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IN THIS ISSUE

In order to estimate change in Gross National Product, it is possible to make computations from the combined changes registered in three current business series, which are identified on page 3. Resulting estimates are compared below with actual changes in GNP.

Seasonally adjusted

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Changes In National Product Related to Selected Business Series

Editor's Note. *The relationships between quarterly changes in Gross National Product and quarterly changes in certain selected business series, as described in this article, have been developed as an experiment. The purpose of the experiment, in its first phase, is to determine whether a few selected monthly business series, in combination, can be shown to have a record of reasonably close correlation with the behavior of GNP in terms of quarterly change. In general, this aim has been fulfilled, as will be seen below.*

The second phase of the experiment, which gives a broader meaning to the entire enterprise, concerns the possible usefulness of the relationships portrayed here to the practical work of business analysis; many workers in this field are engaged periodically in estimating current standings of Gross National Product, before the official estimates for a given quarter have been announced, and often they make forecasts of GNP scores for one or more calendar quarters in advance. The extent to which the relationships outlined here may be found useful in estimation and forecasting cannot be definitely established at this time. In this respect, the experiment is inconclusive, although some suggestions on the point are offered at the end of the article. Enough information is provided in the article to enable the reader to share in the continuing phases of the experiment, by substituting newly observed values of the variables in the framework of the equations.

By use of the relationships described below, it is possible to combine the current (or prospective) standings of a few familiar statistical series on current business activity, which are available with relative promptness, to give a reasonably close approximation of the current (or prospective) standings of the Gross National Product. Such a procedure is not designed to supplant the careful consideration of the behavior of the various component parts of GNP, as practiced by many responsible business analysts. Rather, it is designed to supplement such analysis, with a view to the possibility of providing advance clues as to changes in the current or immediately prospective standing of GNP, prior to the official announcement of estimated figures for GNP and its constituent parts.

The relationships have been developed by regression analysis, utilizing familiar methods of computation. By the adaptation of such methods to the electronic computer, which handles large quantities of detail in a short time, it has been possible to extend quite markedly the range of experimentation in the study of potentially useful relationships.

The chart on the cover of this issue shows the degree of closeness of one of the relationships that has been found to be pertinent. After explaining this particular relationship, including the background of its development,

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attention will be turned to an alternative relationship, based on information drawn from a longer time span.

First Equation

For the first set of relationships, which is identified as "Equation 1", as well as in the case of other relationships discussed later, the statistical series which are selected to play the role of "independent variables" are chosen principally on two counts: (1) their familiarity to business analysts, combined with relative promptness of availability of monthly information and (2) their usefulness in providing a clue, through statistical association, to the changes in GNP. In connection with the first criterion, it is important to bear in mind that fairly good estimates of quarterly values of a given series may often be made on the basis of one or two months' data. Such an estimation procedure has the substantial advantage of making full use of current business series which are available on a monthly basis; official GNP estimates, as such, are available only on a quarterly or annual basis.

Another basic point is that the relationships between GNP and the respective business series utilized here may work, and probably do work, in both directions. That is, the general course of the economy, as indicated by changes in GNP, has an influence upon the fortunes of the particular segments of the economy such as retail sales or inventory behavior, as well as the fortunes of the parts having an influence upon the whole. In the equations discussed below, Gross National Product, for statistical convenience, becomes the "dependent" variable, while the familiar business series become "independent" variables. So long as unwarranted conclusions of a cause-and-effect type are not read into the results, the procedure represents a defensible use of the correlation technique.[1]

(1) Because of the way in which the variables are chosen, they are probably not stochastically independent of each other. The probable occurrence of multi-collinearity is not considered to invalidate the use of the relationship for the associative purpose here described. (For a note on a test of serial correlation of the residuals, which is a different type of consideration, see reference to the Durbin-Watson ratio in the "Statistical Appendix".)

Equation 1 is as follows:

$$X_1 = 1.1328 + 0.7165\,X_2 + 0.6210\,X_3 + 0.01495\,X_4$$

Where:

X_1 = Gross National Product
X_2 = retail sales of durable goods stores
X_3 = change in book value of manufacturers' inventories
X_4 = bank debits outside New York City

All values are expressed in *change* from previous quarter (first differences) at seasonally adjusted annual rates, in billions of dollars. The relationship is based on the period from the first quarter of 1953 through the fourth quarter of 1959.

Selection of Business Series

Let us consider the variables which comprise the right-hand side of this equation. *Retail sales of durable goods stores* is a series which is well known for its sensitivity to cyclical changes, although, as is the case with almost any individual series, it exhibits its own peculiarities of behavior. The series embraces mainly the sales of autos and household goods, as measured by the sales of retail outlets dealing in such types of goods. It is a component part of the U. S. Department of Commerce's well-known series on retail sales, expressed in dollars and available reasonably promptly on a monthly seasonally adjusted basis.

