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important influence. For example, shipments to Britain of military equipment not currently produced were included in exports, even though they brought no immediate income, the export being directly offset by an inventory decumulation, both in the income accounts and in a causal sense.

To sum up, this method of interpreting changes in income components assigns an active and independent role to certain elements in the trade balance and to that part of domestic investment not directly accounted for by the accumulation of imported materials. On the basis of the propensity estimates previously used, the $1,039 million 'autonomous' improvement in the trade balance from 1939 to 1940 must have been responsible for an increase in income amounting to $2,375 million, or more than half of the total increase. The remaining increase in income, $2,125 million, is attributable to a higher rate of domestic investment (other than the part of inventory excluded above) and to random factors not already accounted for.

Conjectural though all these figures are, they suggest that developments abroad, even apart from their influence on domestic plant expansion, have caused an increase in national income during 1939-40 that possibly exceeds that of domestic capital formation and is certainly unprecedented in the last twenty years.

Part Five

FORECASTING NATIONAL INCOME AND RELATED MEASURES

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Discussion

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Forecasting National Income and Related Measures

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FORECASTS OF national income and related indications of the purchasing power of consumers are very useful to the United States Department of Agriculture and to the farmers and agricultural business men it serves through the 'outlook work' of the Bureau of Agricultural Economics. Changes in consumer incomes are responsible in large part for year to year changes in the prices of farm products, and to an even greater extent for the changes in farm income. In administering its various action programs, the Department is directly and vitally concerned with changes in the purchasing power of consumers, which greatly influence the funds required, the type of program likely to be most effective, the timing of action, and the formulation of procedural details.

I   Methods

Numerous attempts have been made to derive mathematical or statistical barometers that could be used in forecasting business conditions and related factors. The Bureau staff engaged in analyzing and forecasting national income and related demand conditions has not found any such automatic forecasting devices upon which reliance can be placed. Although many statistical indications are utilized, the ultimate forecasts are in large degree subjective, that is, they are based on appraisals. Lack of satisfactory quantitative measures of many of the conditions affecting changes in income impede objectivity. Unfortunately, business or industrial data in general are much less complete than the agricultural data used by the Bureau in forecasting agricultural commodity prices.

The authors of this paper, therefore, wish to emphasize at the outset that the charts and other statistical devices used in forecasting national income and related economic factors are not intended as objective statistical tests of hypotheses concerning relationships among these factors, but rather are for the purpose of forming such hypotheses. This paper is intended to describe some of the methods used by the Bureau staff in forecasting economic conditions affecting national income; not to advance, prove, or disprove any theories regarding the causes of changes in national income. Some of the problems encountered may be illustrated by referring to forecasts

of national income for 1942 as made in September 1941 and revised in January 1942, but no attempt will be made to describe the complete basis for such forecasts.

A   Forecasting nonagricultural national income

Separate forecasts of nonagricultural and of agricultural national income are combined to constitute a forecast of national income.

A forecast of industrial activity, as represented by Federal Reserve indexes, is the starting point for all methods of forecasting nonagricultural national income. Under what we may designate Method I the approach is through several steps: (a) factory production is estimated by weighting estimates for various industrial groups; (b) factory employment is estimated from expected factory production, by readings from the regression line for 1934-40 (Fig. 6); (c) factory payroll per worker is estimated partly from its relation to the level of employment (Fig. 7) (for 1942, it was necessary to base the estimate largely on an appraisal of trends prevailing during World War I as shown on the chart, and which evidently are being repeated in this war): (d) the two foregoing estimates are then multiplied and the result used as an independent variable in estimating nonagricultural employees' compensation, based on Figure 8 (the position of the observations for 1938-41 was a determining factor in the estimate for 1942); (e) nonagricultural income payments are estimated from nonagricultural employees' compensation by using Figure 9 (again, in forecasting 1942, much weight was given to the position of the observations for 1938-41); (f) nonagricultural national income is estimated from income payments by using Figure 3. By this method nonagricultural national income for 1942 was forecast as $100 billion.

The charts used in the foregoing procedure merely formalize a process of building up the estimate of nonagricultural national income that has been used in the Bureau for many years. The approach is really much less mechanical than the brief description might indicate. The large element of personal judgment involved has disadvantages as well as advantages. In an effort to evolve a procedure having fewer steps, two other methods of arriving at a forecast of nonagricultural income have been developed.

Under Method II, the situation is first appraised without regard to changes in the price level, then an adjustment is made for prospective price changes. For this purpose it is necessary to use some factor as a 'deflator' which should be as nearly as possible a measure

of changes in the general level of prices of goods and services enter-
ing into national income. As there is no such measure, a series,
believed to be correlated with the desired measure, is substituted.
Various analysts working in this field have used the Bureau of
Labor Statistics cost of living index, which purports to be an index
of retail prices of goods and services. Another series commonly
considered an index of the movements of the general price level
is the Bureau of Labor Statistics index of wholesale prices of all
commodities. It, however, does not include prices of services, which
constitute a substantial part of total business transactions. More-
over, wholesale prices may fluctuate more than wages, service fees,
and all other prices entering into what may be termed the general
price level. In other words, the cost of living series, although not
representing the measure actually desired as a deflator, may be more
highly correlated with it than any other available series. In any case,
higher correlations are obtained between nonagricultural national
income and industrial activity when the cost of living is used as a
deflator instead of wholesale prices. Nevertheless, strong differ-
ences of opinion exist among the Bureau staff regarding the jus-
tification for using the cost of living index.

Using this deflator, the procedure under Method II is relatively
simple. Figure 1 shows the relation between industrial production
and deflated nonagricultural national income, with regressions for
three periods. Given a forecast of industrial production, estimated
by methods outlined in Section I D, an estimate of nonagricultural
income in 1940 dollars may be obtained by reading from the re-
gression line, using judgment liberally. In making a forecast for
1942, for example, a large degree of extrapolation was necessary.
This was done by extending a line passing through 1938-40. The
preliminary estimate for 1941, made after the line was placed on the
chart, was found to be very close to the line. Reading from the
1938-40 line gave $87 billion for 1942 in 1940 dollars. The next
step was to adjust for the prospective change in living costs, as
estimated by methods noted in Section I E. After rounding, this
gave nonagricultural national income for 1942 of about $105
billion.

Method III uses Figure 2 to obtain a forecast of nonagricultural
income payments, and Figure 3 to obtain a forecast of nonagricul-
tural national income. It gives only a slightly higher nonagricultural
national income for 1942 than Method II, if in Figure 2 the extra-
polation is based on a line passing through 1939, 1940, and 1941.

The 1941 tendencies and the probable effect of war conditions on
nonagricultural income payments in relation to industrial produc-
tion are the justification for this procedure.

B   Forecasting agriculture's contribution to national income

Agriculture's contribution to national income was forecast by first
estimating cash income from farm marketings, using Figure 4. The
'nominal value of farm production', used as the independent varia-
ble in this chart, is a combination of separate estimates of prices
received by farmers and of agricultural production. The latter was
used instead of marketings because a forecast of this item is avail-
able when the national income forecasts are made; production,
however, includes quantities for consumption on the farm, and it
is expected to be replaced by marketings when a better basis for
forecasting marketings becomes available. The forecast of prices
received by farmers was obtained by methods described in Sec-
tion I E.

In forecasting cash income from marketings in 1942, the line
representing the 1938-40 relationship (Fig. 4) was again used, de-
spite the relatively small scatter about the line for the entire period
1910-40. This decision was based partly upon the positions of the
observations for recent years and partly upon a detailed analysis of
the situation by commodities, which indicated that cash income
from farm marketings would bear a higher relation to the so-called
'nominal value of farm production' in 1942 than in most of the
years included in the chart.

Given the forecast of cash income from marketings, the next step
was to relate it to agriculture's contribution to national income as
shown in Figure 5. An extrapolation of the regression for 1922-40
was used, since the relation seemed to have been fairly consistent
throughout the period and the observation for 1941 fell close to
the line.

After government payments had been allowed for and the figures
rounded, these two computations indicated that agricultural na-
tional income would be about $10 billion in 1942.

C   The national income forecast

The final step in forecasting national income by these procedures
is to choose among the several forecasts of nonagricultural national
income and combine the selected figure with the estimated agri-
cultural contribution. In this choice, a large element of judgment

is necessarily involved. There is danger, of course, of selecting the estimate that agrees with the forecaster's *a priori* judgment or hunch, then rationalizing this choice. This danger could be obviated by first taking into account all the considerations relating to the appropriateness of the several methods, choosing one, and sticking to the result regardless whether it agreed with the more intuitive preliminary appraisal of the situation. Such objectivity, however, does not seem to be justified at the present stage of forecasting techniques.

In forecasting national income for 1942 there were reasons for believing that income would be somewhat lower than the prospective levels of industrial production and prices might indicate. There were good reasons to believe that nonagricultural national income would not be as high as usual relative to production in 1942. Services could hardly be expected to increase in their usual ratio to industrial production, in view of the prospective shortage of labor, the decline in the use of automobiles, and the general draft of wartime requirements on non-essential industries and occupations. Moreover, much of the wartime industrial production does not enter into the ordinary channels of trade and hence requires less servicing in marketing. These conditions had been taken into account to some extent in extrapolations of the regression lines in the chart, but it was believed that no such use of historical relationships would sufficiently allow for them.

For these reasons, among others, the lowest of the three forecasts of nonagricultural national income, $100 billion, was used. Adding to this figure the forecast of agriculture's contribution, $10 billion, brought the total for 1942 to $110 billion.

