to time lags.

[9] See also Moses Abramovitz, *Inventories and Business Cycles* (New York: National Bureau of Economic Research, 1950), p. 536.

[10] Of course, orders prices may also be needed to deflate new orders.

Table 5.1. **RELATION OF SHIPMENT AND ORDER PRICES TO TIME LAG BETWEEN ORDER AND SHIPMENT**

Length of Lag	Order Prices	Shipment Prices	Unknown	Total
Spot or shelf	16	7	8	31
One week up to one month	51	86	7	144
One month up to three months	113	103	33	249
Three months up to six months	42	4	11	57
Six months up to one year	34	0	0	34
One year or more	12	0	0	12
Unknown	17	51	34	102
Total	285	251	93	629

Source: *The Wholesale Price Index: Review and Evaluation* (June, 1977), Council on Wage and Price Stability, Table I-6, p. I-22.

As noted above, the distinction between orders and shipments prices is of considerable importance for deflation. The relevant price for deflating inventories is a shipments and not an orders price unless orders and shipments are virtually simultaneous. About one-fourth of the BLS price quotations in material manufacturing industries are orders rather than shipments prices.[11]

BEA has always been aware that orders prices are not suitable for deflating inventories. In *National Income*, (1954 Edition) the Office of Business Economics noted that these price series "do not consistently measure the prices of purchased inventories at the transaction stage at which they are acquired by the inventory holder."[12] This was one of the reasons BEA lengthened its estimates of inventory turnover derived from IRS data.

Spot and Contract Prices

Differences between orders and shipments prices become apparent in comparisons of spot and contract prices. The latter two have received little attention from users if not producers of price statistics. This is another aspect of the time dimension of price measurement.[13]

Spot markets exist where commodities are standardized and sellers can hold inventories. This implies the existence of either a futures market or a market in which most transactions are made in accordance with contracts for future deliveries. Spot markets are often marginal markets in the sense that supplies

[11] Included in the material manufacturing industries are: textiles, paper, chemicals, petroleum, rubber, stone, clay and glass, lumber, and primary metals.

[12] U.S. Department of Commerce, Bureau of Economic Analysis (fomerly Office of Business Economics), *National Income, A Supplement to the Survey of Current Business* (1954), p. 138.

[13] Council on Wage and Price Stability, *op. cit.*, p. V-5.

available for current delivery in such markets are usually quite small in proportion to the total sales volume. This certainly is true of markets for major agricultural commodities where deliveries from such markets tend to be only a small fraction—a few percent—of total deliveries. Spot markets exist for most standardized industrial commodities. The importance of price changes in spot transactions reflect short-run temporary disequilibriums. Buyers may underestimate demand and find it necessary to satisfy current needs by purchasing in spot markets. Spot market supplies may be increased if buyers have overestimated demand and wish to unload unwanted inventories. Strikes, threats of strikes, and natural disasters may have similar effects on spot market prices.

Data collected for recent years by the Federal Power Commission[14] on fuel purchases by stream electric utility plants provide some interesting examples of differential price behavior in spot and contract markets and emphasize the importance of focusing on this distinction in sampling price quotations. (See figures 2, 3 and 4.) This example is offered to illustrate different kinds of price measures, not as a critique of BEA's treatment of coal stocks held by electric utilities.

Utilities buy coal under long-term contracts in order to be assured of a fuel supply over the life of a plant. Contracts of 25 to 35 years are not unusual. Price escalation has been common since the early 1970's but when coal prices were depressed in the early 1960's some utilities were able to buy their coal requirements at prices that were fixed for extended periods of time. Utilities also have bought and continue to buy coal in the spot market, partly as a buffer stock against contingencies such as coal strikes, and partly because optimizing inventory holdings entails spot purchases. With the pronounced increase in fuel prices in recent years, some firms have maintained smaller coal stockpiles in order to reduce inventory holding costs and to make greater use of the spot market to satisfy short run variations in the demand for electricity.

Figures 2, 3 and 4 show pertinent price and purchase information over a 3½-year period beginning in the spring of 1973. Prospects of a strike of coal miners in the fall of 1974 caused utilities to increase their spot purchases substantially starting in the fall of 1973. A 3½-week strike began in November 1974. The proportion of deliveries under spot purchases peaked in November 1974 and then fell substantially, leveling off at 12 to 13 percent (figure 2). Spot prices began to rise very rapidly toward the end of 1973. They peaked in November 1974 and then fell so that by mid-1976 the rise in spot prices over the preceding three years was about the same as the rise in contract prices. The special impact of fluctuating spot prices on the weighted average price is illustrated by figure 3.

Figure 4 is a comparison of the movement of the WPI price for bituminous coal bought by electric utilities, which are f.o.b. mine, and the weighted average delivered prices from FPC records. Fluctuation differences between FPC and WPI prices are pronounced. Freight costs are a large part of delivered coal prices, but freight rates alone cannot account for the discrepancy between the two series. According to BLS, from January 1973 to July 1974 WPI prices of coal sold to electric utilities were represented by a contract price but the sample was poor. Starting in August 1974 this kind of coal was represented by spot prices. In its deflation work, BEA used a more comprehensive index—"bituminous coal"—which over the period covered rose more and fell less than the BLS series shown in figure 4. A new series on contract prices for bituminous coal was introduced by BLS effective in June, 1976.

Producers' Prices v. Purchasers' Costs

Even if BLS wholesale prices were perfect indicators of producers' prices, their effectiveness could still be questioned because the appropriate deflator for inventories is an index reflecting purchasers' costs rather than producers' prices. Use of the latter as a proxy assumes a constant percentage spread between the two.

The main elements of the spread between producers' and purchasers' prices are trade margins, transportation costs and import price diffferentials. A reasonable case based on past experience can be made for a percentage margin in trade (chiefly wholesale) that fluctuates within a rather narrow band. But this is not always the case. From August 15, 1971 to April 30, 1974 prices in the U.S. economy were under varying degrees of control. In those sectors where prices were not subject to control, prices showed much greater fluctuations than did BLS indexes of wholesale prices. Table 5.2, excerpted from the steel report of the Council on Wage and Price Stability, in a comparison of price changes for selected steel products from three different

[14] Now the Federal Energy Regulatory Commission.