For the period 1953-59, the behavior of the durable-goods sales series shows a recognizable similarity to that of GNP itself; when combined with other series, to be described below, it plays a valuable part in assessing the changes in GNP through the association principle, for the period under consideration.

Change in book value of manufacturers' inventories is also based on a well-known Department of Commerce series, available monthly on a seasonally adjusted basis. It should be distinguished from the inventory component of GNP accounting, which represents a somewhat different treatment of inventories and which is not available on a monthly basis. Manufacturers' inventories are known to be the most volatile (and, there-

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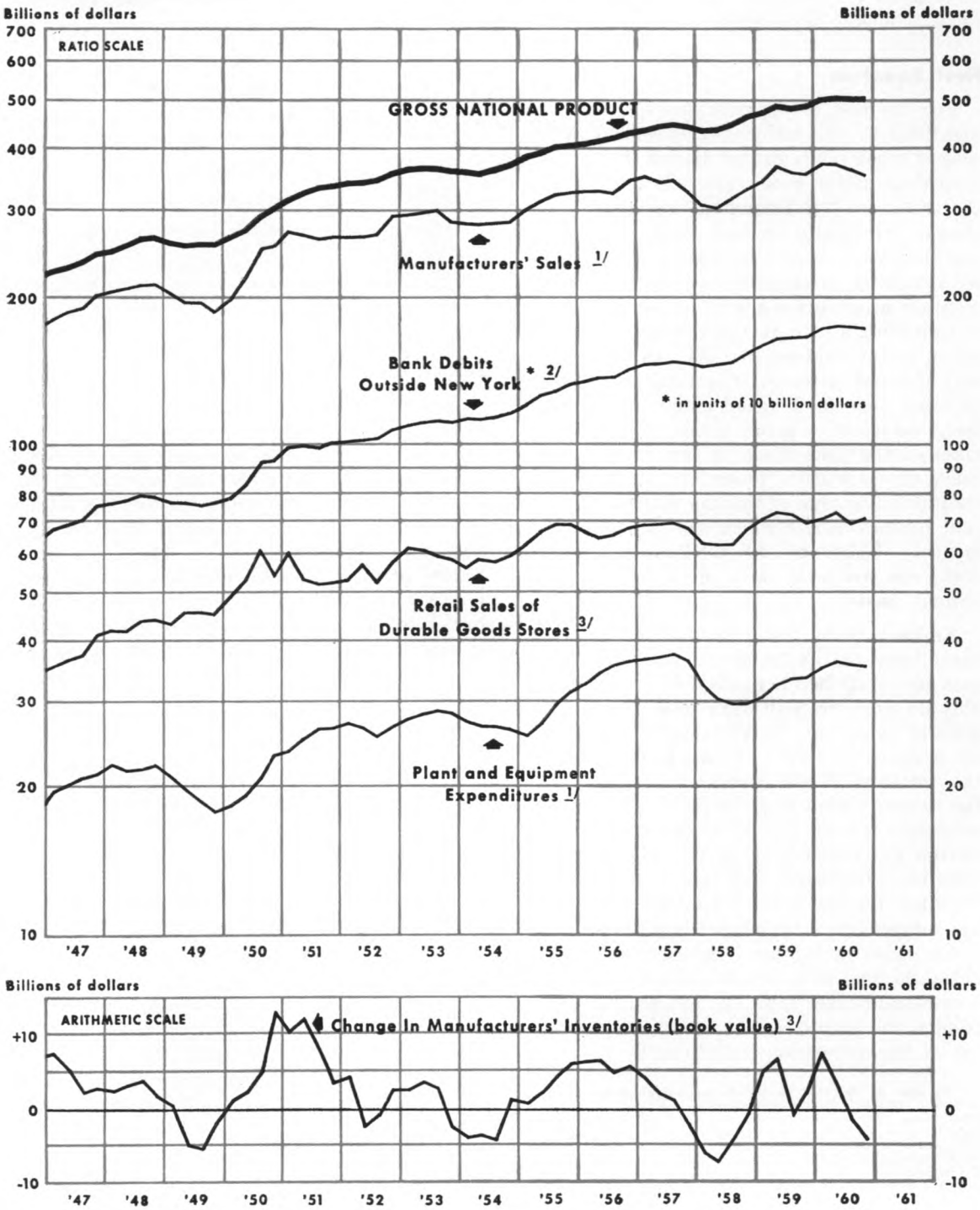
GROSS NATIONAL PRODUCT and FIVE SELECTED VARIABLES

1947 - 1960

Original series, quarterly values in annual rates



1/ Used in Equation 2

2/ Used in both Equation 1 and Equation 2

3/ Used in Equation 1

All series are seasonally adjusted

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fore, a highly strategic) segment of the general series known as "business inventories".

It is essential to note that the *change* in manufacturers' inventories, as compared with the change in the preceding quarter rather than the absolute level of inventories, represents the variable used in the equation, i.e., the inventory series enters the equation as "change in change". The latter concept is familiar to most business analysts.