This was the figure finally used as the Bureau's forecast of national income for 1942. However, it was made before recent revisions in the estimates of national income by the Department of Commerce raised the estimates for recent years and affected the basis for forecasting income for 1942 and subsequent years. Allowance for this factor would make the effective forecast for 1942 between $110 and $115 billion.[1]

Each method of forecasting nonagricultural national income uses as a base a forecast of industrial production (as measured by the Federal Reserve index). The agricultural portion depends also

[1] Revisions have added about one half billion dollars for 1940, a billion for 1941, and the official estimate for 1942 is $120 billion. Had these revisions been used in the charts top range of the forecast for 1942 would probably have been $117 billion.

upon a forecast of prices, and the latter also is an essential element in forecasting nonagricultural income under Methods II and III. Hence, a description of the methods used by the Bureau in forecasting national income would not be complete without reference to the procedures followed in forecasting industrial activity and the general price level.

D   Forecasting industrial production

In general there are two methods of forecasting industrial production: (1) the over-all approach, (2) the individual industry approach. Both are used to some extent by the Bureau, as by practically all forecasters.

Forecasting by either method presents a dilemma fully as difficult as that of the chicken and the egg. The output of individual industries is importantly conditioned by industrial activity as a whole; but the latter is only the sum of production in the several industries. Hence, either approach involves an objectionable though unavoidable degree of circular reasoning.

Various general or over-all economic criteria are commonly used in forecasting industrial production, including: (1) changes in factors affecting over-all money purchasing power, including the net contribution of the government, of private investment and saving, and of the international balance of payments; (2) the relation between the production of durable and of nondurable goods; (3) the relations among prices and costs; (4) indications of 'business confidence' or lack of it, as given by such measures as the ratio of stock prices to bond prices; (5) the movement of various financial or banking measures; (6) characteristic features of different phases of the business cycle, such as speculative activity, advance buying; (7) comparison of the timing of the prevailing movement with a 'typical cycle'; (8) changes in the items included in the over-all industrial 'balance sheet', such as production, consumption, inventories, and new and unfilled orders, subject to data difficulties previously referred to.

In the Bureau's forecasting all these general criteria are taken into account, yet little reliance is placed on any one. The reasons for this lack of faith are too numerous and complicated to mention. Suffice it to say that in actual experience no one criterion has proved satisfactory as a basis for forecasting.

The second type of approach, based on forecasts of the output of

individual industries, has been found more consistently reliable. Under it the output of the major lines of production is estimated and the weighted index is derived. This is not as complicated or endless a procedure as might at first be assumed, since relatively few industries have a very large total weight in the index. Figure 10 shows fluctuations in these important industries contributing to the Federal Reserve index from 1923 through 1941, the lines for the separate items taking into account both the actual changes in their output and their weights in the index.[2]

In estimating the output of the several individual groups of products it is of course necessary to take into account the general economic situation, but the forecaster has as a starting point the general situation as it exists when the forecast is made. What, then, is there in the situation for each separate industry that would be expected to increase or decrease output during the period ahead? Many factors must be considered. Ordinarily these relate chiefly to prospective demand for the products in question, but with demand (at current prices) in excess of supplies of many commodities under wartime conditions the problem since mid-1941 has become more that of forecasting capacity than demand. Since the capacity of some industries has changed greatly subsequent to peak operations in 1929 this situation has presented new difficulties.

Some of these difficulties may be brought out by referring to the Bureau's forecast of industrial activity for 1941 made in September 1940. It proved too low, partly because of a revision of the index in 1941, but largely because of gross underestimation of the output of two groups of items: machinery and transportation equipment. The subsequent increase in the output of machine tools of perhaps 50 per cent indicates that too much trust was placed in semi-official statements issued in autumn 1940 that this industry was already operating at capacity. Rapid changes in the composition of machinery production during the war also add to the forecaster's difficulties. For example, with airplanes given less weight than ice cream in the index, but with airplane motors included in the output of machinery on a man-hour basis without much opportunity for determining their relative importance, there has been little upon which to base appraisals of the effect of increasing production of airplanes on the machinery index as a whole. The same applies to

[2] Lack of time has prevented adjustments in the chart to allow for recent minor revisions in the index.

other war equipment. The revision of the Federal Reserve index in 1940 to include the industrial vitamin B complex, machinery, was indeed a hard blow to the forecaster even though it improved the index!

In relating the general situation to that in individual industries charts similar to Figure 11 are used. Output in individual industries such as iron and steel is estimated on the basis of the preliminary over-all forecast of industrial activity, and resulting estimates are compared with appraisals of reasonable industry outputs based on other criteria. This is a quite different procedure, however, from the mechanical process of starting with a preliminary over-all estimate and combining individual industry estimates obtained by readings from the several regression lines. The latter procedure may be quite misleading. If the correlations were perfect (or if partial regressions were used) the end result would be the same as the preliminary forecast! Thus, any difference between the final and the preliminary forecast would represent merely noncompensating errors in the relationships as depicted by the charts, and the final 'corrected' estimate would have no more meaning than the preliminary.

This cursory survey of the general procedure followed by the Bureau in forecasting industrial activity may be illustrated by the forecasts for 1942 as made in September 1941 and revised early in January 1942. Needs for war equipment, centering largely in the metal trades, could be expected to keep output in these lines at capacity during most of 1942, allowing for the effects of the change-over from peacetime production during the first part of the year. But even this change-over could not be expected to reduce production materially in these lines for the year as a whole, since it would be logical to assume that all the metals and associated materials to become available during the year would be utilized. Industrial production had been advancing rapidly during the first half of 1941, but on a seasonally unadjusted basis had been almost stationary since midyear. This could be taken to indicate that the capacity of existing facilities had been about reached, and that the prospective large increase in the production of war goods would be mainly at the expense of the output of civilian goods made from the same materials. Large inventories of materials had been accumulated by manufacturers during 1941, however, and probable partial utilization of these supplies plus the coming into operation of

some new steel-making and other metal trades facilities offered prospects of a relatively slight increase in the average rate of operations in 1942 compared with those prevailing during the latter part of 1941. Numerous other factors in the general situation had to be taken into account, of course, but the conclusion based on over-all conditions was that the general level of industrial activity in 1942

TABLE 1

Industrial Production, United States, 1925, 1929, 1932, 1937-1941, and Forecast for 1942

(Federal Reserve Board index, adjusted for seasonal, 1935-39 = 100)

	% weight[1]	1925	1929	1932	1937	1938	1939	1940	1941[2]	1942[3]
Manufactures										
Iron and steel	11.00	108	133	32	123	68	114	147	186	195
Machinery	10.81	89	130	43	126	82	103	135	210	275
Transportation equipment	5.92	106	134	38	123	72	103	145	234	350
Nonferrous metal	2.81	104	136	52	122	80	115	137	183	200
Lumber and products	4.39	148	146	51	113	90	106	116	134	135
Stone, clay and glass	3.00	101	110	51	114	92	114	121	152	150
Textiles and products	11.22	84	94	71	106	85	112	114	151	155
Leather and products	2.28	88	95	76	102	93	104	97	121	130
Manufactured food products	10.92	85	101	79	103	101	108	114	128	150
Alcoholic beverages	1.84				108	96	98	101	116	110
Tobacco products	1.24	85	96	79	103	102	106	109	120	135
Paper and products	3.13	66	85	65	107	95	114	123	140	150
Printing and publishing	6.44	84	104	74	109	96	106	111	124	125
Petrol and coal	2.14	69	96	69	108	100	110	116	127	140
Chemicals	6.27	63	89	68	112	96	104	114	139	180
Rubber products	1.39	81	100	64	104	83	113	123	148	75
Minerals										
Fuels	13.01	87	103	72	109	99	105	114	121	135
Metals	2.19	121	134	36	127	86	113	134	149	160
Total industrial production	100.00	90	110	58	113	89	108	123	156	177

[1] Percentage weights assigned to the various groups in the new Federal Reserve index of industrial production.

[2] Preliminary, annual average of monthly indexes without seasonal adjustment.

[3] Advance BAE forecasts.

would average somewhat higher than in the latter part of 1941, with a continuation of the sidewise movement during the first part of the year followed by a resumption of the upward movement.

The next step was to estimate the output of individual industries, but no attempt was made to bring the weighted average into conformity with the forecast based on over-all conditions. The estimates for the various groups of industries are shown in Table 1 with

data for some preceding years for purposes of comparison. They vary from a reduction of about 50 per cent to an increase of as much. It would require a volume to delineate the considerations taken into account in making these individual industry estimates, including as important items priorities, military requirements, and availability of materials.[3] When weighted and summed, the separate industry forecasts indicated an average index for the year of 177 which was within the range of 10 to 15 per cent (172-180) above the 1941 average indicated by the over-all analysis.

It was recognized that both the over-all and individual industry indications might be too low because of the shift of the Federal Reserve index to more nearly a man-hour basis combined with a coincident increase in the number of man-hours per ton of raw materials in the production of industrial goods in wartime. However, there being no satisfactory statistical basis for an allowance for this factor, none was made.

E   The general price level

Many of the considerations discussed in connection with the forecast of the general level of business activity are encountered in forecasting the general level of wholesale and retail prices. Both the over-all and the individual commodity approaches are used.

It was assumed that the purchasing power of consumers was likely to increase in 1942 as a result of the war effort and that the output of goods for civilian use would decline, creating a strong upward pressure on prices. One over-all approach to forecasting the price level in 1942 was an attempt to measure the degree of these forces. As the method described below had not yet been tested by experience and is subject to criticism on several counts, it should be taken as the responsibility of the authors, not of the Bureau.