Table 5.2. **PERCENTAGE CHANGE IN PRICES OF SELECTED STEEL PRODUCTS**

Commodity	1st quarter 1973-2nd quarter 1974			2nd quarter 1974-February 1975		
	Broker	Service center	WPI	Broker	Service center	WPI
Plates	127	12	28	-52	34	23
Cold rolled bars	83	16	23	-29	35	8
Hot rolled bars	96	19	26	-13	22	9
Cold rolled sheet	91	33	23	-39	17	14
Hot rolled sheet	122	26	22	-43	16	14
Structural shapes	127	14	21	-52	30	21

Source: Council on Wage and Price Stability, A Study of Steel Prices (July 1975), p. 66.

sources: the WPI, an independent steel broker and a steel service center. Brokers' prices were not subject to price controls during this period; those of producers (reflected in the WPI) and steel service centers were. When steel demand was strong–from the first quarter of 1973 to the second quarter of 1974–brokers' prices rose more sharply than did WPI prices. When demand weakened–from the second quarter of 1974 to February 1975–brokers' prices fell sharply while BLS prices continued to rise. It should be noted that the three groups are not of equal weight; brokers are much less important than mills or service centers. However, the differences in price fluctuations are large enough to influence significantly average price changes.

Freight Charges

The relevant price for deflating inventories is the delivered price but producers' prices that are generally f.o.b. are used in the WPI. The issue is whether movements in WPI prices parallel movements in delivered prices. Lack of information on transportation charges has been one major obstacle to the use of delivered prices but some progress should be possible with the publication of a new index of railroad freight charges by BLS.

The new BLS index is designed to measure changes in rail freight rates. The index is plotted in figure 5 and compared to the WPI by months from 1969 through 1976. Two distinguishing features of the index are, first, its step-like appearance, which reflects mainly the procedures under which rate increases are granted by the U.S. Interstate Commerce Commission, and second, the lack of parallelism with the WPI over time spans of, say, one year or less. This can be seen also in table 5.3, which compares December-to-December changes in the freight rate index and the WPI. For eight periods that can be compared, there are pronounced differences in changes in three: 1970, 1973, and 1975. Because of the regulatory process there appears to be a distinct lag in the behavior of freight rates compared to wholesale prices, especially from 1973 to 1975.

The right hand column of table 5.3 shows a weighted price change in which railroad freight is given a weight of 3 percent and the WPI a weight of 97 percent. Even with this tiny weight for freight charges there are small but perceptible differences in movement between the weighted index and the WPI in 1970, 1973 and 1975. It is important to note that all of these years are close to business cycle turning points. Ignoring laggard prices like freight rates probably results in a small understatement of real output before and–depending on the length of the downturn and the regulatory lag–in the recovery as well.

Table 5.3. PERCENTAGE CHANGES IN WPI, RAILROAD FREIGHT INDEX AND WEIGHTED AVERAGE (JANUARY 1969–DECEMBER 1976)

Year	WPI All Commodities	Railroad Freight	Weighted[1] Average
1969[2]	4.1	5.7	4.1
1970	2.2	13.2	2.5
1971	4.0	3.4	4.0
1972	6.5	3.4	6.4
1973	15.4	5.0	15.1
1974	20.9	18.3	20.8
1975	4.2	14.3	4.5
1976	4.7	5.9	4.7

[1] WPI weighted 97, freight index weighted 3.
[2] Change for January through December not annualized.

Source: U.S. Department of Labor, Bureau of Labor Statistics weighted average calculated by NBER.

Table 5.4. RATIO OF IMPORTS TO IMPORTS PLUS DOMESTIC PRODUCTION, SELECTED METALS

(Percent)

Commodity	High Ratio[1]	Date	Low Ratio[1]	Date
Iron ore and scrap	24.8	1967	20.0	1972
Aluminum	53.5	1968	50.9	1969
Copper	23.7	1967	11.8	1970
Zinc	50.2	1969	42.1	1975
Lead	36.4	1967	13.2	1975
Steel mill products	17.4	1971	10.7	1966

[1] For 10-year period from 1966 through 1975; ratios are based on physical quantity data.

Source: National Bureau of Economic Research, based on data published in U.S. Department of Commerce Bureau of Economic Analysis, *Survey of Current Business,* various issues.

Imported v. Domestic prices

Including imported goods in inventories raises a number of problems in deflation since, with a few exceptions, the price indexes used to deflate inventories cover domestic prices only. For some commodities, imports are a marginal source of supply, and are subject to more pronounced price fluctuations than domestic output. The differential price behavior is brought out strikingly by experiences in the steel industry from 1973 to early 1975. Figure 6 is useful in demonstrating that import prices, which were not subject to price controls, showed pronounced increases when demand was strong and supplies were very limited, and pronounced decreases when demand weakened. It is interesting to note that the composite European export price, which is an orders price, peaked in June 1974 and by February 1975 had fallen by 38 percent. The price based on U.S. customs value peaked in January 1975 and by March had fallen by 15 percent. The WPI for finished steel rose 16 percent from June 1974 to January 1975 and leveled off in the next two months.

A few years ago BLS started compiling price indexes for U.S. imports and exports. The program was undertaken because the only price data available on the subject were unit values compiled by the Commerce Department. Unit values are not true price indexes because items on which unit values are com-

puted are not standardized. Therefore, unit values may be seriously defective as proxy price measures when the composition of goods within a commodity category changes.

BLS compilation of foreign trade price indexes was started on a modest scale and gradually has been expanded. Over a period of several years it is expected that a major portion of both U.S. exports and imports will be covered. At present the new program applies to commodities accounting for about 24 percent of the value of merchandise imports and 58 percent of the value of merchandise exports. BEA does not now use either the export or the import price indexes for deflating the foreign trade values for the GNP, but relies instead on unit values compiled by Commerce. In deflating inventories BEA uses only WPI data, which essentially exclude price observations on imported goods.[15] Thus, the fact that import prices for a commodity may have different cyclical changes or even long-term trends is lost in the deflation of inventories. Furthermore, imported goods can represent changing proportions of inventories since they represent changing proportions of the total U.S. supply. If separate deflators for imported goods were available they could be combined with domestic prices of the same commodity with changing weights to derive improved overall deflating indexes. In this regard table 5.4 on the import share of aggregate supply for selected metals is of interest.