Bank debits outside New York City constitutes a variable whose cyclical behavior has been found by numerous observers to have a high degree of correlation with that of GNP.[2] Bank debits in New York are excluded from the national totals because they are known to include episodic or random fluctuations of a financial nature, which detract from the usefulness of the series as an indicator of general business activity. However, debits outside New York City, as a kind of broad measure of transactions, do tend to reflect changes in general business activity. The series is available monthly on a seasonally adjusted basis, as computed and published by the Board of Governors of the Federal Reserve System.

Interpreting the Results

When the variables which have just been identified are put to use in the proportions specified by Equation 1, the results are a series of estimates of quarterly changes in Gross National Product. A visual comparison of the estimated values with the actual values for the period from the first quarter of 1953 through the final quarter of 1960 is shown on the cover chart. (The equation was derived from correlation analysis applying to 1953 through 1959. For the year 1960, the estimated values shown on the chart were obtained through use of the equation.)

How close are the estimated values to the actual values in this instance? The usual statistical tests may be used to measure the degree of closeness. Thus, the coefficient of multiple correlation is .9321.[3] The coefficient of determination is .8689, indicating that about 87 percent of the variation in GNP *changes* has been accounted for by the combination of changes in the three named variables. The standard error of the estimate is $\pm$ $2.33 billion, indicating that in two-thirds of the cases an estimate based on the equation will differ from the actual value by an amount within a range of plus or minus $2.33 billion. (For additional detail, see Statistical Appendix.) These results are considered to throw a favorable light on the use of Equation 1 for determining an early approximation of GNP.

It should be noted that all of the variables used in this analysis, including GNP, are in terms of dollar values unadjusted for price changes. Such a procedure is preferable to the use of estimated "physical volume" series, mainly for practical reasons stemming from the obvious complexity, and probable artificiality, which would be involved in any attempt to deflate the various series by estimations of price changes applying to the individual series.

Rejection of Alternative Series

It is important to call attention to other business series which might have been used in the equation, but which were not used. In fact, a number of other series were subjected to experimentation in the sense that relationships built upon them were run through computations to determine coefficients of correlation, standard error, etc. In some cases, such alternative series, which were finally rejected, were originally considered as substitutes for the independent variables previously described; in other cases they were considered in the role of additional independent variables, thus bringing the number of such vari-

(2) See, for example, John M. Firestone, *Federal Receipts and Expenditures During Business Cycles, 1879-1958*, a study by the National Bureau of Economic Research, Princeton University Press, 1960, p. 56.

(3) In evaluating the significance of such results, and the usefulness of the relationship as a practical device, it should be borne in mind that the variables are all expressed as first differences rather than as absolute values of the original series. For this type of correlation, a given standing of r or r^2 is more significant than it would be for an absolute-value series.

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ables which would have been used in the multiple correlation to four or more.[4]

What is, from some standpoints, the most interesting of the alternative variables considered and rejected is the series known as *business expenditures for new plant and equipment.* On *a priori* grounds this series would be considered a leading candidate. In fact, with a different time span (as described later) the series does emerge as a variable which should be utilized in order to obtain a significant relationship.

Where the period concerned is 1953-1959, however, the "plant and equipment expenditures" series was found to be a harmful rather than a helpful member of the cast. The principal reason for such a finding is the marked lag of plant and equipment expenditures (behind the general business cycle) in the turns to recovery in 1954 and 1958. (See the charts on page 4 showing the various series in original data form.) Whether or not the series should be generally considered a lagging series—a subject of some current debate—the fact remains that at the troughs of recent cycles, but not at the peaks, there has been a marked tendency for it to lag; as a consequence, the timing of this series becomes off-beat in relation to the timing of other series. What will happen to the timing of this series in the setting of the current turn of the general business cycle is also a matter of considerable interest, although it is not a subject of the present study.

A group of variables which was also considered and rejected was drawn from the operations of the Federal government. At first impression, one might wonder whether any set of relationships purporting to give a clue to the behavior of GNP would be satisfactory if it did not include at least one factor taking account of the role of the Federal government. But it will be seen that the lack of strict independence on the part of the variable on the right-hand side of the equation has some advantages in this connection. Each of the business series which has been selected for inclusion in the equation is quite clearly influenced by government activity; thus, the role of government has already been reflected to a considerable extent.

As a consequence, the question of including variables which are drawn from government activity should be resolved, not on the basis of whether the government plays a significant role in economic activity (as it certainly does) but rather by a finding as to whether the inclusion of any particular government activity series would make for a closer relationship in the final result. While other investigators, under other circumstances, might come to a different conclusion, the experiments performed in this particular study yield a negative result. That is, each of the government activity series which was tried experimentally had the effect of influencing the relationship toward either a poorer degree of correlation, or a better one to such a very slight extent that the addition of the variable has been deemed not worth while.