To estimate the money available to spend on consumer goods and services, national income at the 1941 general price level, made by the methods described above, was first forecast. Then an estimate of the prospective increase in federal, state, and local taxes applying to individuals was subtracted. The result was taken to be a rough estimate of the purchasing power of consumers in 1942 assuming

[3] In thus inviting disaster by releasing these individual industry estimates, the authors wish to offer an alibi by pointing out that many of the decisions that will govern the utilization by industries of available materials and labor are still to be made, and that changes in the allocation of man-hours among industries included in the index might bring radical changes in the individual items yet not greatly affect the total.

no change in the general price level. It indicated a slight increase in 1942 over the average for 1941.[4]

The quantity of processed goods to become available for civilian use in 1942, estimated by deducting from estimated total output the quantity likely to be diverted to war production and exports, was about 20 to 25 per cent below the 1941 level, or at about the 1939 level.[5] Partly offsetting this reduction, of course, might be a considerable (absolute) increase in the services purchased by consumers. But if we assume no change in the latter, the combined volume of goods and services available to consumers would be somewhat less than 20 per cent smaller in 1942 than in 1941. This would mean an increase in purchasing power relative to goods and services, or what is sometimes referred to as the 'inflation gap', of about 25 per cent (that is, a ratio of available money to available goods, with 1941 as a base, of 1.25) and, therefore, a strong upward pressure on prices.[6] If the marked increase in inventories of consumers' goods in the hands of dealers and producers in 1941 and the probable substantial decrease in 1942, and the proportion of the increase in defense bond sales that would actually affect consumer expenditures were allowed for, the 'gap' would be much smaller, ranging from 0 to 15 per cent depending upon the particular assumptions with respect to these factors.[7]

Actually, of course, the so-called inflation gap must be covered either by diverting the excess income to other uses (taxes, defense bonds, and other savings) not allowed for by the computations or by a rise in the level of prices sufficient to absorb the excess income. Although no attempt was made to translate this gap directly into

[4] In addition, of course, increases in sales of defense bonds might be deducted. The actual effect on money available to consumers for current spending is difficult to evaluate, however, because a considerable proportion of such sales are to institutional investors or are paid for from funds representing idle bank deposits, and hence do not constitute a deduction from current income that would otherwise be used for purchasing. The same may be said, of course, of some taxes that have been deducted, but in the authors' opinion to a lesser degree.

[5] The procedure makes no allowance for inventory changes, and assumes: (a) war expenditures in line with the President's message to Congress, (b) no change in prices, (c) a number of man-hours per ton of raw materials no greater in the production of war than of civilian goods.

[6] This inflation 'gap' or 'wedge' is much smaller than similar estimates made (in terms of dollars rather than ratios) by several other agencies, some of which, at least, seemed to be erroneously based on a deduction of gross war expenditures from national income, a 'net' figure.

[7] If any percentage within this range is applied to the 1941 level of prices, the indicated level for 1942 is lower than the forecast, or than the level actually attained.

specific price forecasts, it seemed to check with forecasts made on other bases, as described below. This approach to forecasting the general price level, although relatively new and untried, may become more useful in the future as certain details are brought into better focus.

Other general factors in the price situation for 1942 included speculative or advance buying by business men, inventory policies, and the distribution of available supplies by commodities. During 1941 many of these forces were pushing hard on the general price level: both business men and consumers were attempting to buy against future shortages and prospective price advances. In addition, some new, and changes in some old, government programs affecting farm prices had served to accelerate the advance. With requisitioning of inventories and materials for defense purposes and other government controls in the picture for 1942, some of these pressures could be expected to diminish in 1942, although others would become stronger.

An influential factor in the situation would be more direct government controls over prices, expected to have an important influence on prices of raw and semifinished commodities which in turn importantly influence prices of other industrial goods. But it was recognized that even some controlled prices would have to rise if the inflation gap were not otherwise absorbed and if wages and other costs rose substantially. It might be necessary or desirable, also, to permit some price increases in order to encourage increased production.

Supplementing this appraisal of the general conditions affecting the probable movement of prices in 1942, prices of groups of commodities making up the Bureau of Labor Statistics index were forecast (Table 2). The final result of these computations was within the range of our over-all forecast of an increase in wholesale prices of all commodities in 1942 as a whole of about 15 to 20 per cent above the 1941 average.

Prices received by farmers may be related to wholesale prices of all commodities, as shown in Figure 12, and a forecast of the former made by using a forecast of the latter as determined by methods outlined immediately above. This forecast, in turn, is checked against one based on a weighted average of individual agricultural commodity price forecasts made by the several commodity analysts.

In forecasting living costs or retail prices, used as a deflator in

forecasting national income, Figures 13 and 14 are used. In these charts, and in others previously cited, price relationships tend to change from one period to another in what may be termed zig-zag fashion. Going up on one line, one series of prices relative to another is likely to decline on another line, rather than run back on the original, and to form still another line on the next general rise, although variations of individual observations within each period tend to be consistent with the relationship in effect for the period. Consequently, the greatest errors in using such relationships for forecasting purposes are likely to be encountered at the beginning or end of one of such periods composing a given line. In Figure 13 the observations for 1940 and 1941 are close to the

TABLE 2

Wholesale Prices, United States, 1917, 1918, 1941,
and Forecast for 1942 (Indexes, 1926 = 100)

	1917	1918	1941	1942
All commodities	118	131	87	105
Farm	129	148	82	105
Food	105	119	83	105
All excluding farm and food	114	125	89	105
Hides and leather	124	126	108	125
Textiles	99	137	85	115
Fuel and light	105	109	76	85
Metals	151	137	99	109
Building materials	88	99	103	115
Chemicals	165	187	85	100
House furnishings	74	93	94	120
Miscellaneous	122	134	82	100

line representing 1933-40. But since the pattern of change during World War I was quite different from that prevailing before and after, the relationships had to be interpreted with a large degree of judgment for purposes of making a forecast for 1942. It was believed that the rise in retail prices of nonagricultural products from 1941 to 1942 would be less precipitate than during the corresponding years in World War I because of more widespread and effective government controls, and the determined effort to keep purchasing power in more normal relation to the goods and services available for civilian consumption. Similar considerations were involved in the interpretation of Figure 14 in estimating retail food prices for 1942. After a purely judgment estimate of changes in rents from 1941 to 1942, the over-all living cost index was forecast by weighting the several components.

II   Reliability of Forecasts

The reliability of forecasts of national income and related items is difficult to evaluate chiefly for two reasons. In the first place, the published forecasts are usually not in strictly quantitative terms, resort being had by most forecasters to various terms indicating degree of change, such as 'slightly', 'somewhat', and 'materially'. Recognizing that these terms are not interpreted in the same manner by all readers, the Bureau has made some effort to standardize usage and otherwise reduce the confusion resulting from this practice, but for policy and other reasons the forecaster's language must remain less explicit than would be desirable from some standpoints. In addition, some forecasts are hedged by indicating possible alternative movements and in other ways. Hence, what is to be evaluated as to reliability is the net over-all impression given the reader by the forecast and its setting; consequently the evaluation must be in a certain degree subjective.

In the second place, the accuracy of even definite quantitative forecasts made for internal administrative use is difficult to evaluate. Suppose, for example, that a rise of 10 per cent in national income is forecast, and a rise of 15 per cent actually occurs. What quantitative measure of accuracy or its lack could be assigned to this forecast? If the forecast were stated as a range, and the actual figure fell within the range, it might be counted as 100 per cent accurate, but this might be misleading since the range could be made wide enough to give some very pleasing appraisals!

Moreover, even if it were possible to find a satisfactory method of arriving at such a percentage of accuracy, the question of 'tolerance' would arise, or the standard with which the percentage of accuracy should be compared. For example, weather forecasts might be correct in a large percentage of cases and yet not be helpful, since it would be possible merely by always predicting fair weather to have a high percentage of accuracy. Similarly, merely by following a general trend until a new one develops it would be possible to have an impressive average percentage of accuracy in forecasting national income and other economic conditions, but at the same time some important temporal changes would be entirely missed. A given percentage error in one forecast may lead to much more serious mistakes on the part of its user than would a similar error in the forecast of another factor. For such reasons, one series of

forecasts might be more helpful or 'reliable' than another even though its percentage of accuracy was lower.

The general policy of the Bureau has been that the forecasts are valuable if users (farmers, agricultural business men, and government officials) are better able to project future trends. According to this standard, an accuracy of 55 per cent in price forecasts for one commodity might be more helpful than an accuracy of 85 per cent for another commodity for which it is relatively easy to anticipate changes. Even forecasts of less than 50 per cent accuracy might be helpful to many people, since under several possible conditions their own forecasts might have an even lower percentage of accuracy. This would be true, for example, of many farmers and business men who tend to expand after periods of prosperity and to contract after depressions. Fortunately, however, the Bureau has not had to rely upon such cases in justifying the degree of accuracy attained in its forecasting.

Since February 1937 when forecasts of probable future changes in business conditions and national income were first published in the Bureau's monthly *Demand and Price Situation,* several fairly distinct movements of these conditions have occurred: (1) the depression beginning in autumn 1937, (2) the recovery beginning in spring 1938, (3) a relatively small recession, little more than a sidewise movement, in the first part of 1939, (4) the rise in the second half of 1939, (5) a rather sharp downturn in the first part of 1940, followed by (6) a rise through 1942.