A SIMULATION EXERCISE

The deflation of current dollar variables (inventories, shipments, etc.) by means of the WPI and its components has suffered because BLS has not differentiated between orders and shipments prices. Generally, this has not constituted a serious problem. It becomes important, however, when the rate of inflation is high and subject to pronounced change. These conditions clearly occurred in the 1973-75 period.

Some simulations were run for this study that employed alternative approaches to price measurement for production and maintenance materials. A set of extreme assumptions was made, namely, that (a) all BLS wholesale prices were order prices and (b) goods were delivered at the same price at which they were ordered. In reality, only some BLS prices are orders prices and some sellers escalate their initial orders prices, a procedure that has become more important in the past few years. Finally, although purchasers may lengthen the time of their purchasing when demand increases, they may be unable to obtain firm prices for future delivery. Sellers, for example, may be willing to make firm commitments regarding future quantities but not regarding future prices.

The National Association of Purchasing Management (NAPM) has for many years published a monthly survey of purchasing officials. The participants report, among other things, on new orders by scheduled time of delivery.[16] The survey is based on responses from about 200 large companies, and on a relatively small group of commodities. It is said by purchasing experts that in most companies a small percentage of key commodities account for a large percentage of the total value of purchases; spot checks in the field confirmed this view offered by NAPM officials.

The NAPM survey results are presented in terms of a percentage distribution of respondents by scheduled delivery time. The percentage distribution of new orders placed by delivery time can be used as a set of weights for prices. The delivery times used in the survey are as follows:

Hand-to-mouth
30 days
60 days
90 days
120 days
6 months to one year

We interpret "Hand-to-mouth" to mean delivery in the same month as the order. Thirty days means one month after the order is placed and so on. Since separate figures are shown for production materials, and maintenance materials and supplies, the two groups were combined using a weight of 90 and 10 respectively.

For a given month, the percentage distribution just described was multiplied by the seasonally adjusted dollar total of new orders for two market categories published in the Census Bureau's M3 survey: "other materials and supplies and intermediate product" and "construction materials, supplies and intermediate products."[17] The procedure would yield a table like table 5.5, based on hypothetical data. By totaling a column for a given month and year a set of weights for prices in deliveries can be obtained. The weighted average delivered price for a given month is thus based on order prices for that month and earlier months, with weights derived from table 5.5. Thus for March deliveries the January price is weighted by $\frac{10}{90}$, the February price by $\frac{30}{90}$ and the March price by $\frac{50}{90}$. The key point about the weights is that they vary in accordance with the pattern shown in the NAPM survey of purchasing officials. This calculated delivery price index is called NAPM-I for table 5.6. This index can be compared with the actual BLS index for the same delivery month in order to test a common assumption in deflation work: that the BLS price of a given month represents the price at which goods are delivered. This has not been the assumption underlying BEA's deflation of inventories or producers' durable equipment but it has crept into some work affecting manufacturers' shipments. Note that any costs between shipments by the seller and receipt by the buyer are not considered.

In order to relax the assumptions about orders prices employed above some data reported in the Ruggles study of the WPI were used. Ruggles' 1-in-14 sample of BLS price quotations generally contained a larger proportion of orders prices than of shipments prices. However, there is a heavy concentra-

[15] An important exception is petroleum because the WPI does not include imported crude oil. In this case BEA uses unit values based on import data.

[16] Business Survey Committee, National Association of Purchasing Management, Inc. *Business Survey Report* (New York), monthly.

[17] This simulation was based on data in the M3 prior to the January 1977 revision.

Table 5.5. TIME LAGS IN DELIVERY OF NEW ORDERS, HYPOTHETICAL EXAMPLE

Month of new order	Value of new orders placed	Month of delivery						
		January	February	March	April	May	June	July
January	100	50	30	10	10	0	0	0
February	90	(X)	40	30	10	10	0	0
March	110	(X)	(X)	50	40	10	5	5
April	120	(X)	(X)	(X)	65	35	15	5

X Not applicable.

tion of orders prices in machinery. Focusing on nondurable industries (except food) plus lumber, stone and primary metals, 52 out of 192 quotations in the Ruggles study were found to be orders prices. On this rough basis it was concluded that about one-fourth of the price quotations in these industries are orders prices. This was made the basis for constructing a somewhat more realistic variant of NAPM-I. In the new variant (NAPM-II, table 5.6) the actual WPI (for immediate materials) was given a weight of three-fourths and NAPM-I a weight of one-fourth.

Table 5.6 is a comparison of changes (prior to seasonal adjustments) for three indexes. To obtain the change for each index a simple average of the three monthly indexes for a given calendar quarter was calculated and compared with the average for the succeeding quarter. The changes were not expressed as annual rates.

Differences between the WPI for industrial materials and NAPM-I are quite pronounced, as can be seen in column (4). When NAPM-II is used, column (5), the differences are considerably reduced but nonetheless substantial. In view of the fact that there were no appropriate data for industries and that no allowance was made for escalators, these alternative measures are offered as suggestive of possible biases. Generally, price increases for 1973 and through the first half of 1974 may have been smaller than measured, and the retardation in the rate of price increase from 4Q 1974 through 3Q 1975 may have been smaller than actually measured. The biases in real variables obtained by deflation would have the opposite sign.