Among the government series which were tested for such a purpose are the monthly series known as "Cash Receipts from the Public", "Cash Payments to the Public", and "Excess of Receipts or Payments". The series which comes closest to filling the bill for the purpose at hand is "Cash Receipts". Of all the readily available series on Federal government activity, the cash receipts series apparently has the strongest record of corresponding with business cycle fluctuations. (See Firestone, *op cit.*) But even in this case, the effects of the inclusion of that variable do not justify its selection in terms of a sufficient improvement of the closeness of the relationship.

Still another type of series which was examined was drawn from the international trade sector. The international sector, as is

(4) Repeated experiment tended to fortify the conclusion that three well-chosen independent variables are sufficient to accomplish the task of approximation which has been undertaken. Addition of a fourth or fifth independent variable appeared to yield no significant improvement. Such an outcome appears to be similar to the experience encountered by other investigators who have recently concerned themselves with regression analyses of a somewhat parallel statistical nature.

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well known, represents a relatively small but significant part of GNP. The empirical tests applied to the inclusion of various series on exports, imports, or trade balance, however, resulted in the rejection of the candidates involved.

No serious consideration was given to the inclusion of any business series which tends to show a pattern of relatively uninterrupted growth, as distinct from cyclical fluctuation. Thus, many series which are important segments of GNP are ruled out at the start, including those associated with consumer expenditures for nondurable goods or services and those associated with state and local government outlays. The effects of such growth factors are reflected in consolidated form within the single "plus" value which appears as a constant in the equation. (In Equation 1, that value is 1.1328 billion.)

Relationship Drawn From Longer Time Span

The relationship which has been discussed above is based upon a relatively short span of years. In light of the fact that use of *any* mathematical relationship based on closely associated historical data is of questionable accuracy for future computations to the extent that such associations become altered, a question naturally arises as to whether use of a longer time span might provide more reliable conclusions. With this point in mind, Equation 2 has been developed. This equation is drawn from historical relationships revealed over the period from the first quarter of 1947 through the final quarter of 1959. The thirteen-year span virtually encompasses the entire postwar period to date.

Equation 2 may be identified as follows:

$$X_1 = 2.4158 + 0.8020\,X_2 + 0.3230\,X_3 + 0.0065\,X_4$$

Where:

X_1 = Gross National Product

X_2 = plant and equipment expenditures

X_3 = manufacturers' sales

X_4 = bank debits outside New York City

All values are expressed in *change* from previous quarter at seasonally adjusted annual rates, in billions of dollars. The relationship is based on the period from the first quarter of 1947 through the fourth quarter of 1959.

Let us consider the variables which go into the right-hand side of *this* equation. One of the variables has been met as part of Equation 1, namely, bank debits outside New York City. It remains to explain why two of the variables used in Equation 1 are not used in Equation 2, and why two others have been substituted.

"Retail sales of durable goods stores" turns out to be an unwise choice for the longer time span. The reason may be readily deduced. During the recession period of 1948-49, retail sales of consumer durables continued to march upward. (See the behavior of retail sales of durable goods stores in 1948-49 on the accompanying charts on page 4 which depict the various business series here under discussion in their original data form.) The pent-up demand which had resulted from wartime deprivations had been far from fully satisfied at that time; that demand was one of the principal features of the early postwar economic panorama. It is not surprising, therefore, that the degree of statistical relationship which was obtained through including the consumer durables series over the longer time span failed to justify the inclusion of that series.

The case of *plant and equipment expenditures* is, in some respects, the direct opposite of the consumer durables case. That is, in the early postwar period, plant and equipment expenditures performed in a way which was highly indicative of the general business cycle. It was in the trough phases of the more recent cycles, as noted earlier, that an offbeat timing of this series is observable. The results of the correlation tests indicate that, despite the lag of plant and equipment expenditures at certain turning points of recent years, the general performance of the series over the entire span of thirteen years justifies its inclusion as a variable in Equation 2.