The Bureau's annual and monthly outlook reports correctly anticipated each of these movements, not only of general business activity and national income, but also of most of the less important factors making up the over-all picture. The one important exception was the forecast made in the autumn of 1938 of 'somewhat higher' average commodity prices in 1939. Practically all groups of commodity prices averaged slightly lower in 1939 than in 1938, although they were rising during the second half of the year and nearly all measures of demand conditions were up in 1939 compared with 1938.
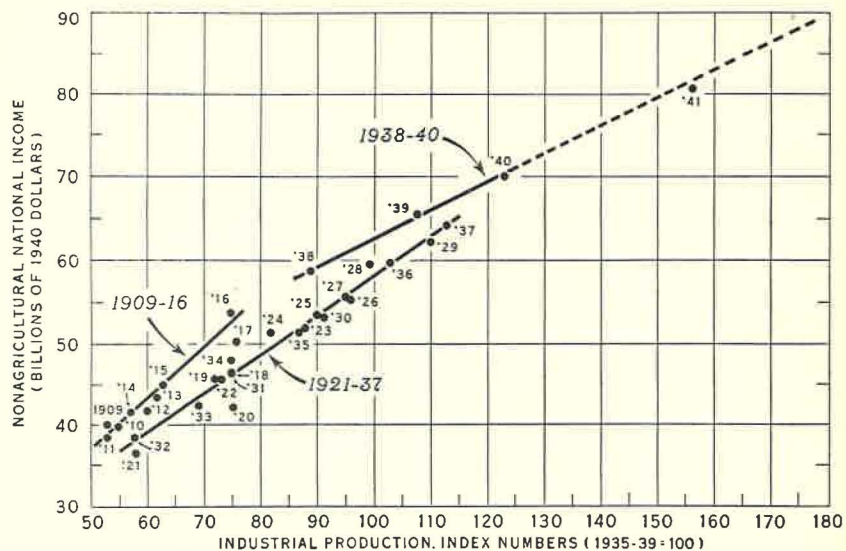
The authors of this paper wish it were possible to conclude with this pleasing picture of the accuracy of Bureau forecasts, but the record of the reliability of the forecasts with respect to the degree of movement is much less favorable. There was little in the forecast for 1938 (prepared in summer 1937) to indicate the severity of the depression that actually occurred. The speed of the recovery in the

second half of 1938 was also underestimated. Again, the degree of rise in 1941 proved much greater than that indicated by the Bureau's forecast issued in autumn 1940.

Despite these failures, the record as a whole during these years in which the Bureau has been making rather definite forecasts has been so good that the authors are confident it is due in no small degree to Dame Fortune. A longer period will be required to ascertain how many of the successes have been due to good luck and how many to progress in the development of a forecasting technique.

No one realizes more than the Bureau's staff the inadequacy of the methods. The principal need is for forecasting procedures in which personal judgment is exercised *a priori* in the selection of methods, weights, etc. as opposed to the selection of specific methods after the results of their application to the facts at any one time are known. This would help to avoid the danger, so great under present methods, of merely going through a statistical process of rationalizing hunches. As long as results depend so largely upon personal judgment they will be of fluctuating reliability, and changes in staff will mean the discarding of much valuable experience. A main impediment to the development of this kind of objectivity is the lack of comprehensive and reliable data. Method cannot be refined beyond limits set by the nature of the data. We have no satisfactory measures of the output and prices of services, an essential element in forecasting national income. Even the measures applicable to commodities are far from complete and satisfactory for these purposes. The estimates of national income itself are not entirely beyond question, and it is not always easy to determine whether an apparent error in forecasting is due to error in the forecast or in the estimate of the income for the year in question.
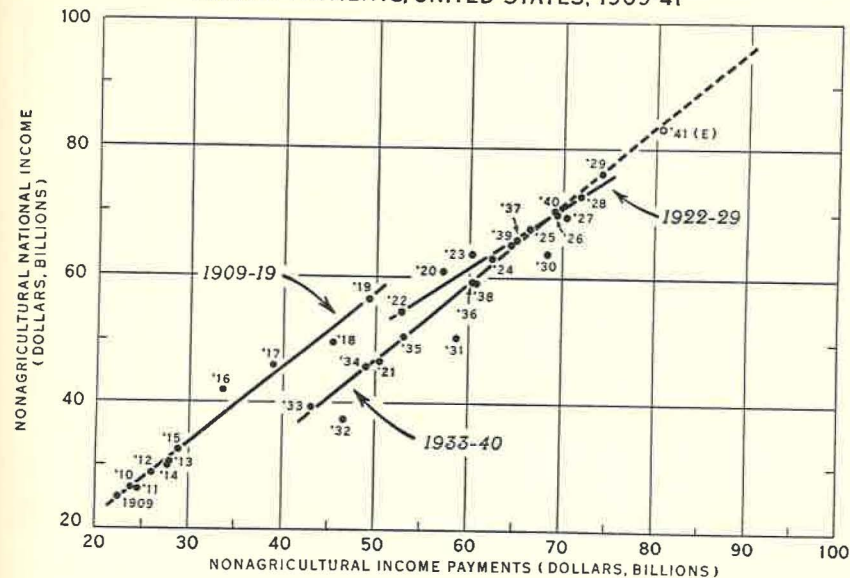
FIGURE 1

NONAGRICULTURAL NATIONAL INCOME RELATED TO INDUSTRIAL PRODUCTION, UNITED STATES, 1909-41

1938-40

1909-16

1921-37

NONAGRICULTURAL NATIONAL INCOME (BILLIONS OF 1940 DOLLARS)

INDUSTRIAL PRODUCTION, INDEX NUMBERS (1935-39 = 100)

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FIGURE 2

NONAGRICULTURAL INCOME PAYMENTS RELATED TO INDUSTRIAL PRODUCTION, UNITED STATES, 1909-41

1931-40

1921-30

NONAGRICULTURAL INCOME PAYMENTS, ADJUSTED FOR LIVING COSTS (BILLIONS OF 1940 DOLLARS)

INDUSTRIAL PRODUCTION, INDEX NUMBERS (1935-39 = 100)*

* CURRENT YEAR WEIGHTED BY 2 AND PRECEDING YEAR BY 1

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FIGURE 3

NONAGRICULTURAL NATIONAL INCOME RELATED TO NONAGRICULTURAL INCOME PAYMENTS, UNITED STATES, 1909-41

1909-19

1922-29

1933-40

'41 (E)

NONAGRICULTURAL NATIONAL INCOME (DOLLARS, BILLIONS)

NONAGRICULTURAL INCOME PAYMENTS (DOLLARS, BILLIONS)

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FIGURE 4

## CASH INCOME FROM MARKETINGS RELATED TO NOMINAL VALUE OF FARM PRODUCTION, UNITED STATES, 1910-41

1938-40

1910-40

CASH INCOME FROM MARKETINGS ADJUSTED FOR CHANGES IN INVENTORIES (DOLLARS, MILLIONS)

NOMINAL VALUE OF FARM PRODUCTION, INDEX NUMBERS*

* COMPUTED ON BASIS OF PRODUCTION ON 1935-39 BASE AND PRICES ON 1910-14 BASE.

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FIGURE 5

AGRICULTURE'S CONTRIBUTION TO NATIONAL INCOME RELATED TO CASH INCOME FROM MARKETINGS, UNITED STATES, 1910-41
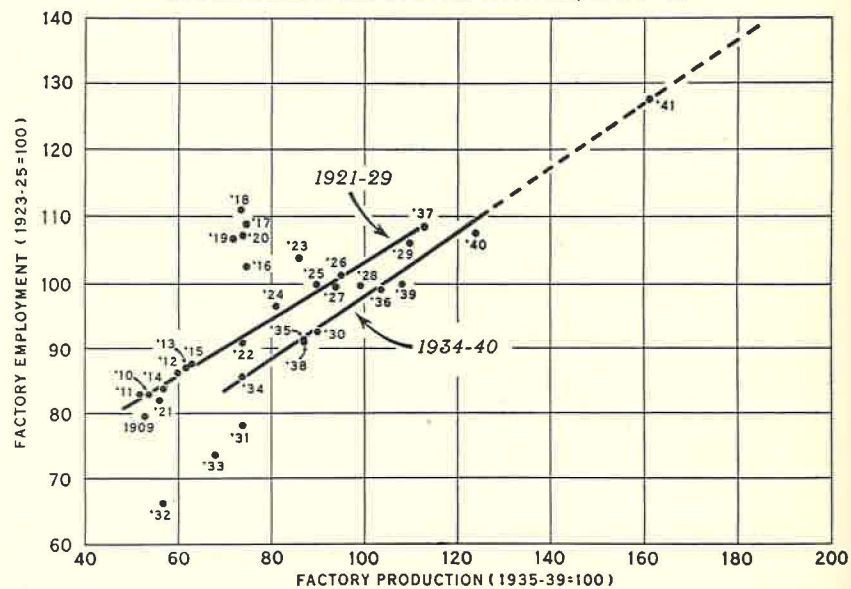