A FURTHER NOTE ON DEFLATION

In addition to presenting the GNP by final expenditure components (consumption, fixed investment, and other components) plus inventory change, BEA makes annual estimates

Table 5.6. COMPARISON OF WPI INDEXES OF INTERMEDIATE MATERIALS WITH ALTERNATIVE MEASURES, QUARTERLY RATE OF CHANGE

Year and quarter	WPI intermediate materials (1)	NAPM-I (2)	NAPM-II (3)	(1)-(2) (4)	(1)-(3) (5)
1973:					
1st quarter	2.1	0.9	1.8	1.2	0.3
2nd quarter	3.9	3.1	3.7	.8	.2
3rd quarter	1.3	2.6	1.6	-1.3	-.3
4th quarter	2.7	1.4	2.3	1.3	.4
1974:					
1st quarter	6.6	3.0	5.7	3.6	0.9
2nd quarter	10.0	6.6	9.2	3.4	0.8
3rd quarter	8.2	8.2	8.2	0	0
4th quarter	2.7	7.3	3.8	-4.6	-1.1
1975:					
1st quarter	1.7	3.6	2.2	-1.9	-.5
2nd quarter	1.0	2.4	1.4	-1.4	-.4
3rd quarter	.9	1.3	1.0	-.4	-.1
4th quarter	1.6	1.4	1.5	.2	.1

Source: Col. (1): Bureau of Labor Statistics; all others: National Bureau of Economic Research.

of gross product originating by industry in current and constant prices. In manufacturing, the gross product originating in an industry in constant prices is obtained by deflating gross product originating in current dollars by an industry deflator. The derivation of the deflator in turn is dependent on a procedure known as double deflation, in which outputs and inputs are deflated by appropriate price indexes.

The treatment of deflators used to deflate material inputs to production should be consistent with the treatment of deflators used to calculate the change in business inventories in the GNP. For example, for a FIFO firm with a three-month turnover, end-of-year inventories should be deflated by price indexes based upon October, November and December transaction prices. In deflating the related cost of materials inputs the consistent procedure calls for deflation by price indexes from October of the preceding year through September of the given year. However, in its double deflation procedure BEA deflates cost of materials for the year by average prices for the calendar year. Usually there are only negligible differences between year-to-year price changes based on, for example, 12 months ending in December and 12 months ending in September. However, when rates of inflation change rapidly, as in 1973-75, the difference in the dating pattern could be of some consequence in the measurement of real inputs as suggested by the figures below. Of course, the effect on gross product originating depends also on the use of appropriately lagged deflators on the output side.

Year-to-Year Percentage Change in Wholesale Prices For 12 Months Ending in

	December	September
1974	18.9	17.1
1975	9.2	13.6
1976	4.6	4.7

RECOMMENDATIONS

Improvement in price data collected for the Wholesale Price Index is one of the most important steps the Federal Government can take to enhance the quality of estimates of the inventory and other components of the GNP. Recommendations made in the Ruggles report to the Council on Wage and Price Stability should be adopted, and numbers 1 through 3 below are meant to add emphasis to the Ruggles report.

1. BLS should greatly expand the number of annual price quotations it obtains in order to provide a kind of price benchmark. This could consist of annual averages as well as monthly or quarterly data. This kind of benchmarking would be analogous to what the Census Bureau now does in its annual retail trade survey (ARTS), discussed in chapter 3.

2. The timing dimensions of the price data stand in greatest need of improvement. In this regard, BLS should conduct a study of the kinds of prices actually being reported now so it can assign a description to each published commodity price index indicating whether it is primarily based upon shipments prices, orders prices or a mixture of the two. Firms reporting orders prices should be asked about the average time span from order to delivery. This can be done promptly and would greatly enhance the utility of the WPI until more fundamental improvements are made.

3. For deflating inventories and other components of the GNP shipments prices are required. However, monitoring price developments in the economy requires orders prices. As a long-run goal, therefore, data on both types of prices should be collected. In practical terms, BLS should collect both types of prices for those commodities where the distinction between the two types is appropriate. The distinction is applicable to a much broader range of goods than capital goods.

The WPI should not be exclusively an orders price index or a shipments price index. If it were the former, BEA could not carry out its deflation properly because the average lag between orders and shipments, as well as the dispersion around the average, is variable. Consequently, knowing what a normal lag is would permit only approximate dating for prices in shipments. On the other hand, if the WPI were solely a shipments price index its monitoring function would be seriously compromised since shipments price changes lag behind orders price changes. It should not be constructed so as to be a compromise between monitoring and deflating functions. Each function is much too important in its own right to warrant such treatment.

4. To the extent that inventories are purchased materials the appropriate price for deflation is the price at which goods are received by the purchaser. Therefore:

- BLS should expand the amount of detail in its rail freight rate index and should speed up its program for the development of truck freight rate indexes.
- BEA should begin to incorporate into its deflators some of the railroad freight rate data now being published by BLS.
- BLS should speed up its program for import price statistics.
- BEA should use for inventory deflation the import price statistics now available from BLS at least on an experimental basis.

5. Ruggles focuses on the WPI as a measure of producers' prices and notes that these prices may not behave in the same fashion as, say, wholesalers' prices. Wholesalers account for a substantial portion of all goods purchased by other businesses; sales of merchant wholesalers are now more than $500 billion annually. Because merchant wholesalers typically sell for immediate or spot delivery their prices are undoubtedly more sensitive than producers' prices which may refer to long-term contracts to a much greater extent. Consequently, any wholesalers presently reporting in the WPI survey should be segregated and shown as a separate component in the published indexes. Further, BLS should substantially increase the number of price quotations obtained from wholesalers. Such quotations will not only provide more sensitive indicators of market conditions but also will make possible more accurate estimates of purchasers' prices.

NEW BLS PROGRAM

After this chapter was written, BLS announced a long-range comprehensive revision of the Wholesale Price Index.

The program was a product of long-range plans and was also affected by criticisms of the WPI made during the recent years of high inflation and in the Ruggles report. The BLS program should help overcome a number of the problems cited in this chapter. In this regard the following features are relevant:

a. Coverage of mining and manufacturing will be complete. (Other sectors will follow.)

b. Probability samples will be used and error measures will be available.

c. All types of transactions will be priced–spot and contract, large shipments and small, sale to user and distributor, sales by both major firms and minor ones, etc.

d. Prices will be for current shipments.

e. Increased effort will go into obtaining transaction prices.