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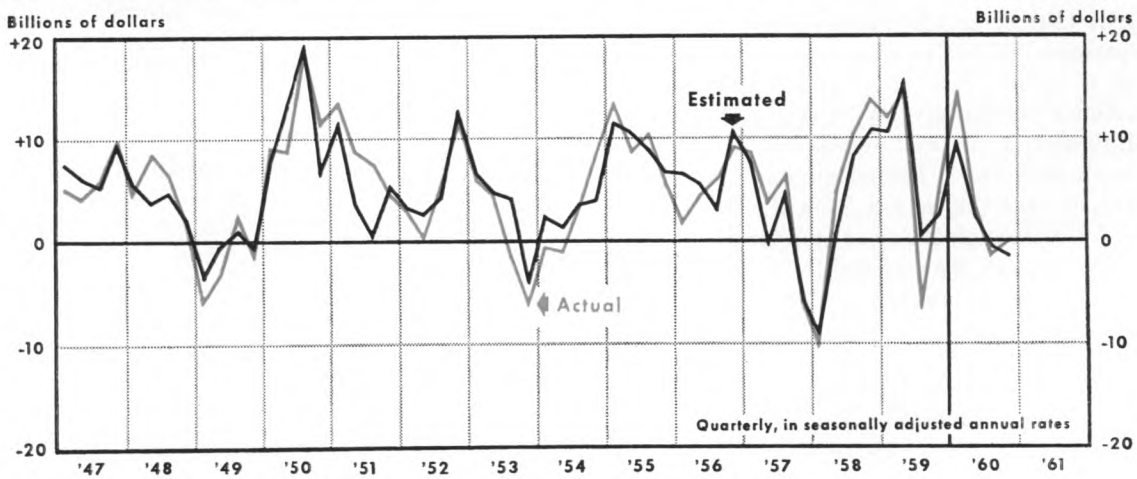
The inclusion of *manufacturers' sales* as a variable in Equation 2 in preference to "change in book value of manufacturers' inventories" (as in Equation 1) also requires explanation. The broad considerations governing these two series, which from a practical standpoint are alternatives for inclusion, are as follows: Any close examination of the behavior of "manufacturers' sales" and of "change in manufacturers' inventories" shows that the two series are quite similar to each other, as well as to GNP, in their broad pattern of cyclical behavior. (This would be quite untrue, if the absolute value of manufacturers' inventories were taken as the original series, rather than the change in inventories.) One reason why the two series are generally similar is that the manufacturers' sales series reflects numerous interindustry transactions, where one firm's sales often become another firm's addition to inventories.

The practical question now becomes whether the "manufacturers' sales" series or the "change in inventory" series is more appropriate for the purpose at hand. Through the use of correlation tests, it has been found that the "change in inventories" series is better for inclusion in the short span (1953-59), while the "sales" series works out better for the longer span involved in Equation 2. However, the differences are not large. Either series might have been used with plausibility for either equation; to use both, however, would represent undesirable duplication. It is difficult to assign any persuasive reason to the observed difference in behavior of these two series within the two contexts of time periods. No attempt to speculate on this point will be made here.

For Equation 2, as was the case with Equation 1, various alternative series were considered and rejected. Both the Federal government type of series and the foreign trade type of series were considered and rejected for the reasons noted previously in connection with Equation 1.

GNP CHANGES ESTIMATED FROM THREE BUSINESS SERIES BY A RELATIONSHIP OVER A 13-YEAR PERIOD

1947 - 1959



The three series used in this relationship (Equation 2) are as follows: plant and equipment expenditures, manufacturers' sales, bank debits outside New York City.

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The degree of correlation found in Equation 2, although it appears to be the best that can be obtained through working with a limited number of variables for the thirteen-year period under consideration, is slightly less than the closeness of relationship found for Equation 1. Thus, for Equation 2, the coefficient of multiple correlation is .8804. The coefficient of determination is .7751, indicating that about 78 percent of the variation in GNP *changes* has been explained by the combination of changes in the three named variables. The standard error of the estimate is ± $2.84 billion, indicating that in two-thirds of the cases an estimate based on the equation will differ from the actual value by an amount within a range of plus or minus $2.84 billion. (For additional detail, see Statistical Appendix.)

The fact that the relationship is not as close for this longer-span equation as it was for the shorter may not be surprising. Insofar as the variables were selected to a large extent on their performance in giving a good fit, the shorter length of time involved in the first equation may have served to limit the problems of non-synchronous timing of individual series in particular cycles. At the same time, it seems possible that the longer-span relationship may have a greater "durability".

Best of Both Worlds?

In view of the differences between the two equations just noted, the question naturally arises as to whether a combination of the two relationships might be employed to advantage. Without attempting a formal consolidation of the two equations, which might present statistical complications beyond the level of suitability for this presentation, a simple arithmetic combination of the two procedures may be essayed on an *ad hoc* basis. Such an operation is illustrated in the accompanying table. Actual and estimated values for GNP changes, utilizing the relationship of Equation 1, are shown alongside the corresponding values obtained from the use of Equation 2, over an identical time span, i.e., 1953 through 1960. For each individual quarter, a mean of the two computed values is ascertained. By comparison with the actual values of GNP changes, the errors (residuals) are shown for each of the three sets of computations, i.e., those based on Equation 1, those based on Equation 2, and those based on the mean of the two results.

An examination of the table indicates that the plus and minus residuals associated with the use of each of the two equations tend to offset each other, at least to some extent. The residuals resulting from the combined operation (as shown in the final column of the table) throw a favorable light upon the use of the joint relationship, insofar as it provides estimates which are slightly closer to actual values.[5] If the combined method should be used in practice to estimate current or prospective changes in GNP, as the latter unfold in each succeeding quarter, the basic logic would be as follows: The advantage of possibly greater stability of the longer-run relationship would be, at least in part, retained. The use of the shorter-span relationship would give an additional "weight" to more recent experience, which seems appropriate.