* EXCLUDING GOVERNMENT PAYMENTS
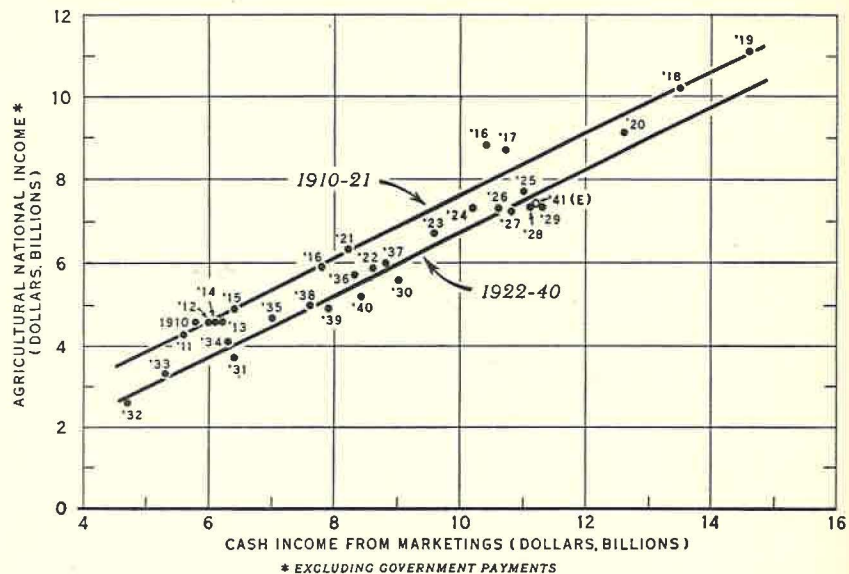
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FIGURE 6

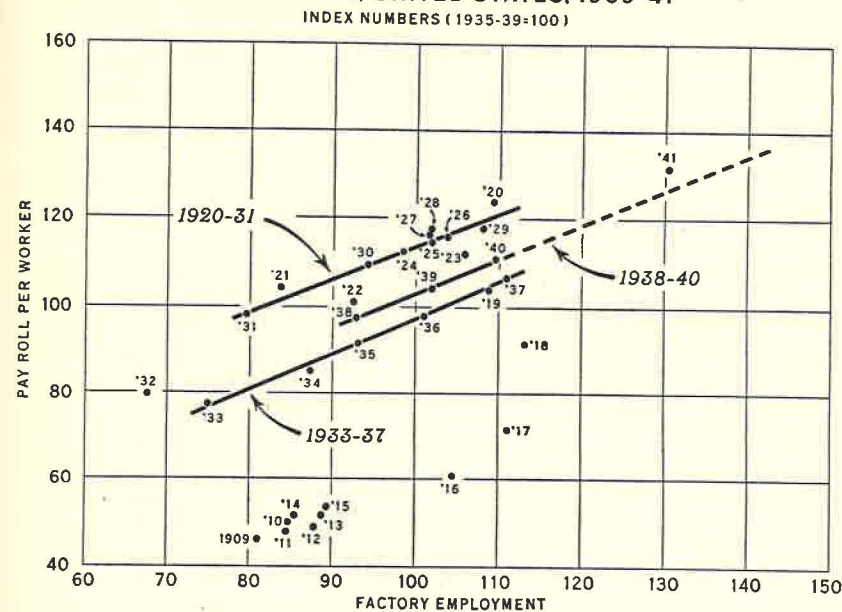## FACTORY EMPLOYMENT RELATED TO FACTORY PRODUCTION, INDEX NUMBERS, UNITED STATES, 1909-41

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FIGURE 7

FACTORY PAY ROLL PER WORKER RELATED TO FACTORY EMPLOYMENT, UNITED STATES, 1909-41
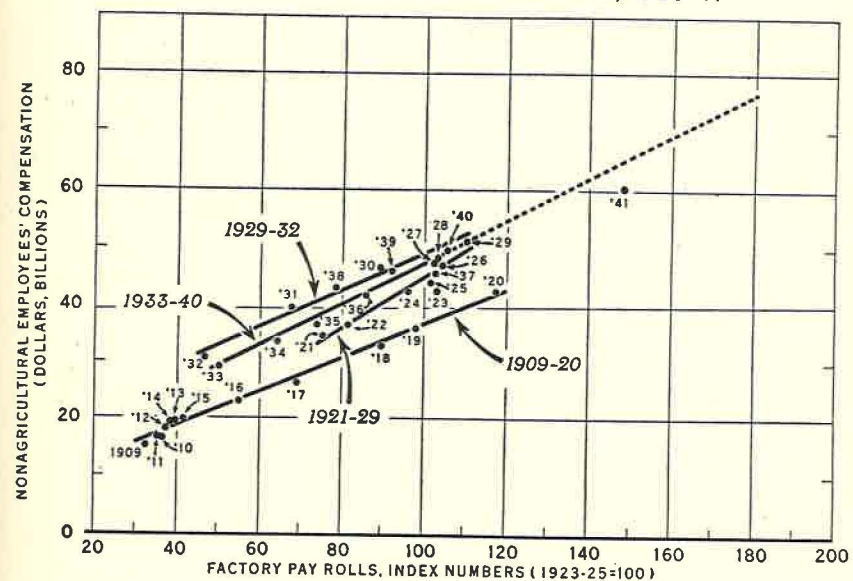INDEX NUMBERS (1935-39=100)

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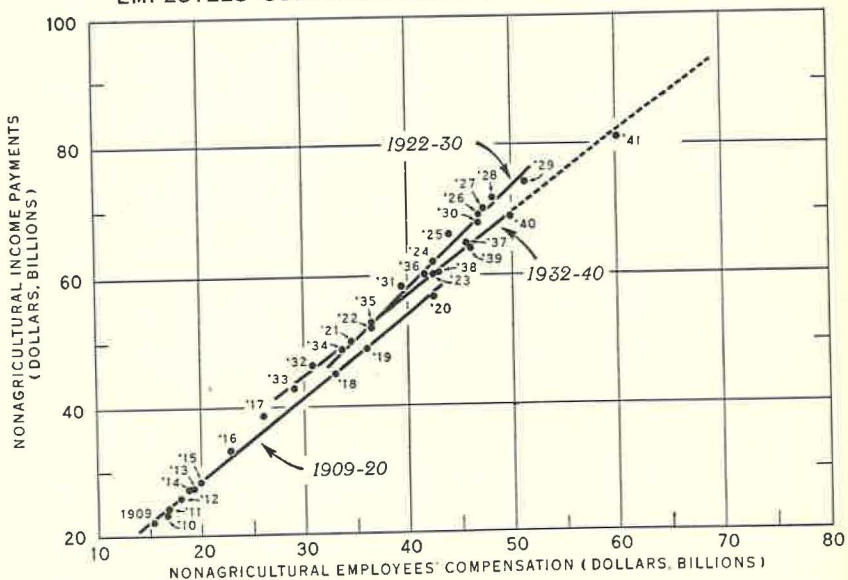BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 8

NONAGRICULTURAL EMPLOYEES' COMPENSATION RELATED TO FACTORY PAY ROLLS, UNITED STATES, 1909-41

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FIGURE 9

NONAGRICULTURAL INCOME PAYMENTS RELATED TO NONAGRICULTURAL
EMPLOYEES' COMPENSATION, UNITED STATES, 1909-41

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FIGURE 10

CONTRIBUTION OF INDIVIDUAL INDUSTRIES TO CHANGES IN
FEDERAL RESERVE INDEX NUMBERS OF INDUSTRIAL
PRODUCTION, UNITED STATES, 1923-41