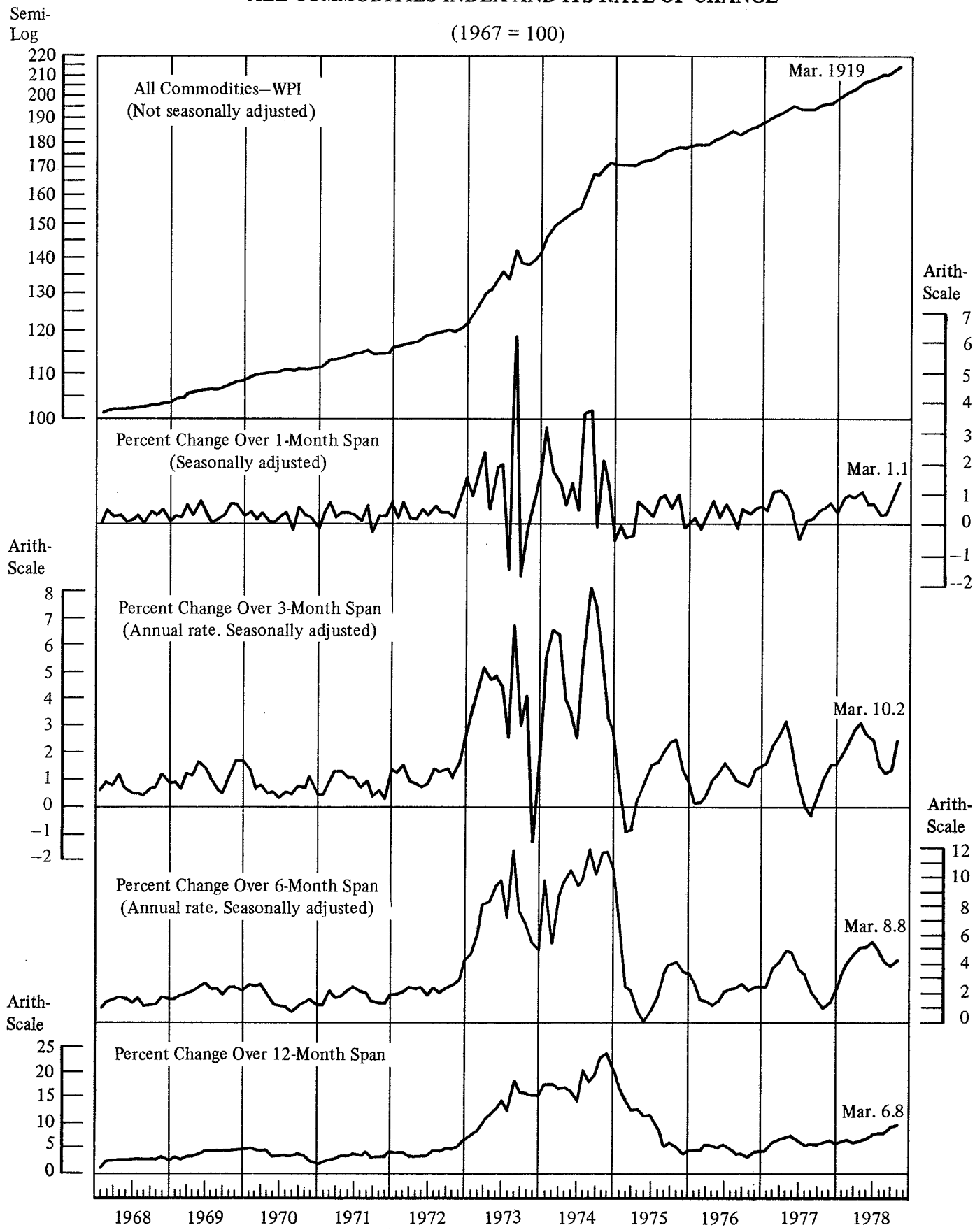
f. Classification will be SIC-based.

g. Industry output price indexes will be net output weighted.[18]

For monitoring prices it is still important that BLS initiate collection of data on orders prices.

[18] Letter, W. John Layng, assistant commissioner, prices and living conditions, Bureau of Labor Statistics to Murray Foss, National Bureau of Economic Research, January 11, 1978.

Figure 1. **WHOLESALE PRICE INDEX 1968-1977**
ALL COMMODITIES INDEX AND ITS RATE OF CHANGE



Source: Bureau of Labor Statistics, Wholesale Price Index.