If the reader should ask which of the three relationships is actually recommended for a try-out in practice (use of Equation 1 or of Equation 2 or of the combined results), a reply that the answer depends on circumstances may seem inadequate. At the least, it may be possible to sort out the circumstances.

Thus, if the busy business analyst has a limited curiosity to try one of these procedures in the simplest possible form, as the business data of succeeding calendar quarters unfold, then he should probably select Equation 1. But if he is suspicious of the performance of the relationship described by Equation 1 and if he has a bit more time or patience for experimenting, it is suggested that he compute the values from both equa-

(5) Thus, the standard error of estimate of the combined result is $2.25 billion, which is less than the 2.33 value for the standard error of the estimate for Equation 1, and less than the 2.84 value for the standard error of the estimate for Equation 2, as applying to the observations from 1953 to 1959.

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ESTIMATES AND RESIDUALS

Three Alternative Procedures

(Annual rates, in billions of dollars)

	GNP Actual Change	Equation 1		Equation 2		Estimates 1 & 2 Combined	
		Estimate	Residual	Estimate	Residual	Mean	Residual
1953 I	+ 5.9	+ 7.3	+ 1.4	+ 6.5	+ .6	+ 6.9	+ 1.0
II	+ 4.3	+ 4.4	+ .1	+ 4.8	+ .5	+ 4.6	+ .3
III	— 1.7	— .3	+ 1.4	+ 4.1	+ 5.8	+ 1.9	+ 3.6
IV	— 6.1	— 4.2	+ 1.9	— 4.2	+ 1.9	— 4.2	+ 1.9
1954 I	— 1.0	+ 1.5	+ 2.5	+ 2.4	+ 3.4	+ 2.0	+ 3.0
II	— 1.1	+ 2.3	+ 3.4	+ 1.5	+ 2.6	+ 1.9	+ 3.0
III	+ 3.1	+ 1.9	— 1.2	+ 3.5	+ .4	+ 2.7	— .4
IV	+ 8.8	+ 9.3	+ .5	+ 3.9	— 4.9	+ 6.6	— 2.2
1955 I	+13.5	+10.3	— 3.2	+11.6	— 1.9	+11.0	— 2.5
II	+ 8.7	+12.1	+ 3.4	+10.7	+ 2.0	+11.4	+ 2.7
III	+10.4	+ 8.5	— 1.9	+ 8.9	— 1.5	+ 8.7	— 1.7
IV	+ 5.5	+ 5.6	+ .1	+ 6.8	+ 1.3	+ 6.2	+ .7
1956 I	+ 1.7	+ 4.1	+ 2.4	+ 6.5	+ 4.8	+ 5.3	+ 3.6
II	+ 4.4	+ 4.0	— .4	+ 5.5	+ 1.1	+ 4.8	+ .4
III	+ 6.0	+ 1.8	— 4.2	+ 2.9	— 3.1	+ 2.4	— 3.6
IV	+ 9.0	+ 8.7	— .3	+10.9	+ 1.9	+ 9.8	+ .8
1957 I	+ 8.5	+ 6.4	— 2.1	+ 7.7	— .8	+ 7.1	— 1.4
II	+ 3.6	+ 1.1	— 2.5	— .2	— 3.8	+ .5	— 3.1
III	+ 6.2	+ 3.9	— 2.3	+ 4.9	— 1.3	+ 4.4	— 1.8
IV	— 6.0	— 6.3	— .3	— 5.4	+ .6	— 5.9	+ .1
1958 I	—10.3	— 8.7	+ 1.6	— 9.1	+ 1.2	— 8.9	+ 1.4
II	+ 4.8	+ 2.8	— 2.0	+ .6	— 4.2	+ 1.7	— 3.1
III	+10.2	+ 7.7	— 2.5	+ 8.5	— 1.7	+ 8.1	— 2.1
IV	+14.0	+15.7	+ 1.7	+10.9	— 3.1	+13.3	— .7
1959 I	+12.1	+16.9	+ 4.8	+10.9	— 1.2	+13.9	+ 1.8
II	+14.8	+11.5	— 3.3	+15.6	+ .8	+13.6	— 1.2
III	— 6.5	— 3.9	+ 2.6	+ .4	+ 6.9	— 1.8	+ 4.7
IV	+ 5.0	+ 3.3	— 1.7	+ 2.5	— 2.5	+ 2.9	— 2.1
1960 I	+14.9	+ 6.7	— 8.2	+ 9.7	— 5.2	+ 8.2	— 6.7
II	+ 3.7	+ .2	— 3.5	+ 2.6	— 1.1	+ 1.4	— 2.3
III	— 1.5	— 5.1	— 3.6	— .7	+ .8	— 2.9	— 1.4
IV	—0—	+ .7	+ .7	— 1.7	— 1.7	— .5	— .5

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tions, and then compute the mean of the two values as suggested by the combined method. In any event, the analyst should bring his general knowledge of the current economic situation to bear upon the choice of a final estimate or forecast. As stated at the outset, the devices described here are intended, at most, to offer a supplement to, rather than a substitute for, other methods of estimating Gross National Product.