(1935-39 = 0)
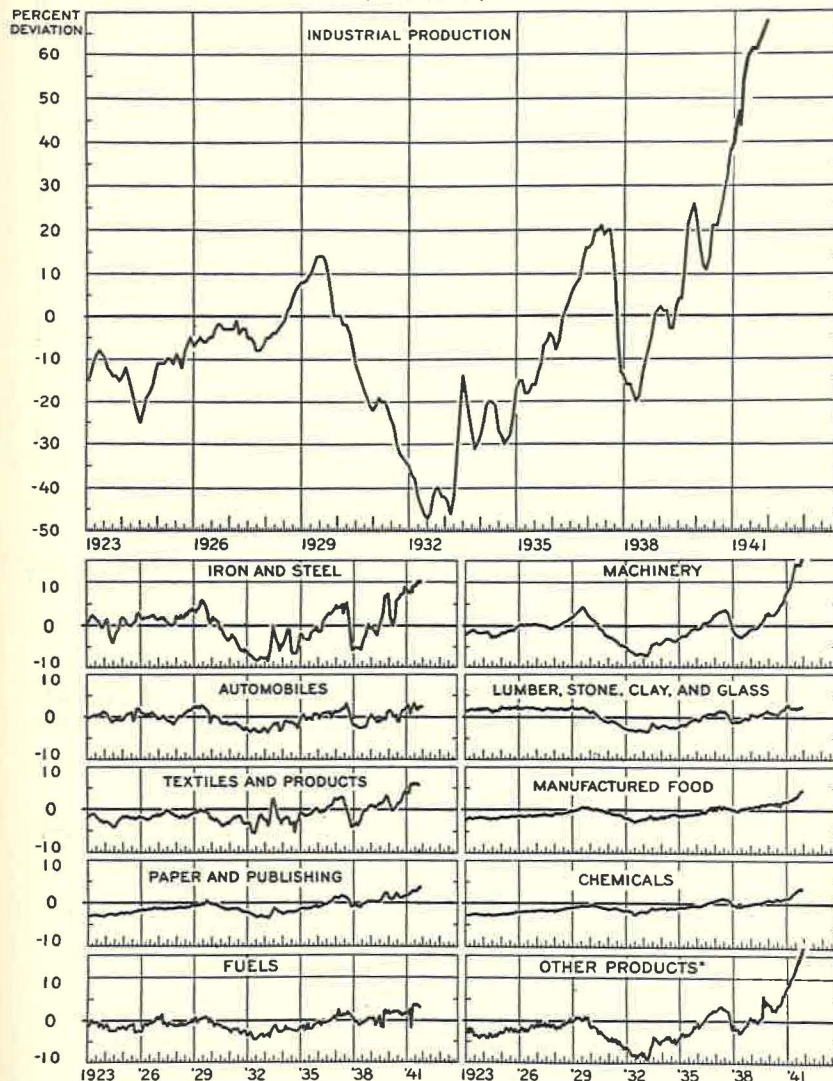
THE CONTRIBUTION OF INDIVIDUAL INDUSTRIES OR COMMODITIES TO FLUCTUATIONS OF THE NEW FEDERAL RESERVE INDEX OF IN-
DUSTRIAL PRODUCTION DEPENDS UPON: (1) THE CHANGE IN OUTPUT; (2) THE WEIGHT IN THE INDEX. IN THE LOWER SECTIONS
OF THIS CHART, THE INFLUENCE OF BOTH OF THESE FACTORS HAS BEEN COMBINED. THE DEGREE OF FLUCTUATION IN THE LINES
REPRESENTING THE SEVERAL INDUSTRIES INDICATES THEIR RESPECTIVE CONTRIBUTIONS TO THE TOTAL VARIATION OF INDUS-
TRIAL PRODUCTION. THE ALGEBRAIC SUM OF THE MONTH TO MONTH CHANGES IN THE INDIVIDUAL LINES IS EQUAL TO THE NET
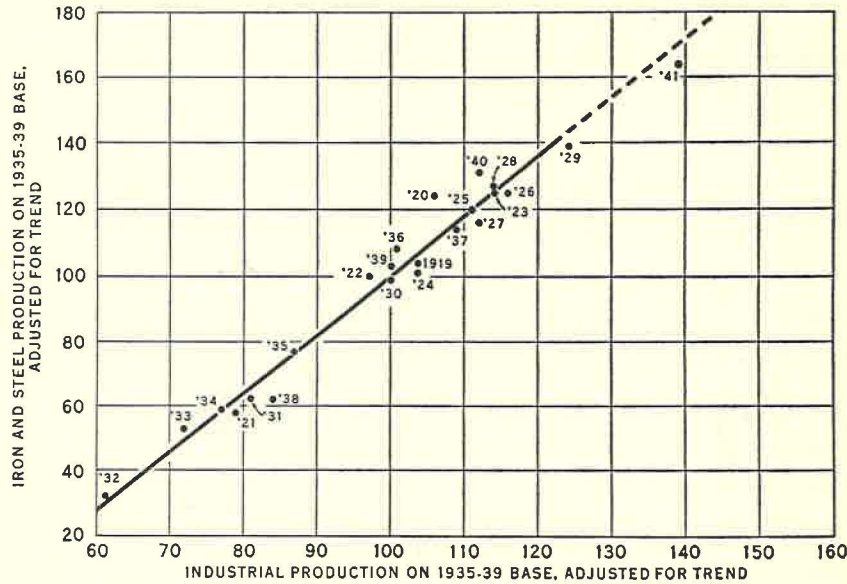CHANGE IN THE INDEX.

*OTHER PRODUCTS: AIRCRAFT, RAILROAD EQUIPMENT, LOCOMOTIVES, SHIPBUILDING, NONFERROUS METALS, FURNITURE,
LEATHER, ALCOHOLIC BEVERAGES, TOBACCO, PETROLEUM AND COAL PRODUCTS, RUBBER PRODUCTS, AND METALS

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FIGURE 11

RELATION BETWEEN IRON AND STEEL AND INDUSTRIAL PRODUCTION, INDEX NUMBERS ADJUSTED FOR TRENDS, UNITED STATES, 1919-41

IRON AND STEEL PRODUCTION ON 1935-39 BASE, ADJUSTED FOR TREND

INDUSTRIAL PRODUCTION ON 1935-39 BASE, ADJUSTED FOR TREND

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FIGURE 13

LIVING COSTS RELATED TO WHOLESALE PRICES OF NONAGRICULTURAL PRODUCTS, INDEX NUMBERS, UNITED STATES, 1909-41

LIVING COSTS EXCLUDING FOOD AND RENT (1935-39=100)

1922-30

1933-40

1913-17

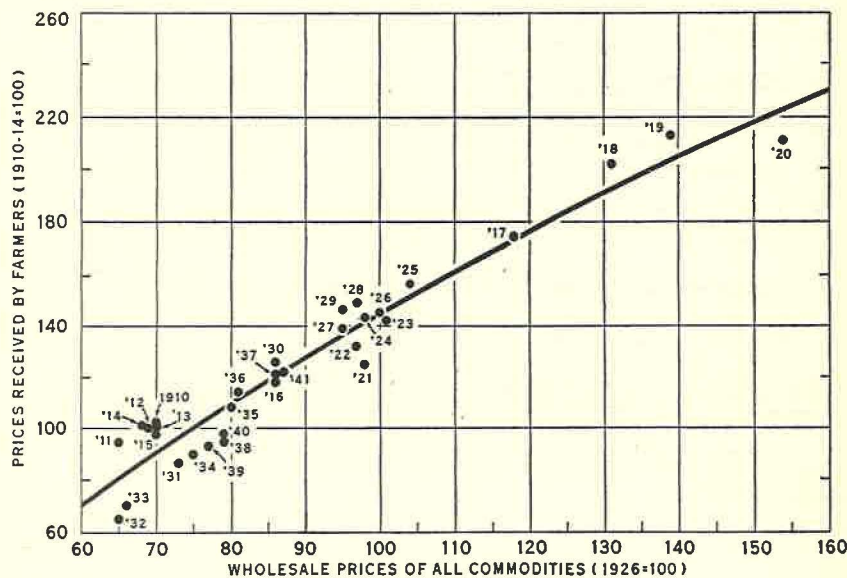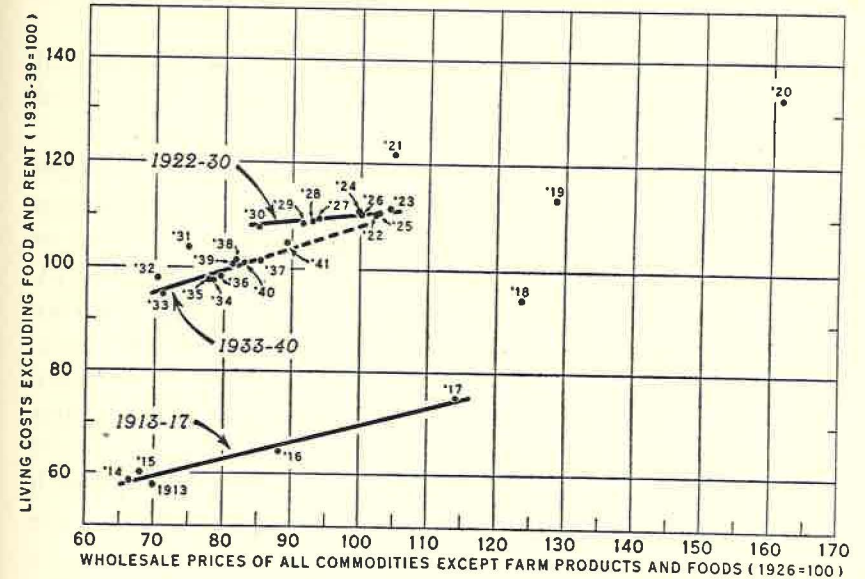WHOLESALE PRICES OF ALL COMMODITIES EXCEPT FARM PRODUCTS AND FOODS (1926=100)

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FIGURE 12

PRICES RECEIVED BY FARMERS RELATED TO WHOLESALE PRICES OF ALL COMMODITIES, INDEX NUMBERS, UNITED STATES, 1910-41

PRICES RECEIVED BY FARMERS (1910-14=100)

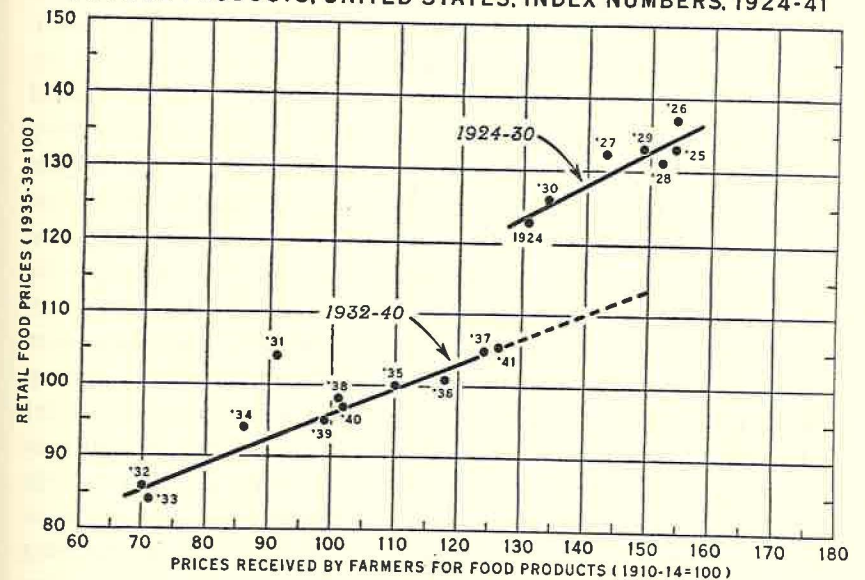WHOLESALE PRICES OF ALL COMMODITIES (1926=100)

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FIGURE 14

RETAIL FOOD PRICES RELATED TO PRICES RECEIVED BY FARMERS FOR FOOD PRODUCTS, UNITED STATES, INDEX NUMBERS, 1924-41

RETAIL FOOD PRICES (1935-39=100)

1924-30

1932-40

PRICES RECEIVED BY FARMERS FOR FOOD PRODUCTS (1910-14=100)

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Discussion

FRANK R. GARFIELD

The authors of this paper are in an unusual position—after several years of continuous public forecasting, they can speak a good word for Dame Fortune.