Figure 2. **PROPORTION OF TOTAL QUANTITY OF COAL AT STEAM ELECTRIC PLANTS PURCHASED AT SPOT PRICES (FPC)**

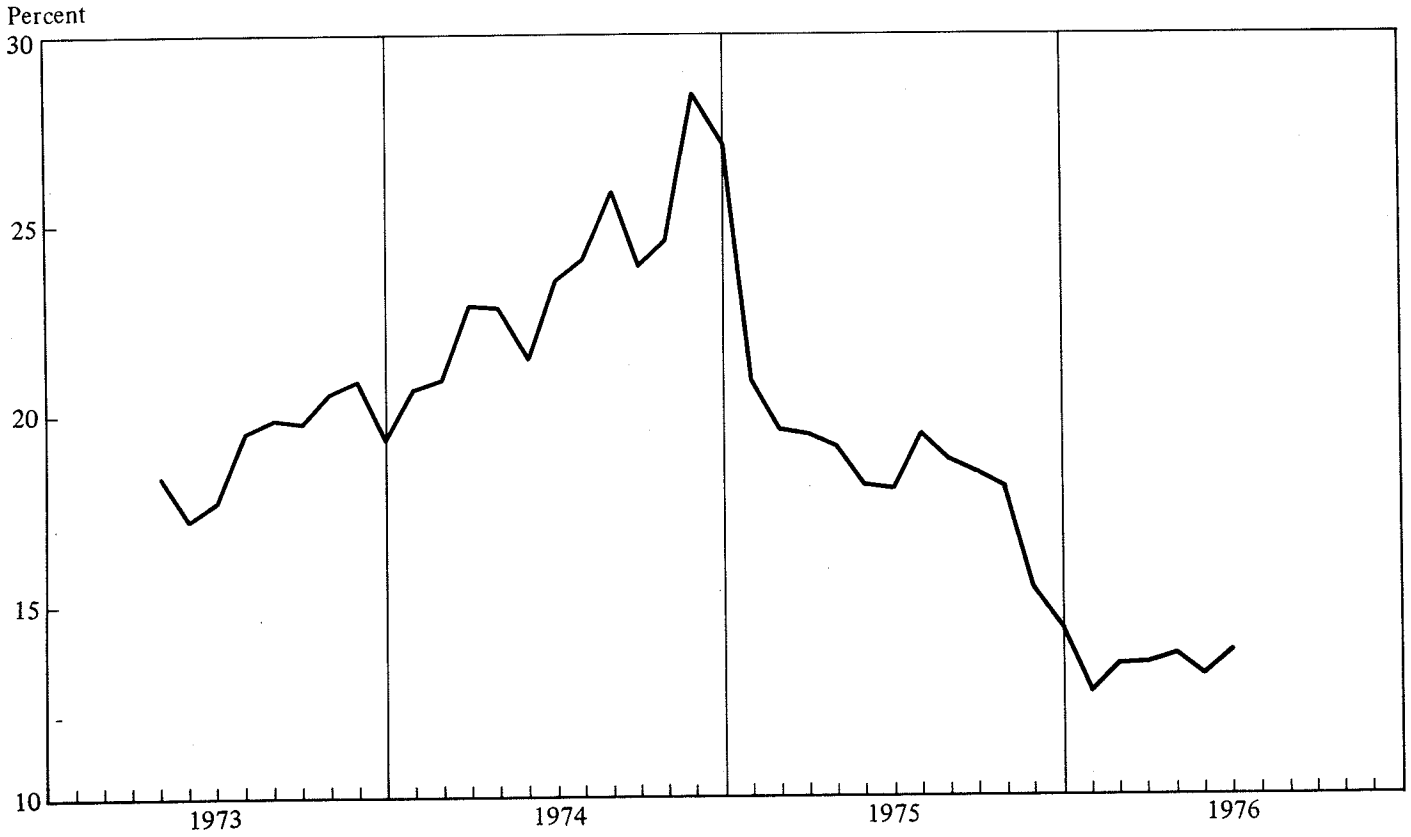
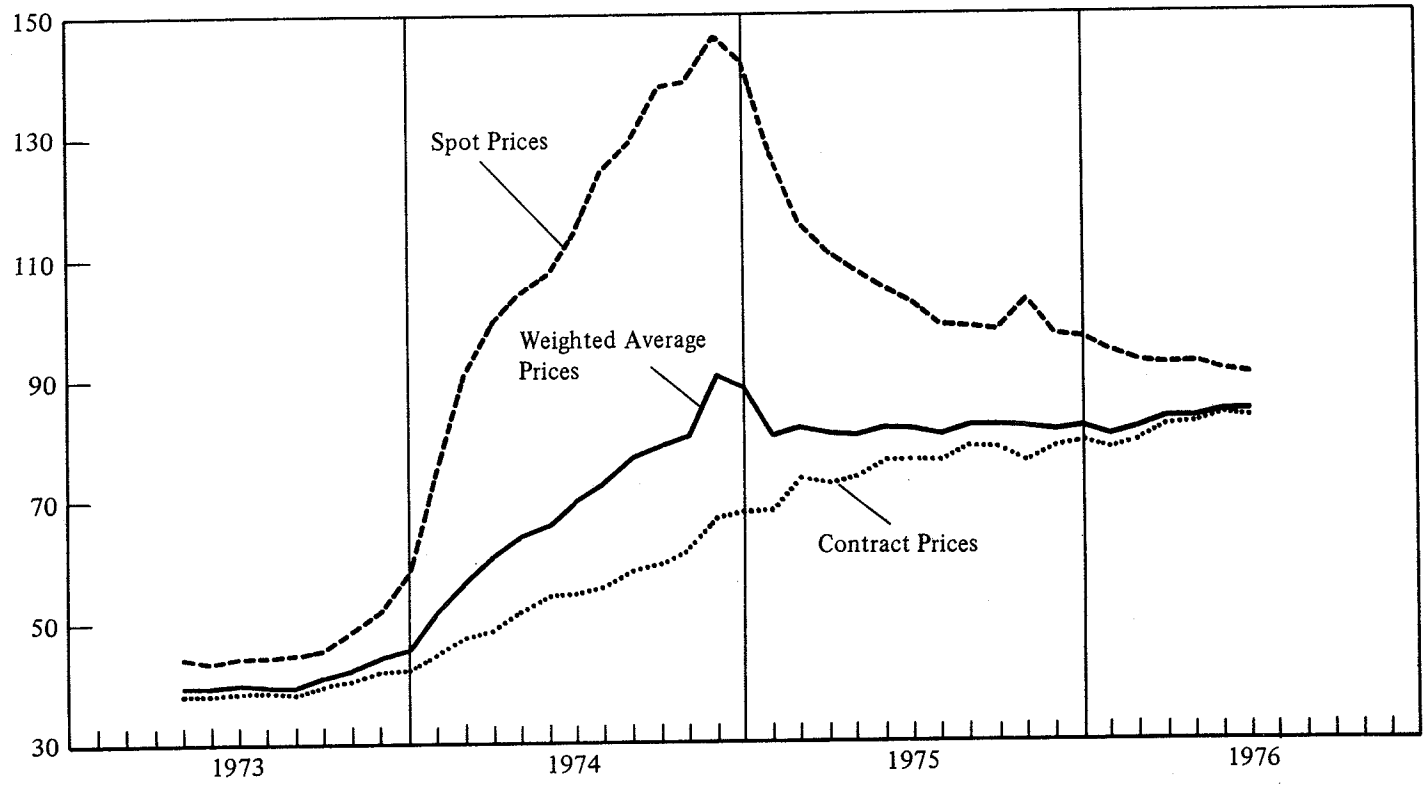


Figure 3. **SPOT PRICES, CONTRACT PRICES, AND WEIGHTED AVERAGE PRICES OF COAL DELIVERED TO STEAM ELECTRICAL PLANTS**



Source: Basic data from Federal Power Commission.