The practical usefulness of any or all of the relationships discussed above will depend not only on the closeness of the particular relationship selected (and its stability) but also—and perhaps in even greater measure —upon the readiness with which the values for the business series on the right-hand side of the equation can be ascertained, estimated, or forecasted on a developing, current basis. Attention must now be given to this phase of the question.

Problems In Estimating Individual Series

The procedures herein outlined may be employed under two sets of circumstances which differ in respect to the boldness of the forecasting element involved in the project.

Under one set of circumstances, the analyst finds himself, let us say, in early April to be confronted with the task of estimating GNP for the first calendar quarter of that year. The preliminary (earliest available) official estimates of first-quarter GNP will not arrive at his desk until late in April. Using Equation 1, as outlined above, the analyst will assemble the monthly data for changes in the three independent variables. He probably will have figures for all of the series as applying to the months of January and February. He will make his estimates or guesses for the missing March data as required and then will assemble his partly known and partly estimated quarterly figures representing change from the previous quarter; he will then utilize the equation to compute his estimated change for GNP for the first quarter. Whether this entire procedure should be termed "estimation" or "forecasting" is a matter of language. In any event, the forecasting element in this case is relatively modest.

A different set of circumstances obtains when the analyst in early April, for example, is attempting to make an outright forecast of GNP for the second, third, and fourth quarters of the given year. At this point, the question naturally arises as to how "forecastable" the individual series utilized in the equations may be considered to be. Some of the variables are more difficult to forecast than others.

Among the three variables which were selected for Equation 2, for example, it seems clear that *plant and equipment expenditures* lends itself readily to forecasting. The familiar survey of business intentions to make expenditures for plant and equipment, as assembled and published by the U. S. Department of Commerce and the Securities and Exchange Commission, is a great aid at this point; somewhat similar surveys published by several private organizations are of significant supplementary value.

Another one of the variables, which is used here in both equations, does not lend itself readily to forecasting, namely, *bank debits outside New York City*. There is little or nothing by way of statistical resources which will provide a crutch for forecasters in respect to this series. The analyst, unless he is cautious, is apt to have his judgment on that variable influenced unduly by his over-all view of the future of the economy; in the given context, this becomes circular reasoning, which is, unfortunately, an all too familiar experience in the art of outlooking. Such a drawback attributable to the bank debits series for the purpose at hand might result in the series being excluded from the equation, were it not for the fact of its outstanding statistical performance in the matter of correlation with quarterly changes in GNP, and therefore its contribution to "fit". (See "partial correlation coefficients" in the Statistical Appendix.)

The other variables utilized either in Equation 1 or Equation 2 fall somewhere between "plant and equipment expenditures" and "bank debits" in respect to ease or difficulty

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of forecasting. In the case of *retail sales of durable goods stores,* there is a body of pertinent information on outlook which is available, although it is not always in the form desired. Thus, there are several well-known surveys of consumer intentions to spend for durable goods which throw a general, but usually indirect, light on the future course of that variable.

In the case of *change in book value of manufacturers' inventories,* there is much current discussion among economists as to how the outlook for the series under a given set of circumstances is to be evaluated. Regression analyses, somewhat similar to that employed for GNP in this endeavor, have been brought to bear upon the behavior of business inventories.[6] *Manufacturers' sales,* as distinct from "manufacturers' inventories", constitutes a series which perhaps deserves more analytical attention than it ordinarily receives. Preoccupation with inventory-sales ratios may have diverted attention from the behavior of "manufacturers' sales" as a series in its own right. As it now stands, there appear to be few, if any, mechanical aids which offer assistance toward outright forecasting of that particular series; data on manufacturing output may be of some indirect help.

Altogether, it may be concluded that the specific business series which are utilized in the relationships discussed in this article appear in a less favorable light from the standpoint of their predictability than they do from the standpoint of their ready availability on a current basis. The test of the usefulness of the entire procedure for estimation or forecasting of GNP may turn about this point. For, if the analyst in practice is forced to turn to other material because of any blind side in respect to these particular variables, he may decide that the entire device is not worth the candle. The outcome remains to be seen. No useful end would be served by exaggerating the potentialities of what is, after all, a rather mechanical device in a field which is still governed more largely by art than by mathematics.

A study which would be related to the present one, and which would be interesting although quite complex, would be an attempt to develop a regression analysis for GNP along the lines followed here, but with the amendment that variables would be selected explicitly and measurably upon the basis of relative forecastability, as well as upon the basis of their ready availability and their contribution to "fit."

(6) See "Measures of Inventory Conditions", by Nestor E. Terleckyj and Alfred Tella, Technical Paper No. 8, National Industrial Conference Board, New York, 1960. (The equations developed in this study apply to total business inventories rather than manufacturers' inventories.)