The major fault the authors find with their present technique is that it involves the use of too much common sense: "as long as results depend so largely upon personal judgment they will be of fluctuating reliability and changes in staff will mean the discarding of much valuable experience". Seeking more certainty and continuity, they urge the development of "procedures in which personal judgment is exercised *a priori* in the selection of methods, weights, etc. as opposed to the selection of specific methods after the results of their application to the facts at any one time are known". In their view a main obstacle to the development of such 'objective' procedures is lack of adequate data, particularly in the industrial field.

Undoubtedly more data are needed; it seems, however, that the nature of economic change is a much more fundamental impediment to the successful mechanization of economic forecasting. If basic conditions and relationships were generally simple and regular enough to fit into such formulas as statisticians devise, forecasts might be made with more statistical formality and less personal judgment. But many important changes in basic conditions and relationships are far too complex and irregular for expression in any formulas so far developed or likely to be developed in the near future. Consequently, it would seem essential for forecasters to adopt methods that leave them free at every stage of the process to use all information bearing on conditions in the period for which they are forecasting. The nation may then be at peace or at war; the course of production may be determined largely by market demand or by government order, subject to limitations of plant capacity, supplies of materials, and the like; and prices may be going up or down, depending in part on policy decisions concerning price ceilings, taxes, wage rates, parity loans, consumer credit, and a host of other things. In one situation large inventories may forebode a decline in production, in another encourage further expansion; at one time a rise in industrial production may increase trade, at another cause it to decline. On all such matters, relating to basic conditions and relationships and their effect on human

behavior, the forecaster must make his own judgments for each period.

In forecasting industrial production the authors themselves reject various mechanical approaches, for reasons "too numerous and complicated to mention"; and throughout their current work they allow themselves a considerable range of judgment concerning results. This is true despite the formal appearance of the relationships shown on most of the charts presented. For example, in forecasting nonagricultural national income for 1942 they weigh heavily the many special conditions likely to affect industrial production, select all sorts of different past periods for drawing regression lines to project apparent relationships into the future, and in the end, when answering the $64 question, choose one extreme of a $5 billion range of alternative estimates.

In any program for improving forecasts, attention might well be given first to the basic choice of what to forecast in order to gauge demand for farm products. The present choice is national income. In view of the basic purpose of forecasts, disposable consumer income (income payments minus personal taxes) would seem definitely preferable and income payments more suitable than national income. Increases in corporate savings and social security taxes would hardly reflect increases in income likely to be used to purchase farm products. As it is, the disposable income notion is discussed only incidentally in the consideration of price prospects, and estimates of income payments are used merely as a stepping stone to estimates of national income. Also, consideration might be given to the possibility of estimating savings, to be deducted from disposable income in order to approximate more closely the current funds available for buying all sorts of goods and services. A further refinement might be to take account of the amount of such funds likely to be spent by consumers for purposes other than the purchase of farm products, in view of probable shortages, changes in the distribution of income, and the like.

Second, would it be preferable to calculate nonagricultural income payments by adding the estimated parts rather than by a series of inferences from estimates of industrial production? Such a procedure would seem to have many advantages similar to those the authors find in estimating industrial production by parts. Estimates of the total so calculated should be more accurate because past estimates could be checked in detail against the final figures and also because account would be taken of many of the differences

among industry groups that increase the hazard in such over-all comparisons as those used by the authors in the several steps from industrial production to national income. Estimates of the various parts—wages and salaries, dividends, and the like by broad industry groups, such as transportation and trade and their major divisions —might be very useful themselves; their usefulness, however, might be mainly for purposes other than the analysis of demand for farm products. In this approach, as in others, the lack of adequate data would be a handicap but what data are available could be exploited to better advantage. One principal question about such a procedure would be the labor involved. Of course it takes time to make careful judgments and there would be many. In the end experiment alone will reveal whether the benefits warrant the labor.

In estimating income payments in the fashion here suggested the forecaster would be able to check his basic notions at many more points and to grasp more fully their impact on the final estimates. He would be making more personal judgments but most of them would be less decisive; moreover, the basis for most of the decisions should be much better, except so far as the estimate of each part might be affected by preliminary hunches about the course of affairs generally. In all his judgments the forecaster would consider clues gleaned from the study of past developments, especially when he had good reason to suppose that things closely related in the recent past would be similarly related in the immediate future. In every case, however, the final judgment would have to be made without undue respect for projection of regression lines representing average performance during various past periods, especially when the levels in prospect are unprecedented. Proceeding in this fashion, the forecaster could have as much faith in his own work as would be warranted in view of the difficulties of the problem.

The third step under Method I was to estimate factory payroll per worker, partly from factory employment. This is a long jump in any year, but especially in one such as 1942 in view of changes in the composition of factory employment, the dispersion of wage rates, differential changes in wage rates by industries, and varied changes in the proportion of overtime work. The authors recognize the limitations of the recent past as a guide to their over-all decision here; but in reaching for a better answer they seek a parallel in the inadequate records of the very different first World War period, 25 years ago, rather than grapple with specific factors likely to determine the course of developments in the future. The figures for

the World War period shown in Figure 7 seem to afford little basis for any sort of judgment. Might it not have been more satisfactory to start with estimates of employment, hours, wage rates, and average hourly earnings in factories during 1942, by major industries or industry groups?

In the fourth step under Method I, from estimated factory payrolls to nonagricultural employees' compensation, great weight was given to the apparent relationship in 1938-1941. In view of the prospect for increasing concentration on industrial production in 1942 at the expense of some other activities, it seems doubtful that such a regression line could be of much assistance; and this question might be still more important with respect to 1943. Certainly the forecast as well as the economic history of these war years should take into account the growth of the armed forces, the widespread reallocation of labor among the various sectors of the economy, and differential changes in rates of pay.

One step in the procedure under Method II is to move, on the basis of a regression line, from an estimate of industrial production to an estimate of the production of all nonagricultural goods and services (nonagricultural income deflated by the cost of living). The authors raise some questions about the appropriateness of the cost of living as a deflator for nonagricultural income and finally choose it only because there is nothing better in sight. The difficulties seem even more serious than they admit. If one considers nonagricultural income in terms of the components used in its computation, the amplitude and timing of the fluctuations in the cost of living index certainly cannot be expected to be closely similar to those in a hypothetical index of wage rates, dividend rates, and other price factors affecting various components of nonagricultural income. The several price series in the cost of living index are weighted in accordance with the importance of various items in the cost of living, not in nonagricultural income. For example, rent, which fluctuates quite in its own fashion, has a heavy weight in the cost of living index but is a very small factor in nonagricultural income; also, nothing in the cost of living index directly represents the prices of armaments and of other goods sold to the government. Or, if one considers nonagricultural income figures to represent the value of output, the same serious weighting problems are involved; also, the cost of living figures are based on market prices whereas national income figures are something else again, as indicated in current discussions contrasting national income and gross national

product at market prices. Altogether the deflated nonagricultural income figures as calculated by the authors seem to mean little. Even if they do represent physical production in this sector of the economy, it is by no means clear that any relationships apparent in the past between this series and industrial production should hold for 1942, when activity is being concentrated in increasing degree in industrial establishments.

Some of the drawbacks of Method II are reflected in Figure 1, which shows a regression line for 1938-40 sharply different from that for the preceding period. How good would the estimate for 1938 have been if based on the 1921-37 regression line? How much reliance can be placed on the extension of the 1938-40 line to 1942 levels, even though it hits 1941 quite closely?

In Method III choosing 1939-41 for projection purposes may have been wise, and the use of different periods in establishing the various relationships probably reflects a desirable flexibility. Nevertheless, it seems as though any comfort to be derived from a close fit of data would be limited considerably by the thought that the choice of years is determined by that fit and that the year being forecast may easily be the beginning of a new period rather than a continuation of the old.

The estimates of industrial production, which provide the starting point for all three estimates of nonagricultural income, are made with special care, mainly on the basis of a study of prospects for selected industries and groups of industries, taking account of current war objectives, limited resources, and the like. A chart showing deviations from the 1935-39 average for selected industries in terms of points in the total index is a useful innovation. Little is said about efforts to relate production in particular industries to the total of industrial output (both adjusted for trend) and it seems unlikely that in a year like 1942 such comparisons would yield very dependable results.

One or two remarks about the Reserve Board's index of industrial production are a bit puzzling. It is implied in the last paragraph on forecasting industrial production that the series based on man-hours, adjusted for estimated changes in productivity, are unsatisfactory because they move somewhat differently from the consumption of materials. Is there any reason to believe that series based on the consumption of materials, if available, would always be better measures of changes in production, value added at constant prices, than series based on man-hours? Does it not depend

on the nature of the industry? The statement that airplanes are given less weight than ice cream seems to imply much more than is meant or warranted. Currently the number of points in the total index represented by the airplane series is several times that for the ice cream series; airplane production has expanded much more than ice cream production since the base period. The remark about lack of opportunity for determining the relative importance of airplane engines and other components of the machinery group seems too strong; the Bureau of Labor Statistics publishes data on employment and average hours for several industries in the machinery group.