Figure 4. **WPI AND FPC WEIGHTED AVERAGE PRICES OF COAL AT STEAM ELECTRIC UTILITIES**

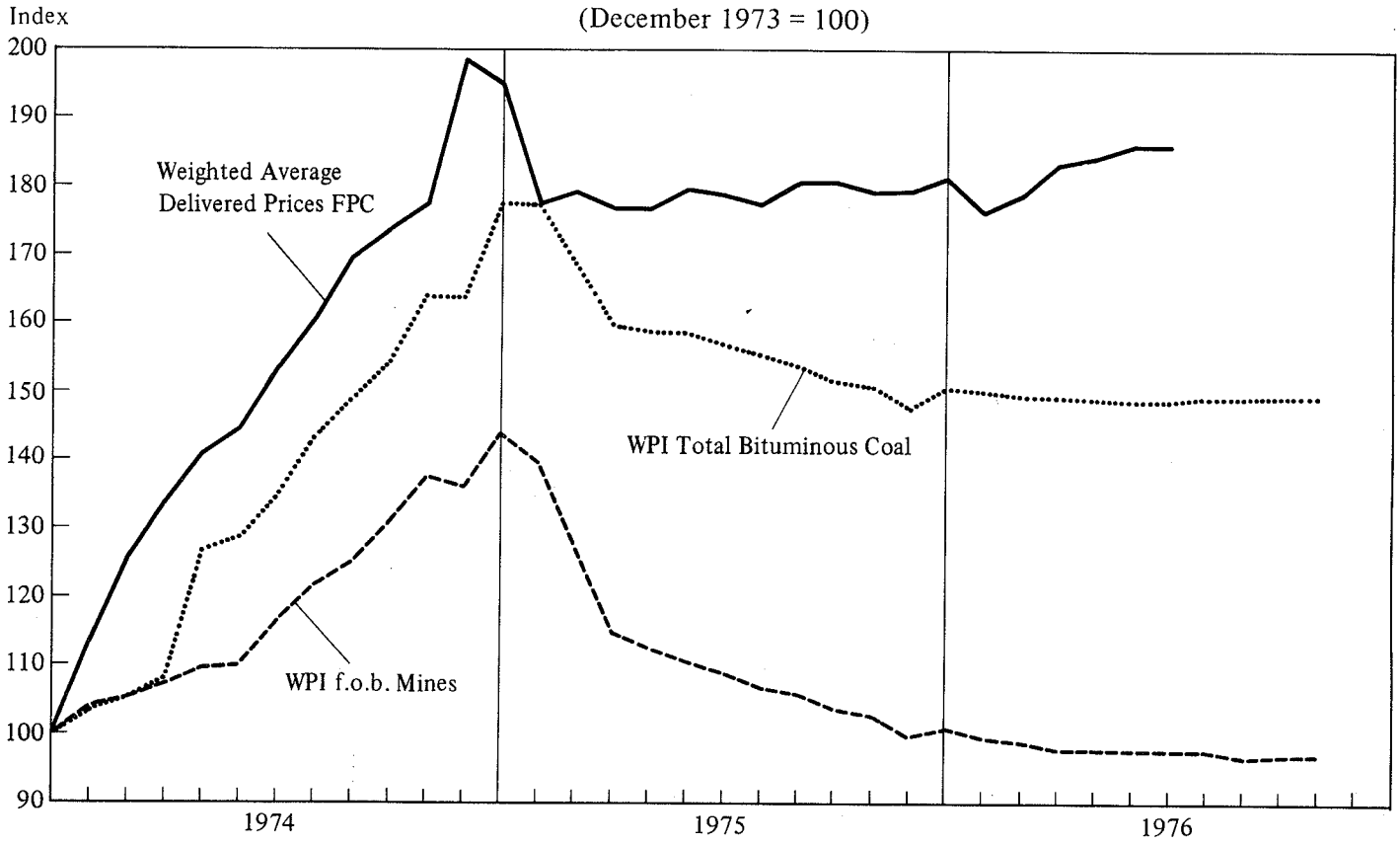
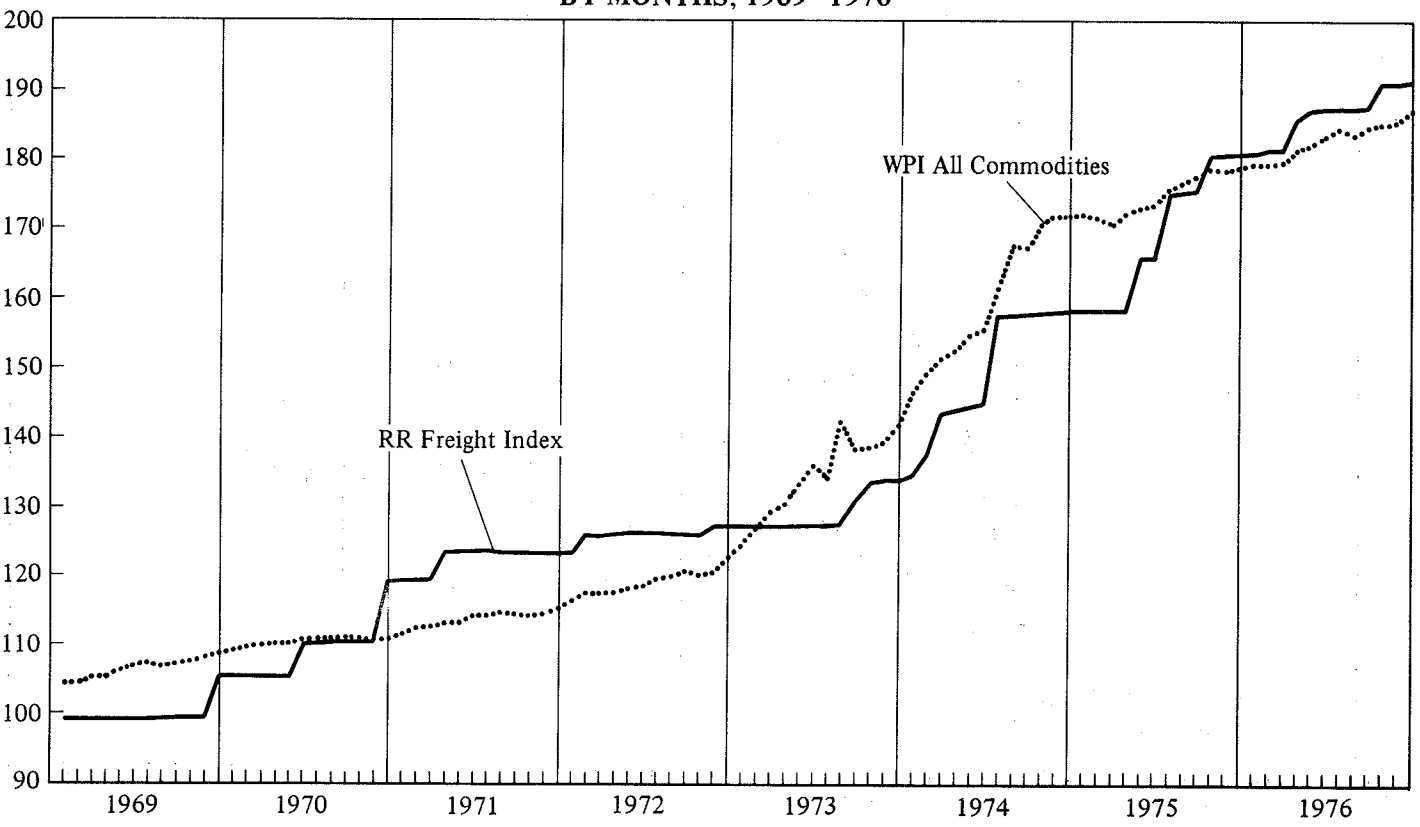
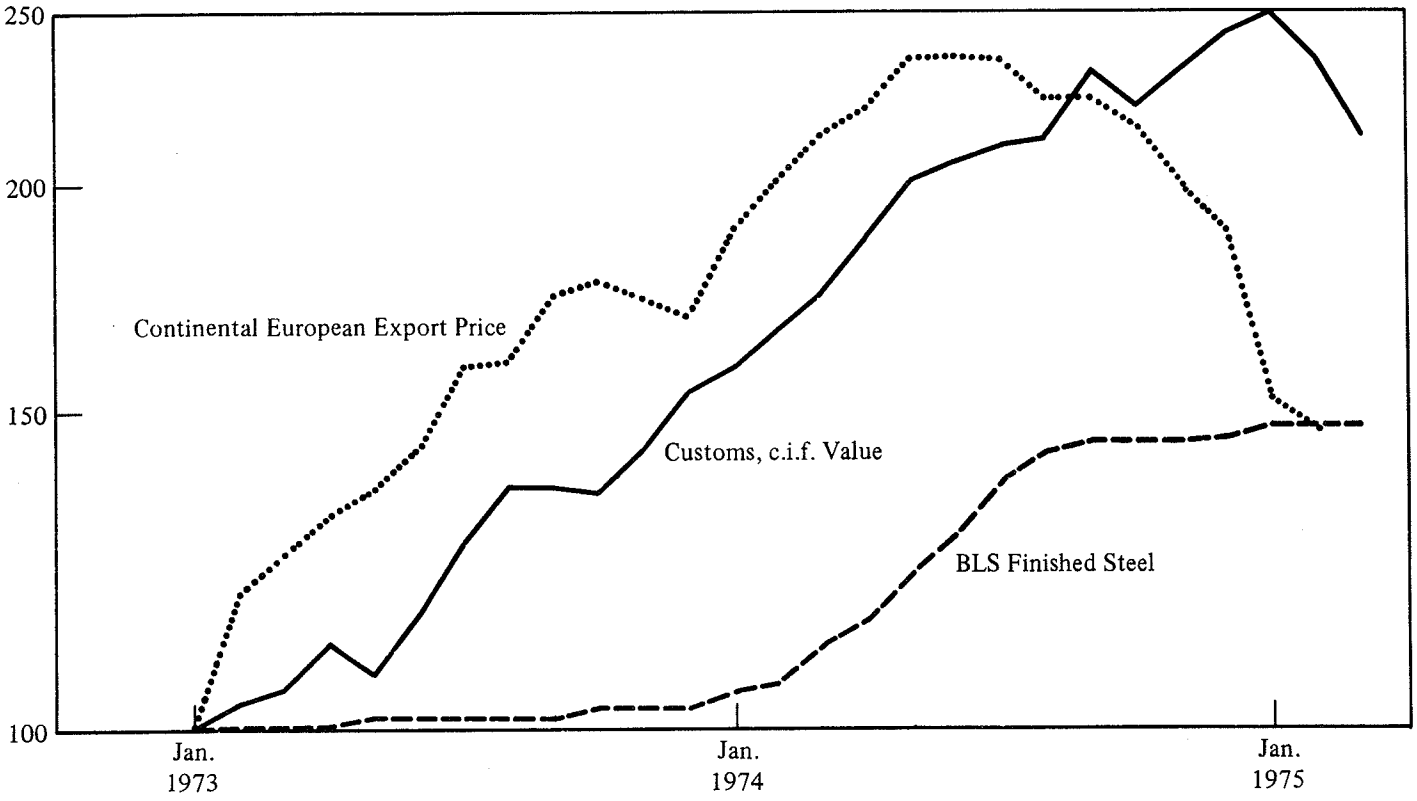


Figure 5. **COMPARISON OF WPI AND BLS RAILROAD FREIGHT INDEX BY MONTHS, 1969–1976**



Source: Basic data from Bureau of Labor Statistics.

Figure 6. **STEEL PRICE COMPARISON: BLS (WPI) VERSUS PRICES OF FOREIGN STEEL**



Source: Council of Wage and Price Stability, A Study of Steel Prices (July 1975), p. 64.