These, however, are subsidiary problems. The main questions, as noted earlier, are what to forecast in gauging demand for farm products and what emphasis to place on various forecasting methods. It has been suggested that for the purpose in hand estimates of income payments or some refinement of them would probably be more useful than estimates of national income. As noted, more reliance might be placed on informed judgment and direct estimates of parts to be added to a total and less on mechanical projection into the future of over-all relationships apparently prevailing in the past. The authors themselves have indicated many of the limitations inherent in mechanical procedures, especially for a war period, and appraised in detail many probable developments, going further in this direction than some other forecasters.

The flexible judgment approach will have special advantages in the next few years. During 1942 economic life was being further converted to a war basis; the main forecasting problem was to estimate how fast various phases of this conversion would come about and how far they would go. Regression lines for prewar years are not of much help. Sooner or later peace will come; and if there is any chance of forecasting when this will be, it lies in personal judgment. During the transition to some sort of peacetime economy, as well as in the succeeding period, the forecaster will need to use all the knowledge and judgment he can command, unhampered by undue respect for any particular mechanical device. Of course in every period the forecaster must be informed about past developments and have opinions about their effect on the future. The argument is not that the past should be ignored but rather that it should be considered in more detail and that in forecasting each new period the relevance of generalizations drawn from the past should be reviewed anew.

If in the troubled years ahead forecasters are not too busy they may come to rely less on mechanical devices and more on informed judgment about a wide range of affairs. And informed judgment may then acquire a new respectability among forecasters, especially if meanwhile Dame Fortune does her part.

CHARLES A. R. WARDWELL

The basic equipment of a forecaster is threefold: (1) quantitative information, as basic and as comprehensive as possible, describing the past and present trends of the governing factors; (2) statistical techniques of measuring, analyzing, organizing this information in such ways as to extract its true significance and apply it to the problem in hand; (3) a clear understanding of how our economy functions in response to changing conditions or stimuli.

Both authors, as their paper shows and as I know from many discussions with them of the business outlook during recent years, are exceedingly well equipped. The forecasts of 1942 national income, industrial production, and wholesale prices, made originally in September 1941 and revised in January 1942 were, in general, remarkably good. The methods they describe seem to be those now rather widely and generally employed by forecasters possessing the necessary equipment. Since any very helpful discussion would necessarily be devoted largely to details of their application and to shades of judgment in arriving at conclusions and to the nature and quantity of underlying and supporting data, I shall not attempt it here. Suffice it to say that in my opinion the methods are in general the best now available and that progress in forecasting will come from extending and improving them.

Several comments which I hope will be constructive, however, suggest themselves. First I should like to stress the point that foretelling the future is an art. It is definitely *not* a science. The quality of the forecasts therefore hinges in some degree on the talent of the forecasters. This point merits emphasis so that people will not take it for granted that other forecasters employing the same methods will achieve equally good results. Moreover, some periods are far more difficult to forecast correctly than others. Consequently, the forecaster who hits a home run one time may strike out the next. In stressing that forecasting is not a science, I do not overlook the fact that forecasters may employ many scientific devices to measure and analyze past and present governing factors; e.g., in-

dexes and correlation techniques. But the process of formulating definite predictions (in 1944, say) as to what is going to happen (say, in 1945) is purely subjective. The helpfulness and accuracy of these techniques depend largely on the forecaster's mastery of his art.

From this standpoint, then, continued improvement in economic forecasting will require the training of more and more people and the development of their skill to an ever higher pitch.

The second point I wish to stress is closely related to the first. The goodness of the forecasts made by Messrs. Thomsen and Bollinger or any other forecasters employing the same methods is in large degree determined by the very first step in their procedure: the initial qualitative analysis and appraisal of the outlook and the formulation of the primary, broad hypothesis fixing the general features of the outlook for the future period covered. If this primary diagnosis and hypothesis is largely erroneous, the forecasts based on it will be disastrously wrong both as to direction of movement, such as predicting continuation and expansion of prosperity just before a downturn sets in, and as to timing and magnitude. On the other hand, if the primary hypothesis is largely correct, the forecasts can be in error only in predicting the amplitude and timing of the coming moves. It is thus at this initial stage that the experience and skill of the forecaster are most invaluable and essential, for they will determine the soundness of the very foundation upon which rests all the subsequent elaboration of quantitative measurements and detailed forecasts of minor components.

Because this primary hypothesis is the very crux of the forecast, the forecasters must state their initial hypothesis fully; in particular (1) what are believed to be the major governing factors in the outlook, (2) what basic assumptions were made concerning any of the governing factors, and (3) how the economy is expected to function under the circumstances in order to bring about the situation outlined in the forecast. An adequate explanation enables others to determine the extent to which the major assumptions concerning the governing factors were arbitrary and unreasonable and to decide whether the expected functioning of the economy is worked out in accordance with the probabilities of the present situation.

The ability to deal with this formulation of the basic, primary hypothesis is at an especially high premium in troubled times like these; for economic forecasts and diagnoses are based in large degree on the manifestations of the regularity of economic change in

the past. The highest skill of the forecaster is required to determine the nature and amount of the departures from previously established regularity likely to be caused by various unprecedented features of the unique current situation and to adjust his primary hypothesis accordingly. This is always difficult, but especially when the outlook hinges in part upon various unpredictable factors. The predicament of Messrs. Thomsen and Bollinger in January 1942 in forecasting the price level is an example. A price level forecast made at that time was largely a forecast as to whether the government would attempt price control and, if so, when and how effective it would be. Their forecast of the prices of farm products, largely exempted from control or controlled only at higher ceilings, will prove in the light of recent developments to be more accurate than their forecasts of industrial ('all other') prices which they evidently did not expect to be controlled as soon or as effectively.

The third point is the imperative need for better economic data as the foundation on which most forecasts rest. The need here is for more data of better quality and more promptly available. Then forecasters will be troubled by fewer areas where absence of data forces them to make outright guesses based on virtually nothing, fewer cases where the crudities, of their index numbers, for instance, introduce margins of error wider than would be the case otherwise, and fewer instances where it is necessary because of lags in reporting data to make a 2- or 3-month forecast in order to know what is happening currently. Especially needed are more and better data on consumer incomes, spending, and saving, on all types of investment by consumers, businesses, and government, on inventories held in various stages of the economic process in the several industries and in various hands, on the quantity and incidence of taxation, on costs and profits of doing business, and a host of others. It is to be hoped that the public will realize the necessity for more and better data if economic forecasting is to be improved and will give its support and cooperation to help achieve this goal.

REPLY BY THE AUTHORS

Messrs. Garfield and Wardwell have been very kind in their reviews of our paper. Perhaps more caustic criticisms were withheld out of consideration for a couple of rural practitioners lost in the big city clinic.

We must agree with nearly all their criticisms. We especially

approve of the statements in the fifth paragraph of Mr. Garfield's comments. In fact, in our demand outlook work for the B.A.E. we have attempted to do exactly what he suggests. These considerations were omitted from our paper for two reasons: (1) the subject of the paper as given to us was forecasting national income, not the demand for farm products; (2) some members of the Bureau staff strongly disagree with the position taken by Mr. Garfield with respect to the measures he discusses.

Mr. Garfield points, particularly in his last two paragraphs, to the fact that some of the forecasting devices referred to in our paper are largely impracticable in forecasting economic conditions in a war year such as 1942. Perhaps these devices were overstressed in relation to the 1942 forecasts; but it was more our desire to illustrate some of the methods we have used in the past and that may be used in the future than to discuss particularly the 1942 outlook. Some of the relationships depicted in the charts would be more useful in forecasting economic conditions in more normal times.

Both Mr. Garfield and Mr. Wardwell devote considerable attention to what they seem to consider a lack of merit in more 'objective' approaches to business forecasting. Mr. Garfield seems to assume erroneously that objectivity necessitates tying everything into a formula, and pleads for methods under which the forecaster must "make his own judgments for each period". Mr. Wardwell insists that business forecasting must continue to be an art rather than a science. The senior author of the paper, particularly, continues to disagree with this viewpoint. All scientists use judgment in applying their science in the solution of specific operating problems. The difference between forecasting as an art and forecasting as a science is the difference between astrology and astronomy.

For many years economists and even statisticians have clung to subjective methods, but we are making some progress toward objectivity. For example, in estimating the production of an agricultural commodity in the United States in a given year several quantitative indications are available. Each variable for past years may be related to production in those years to determine relationships in the form of regressions which can be used in forecasting. The forecast obtained by using any one of the variables in estimating production is likely to be different from that obtained by using one of the other variables. Perhaps the most common method of forecasting production under such circumstances is to ascertain the production on the basis of each variable, then select one or obtain

an average by using selected weights assigned to each. The variable or the weights are chosen after the production indicated by each variable is known. Under such circumstances the estimator cannot escape being influenced by his preconceived notions of what the production is. If, however, he assigned weights to the several variables before knowing the production indicated by them, on the basis of their previous performance as correct indicators or on the basis of the peculiar conditions influencing the probable merits of the several variables as indicators in that particular year, his judgment would not be influenced by his preconceived ideas or hunches as to production. Thus, a high degree of objectivity would be attained in making the production estimate without sacrificing the benefits of judgment.

Much the same sort of objective procedure can be applied in business forecasting. The degree of objectivity attained will depend not only upon the ingenuity of the forecaster and the kind of data available, but also upon the persistence of forecasters in attempting to attain this objectivity. It is for this reason that we labor the point and urge that it be given more consideration by forecasters in the future.

Part Six

A STATISTICAL STUDY OF INCOME DIFFERENCES AMONG COMMUNITIES

HERBERT E. KLARMAN

Discussion

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