(*The statistical appendix to this article appears on the facing page.*)

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STATISTICAL APPENDIX

For Equation 1:

The multiple correlation coefficient = $R_{1.234}$ = .9321

The coefficient of determination = R^2 = .8689

The standard error of estimate = S_x = $2.3263 billion

The partial correlation coefficients are

$r_{12.34}$ = .4764
$r_{13.24}$ = .5014
$r_{14.23}$ = .6712

The β coefficients, based upon a standardized expression of each independent variable, reveal the effects of the individual variables, confirming the relative showings of the partial correlation coefficients, as follows:

$\beta_{12.34}$ = .2680
$\beta_{13.24}$ = .2786
$\beta_{14.23}$ = .5183

The Durbin-Watson ratio for Equation 1 was found to be 2.18. This value being larger than the upper limit of the test ratio (for 28 observations and 3 independent variables) at both the 1% and 5% significance levels, we may conclude that the residuals are not serially correlated.

For Equation 2:

Multiple correlation coefficient = $R_{1.234}$ = .8804

Coefficient of determination = R^2 = .7751

Standard error of estimate = S_x = $2.8428 billion

Partial correlation coefficients = $r_{12.34}$ = .2766
$r_{13.24}$ = .4907
$r_{14.23}$ = .2535

β coefficients are as follows:

$\beta_{12.34}$ = .1582
$\beta_{13.24}$ = .5590
$\beta_{14.23}$ = .2536

The Durbin-Watson ratio, calculated as 1.57 for Equation 2, falls within the "twilight zone" between the lower limit (1.43) and the upper limit (1.68) at the 5% significance level for 3 independent variables and 52 observations. Considering that a ratio greater than 1.68 is required to indicate absence of serial correlation of the residuals at the stated level of significance, it may be concluded that a slight tendency of such correlation may be present. However, it should be noted that the ratio falls nearer the upper limit than the lower limit of the "twilight zone".

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Ownership of Demand Deposits

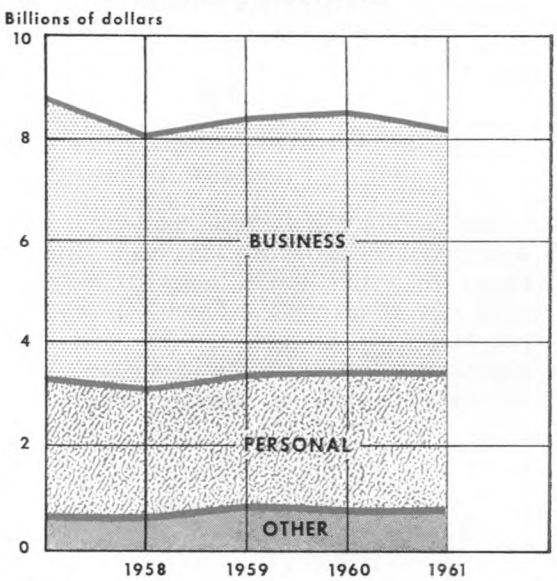
(Fourth District)

BOTH the volume and the ownership distribution of privately held demand deposits at insured commercial banks in the Fourth District showed some effects of the turnaround in business activity which took place in 1960. Hence, the volume of privately held demand deposits declined, on a year-to-year basis for the period ended January 25, 1961, to the lowest level of the past three years, for the days of record. On January 25, 1961, such deposits amounted to an estimated $8,229 million, which was down $447 million from the year-ago figure.[1] The decline was in contrast to a $187-million expansion which had occurred in the twelve-month period ended January 27, 1960.

It is noteworthy that the decline in privately held demand deposits in the twelve-month period ended January 25, 1961, amounted to only 5 percent. By way of contrast, in the twelve-month period ended January 29, 1958, a period which also included a turnaround in business activity, such deposits declined by more than 7 percent. Moreover, in the 1957-58 period, all types of holders of demand deposits accounts shared in the decline, whereas in the most recent period only deposits held by business firms were reduced.

The number of accounts held by individuals, partnerships, and corporations increased slightly during the most recent twelve-month period. As of January 25, 1961, the estimated number of such accounts totaled 4,372,000, which represented an increase of 24,000 accounts from the previous year. Table 1 shows that the increase in the number of accounts was due mainly to the rise in the number of accounts held by individuals. The combination of a slight increase in the total number of accounts and a decline in the deposit volume resulted in a smaller average size of privately held accounts.

Ownership of Demand Deposits
DOLLAR VOLUME, BY TYPE OF OWNER
Fourth District



Note: Figures are plotted for each year as of the last Wednesday of January. The "other" category includes accounts held by unincorporated farmers, nonprofit organizations, foreign individuals and firms, and trust funds of banks.

A decline in business deposits accounted for all of the reduction in the total of privately held demand deposits during the twelve-month period ended on the last Wednesday of January 1961.

(1) Based on the Survey of Ownership of Demand Deposits of Individuals, Partnerships, and Corporations as of January 25, 1961. This was the fifth annual survey of the same sample of insured commercial banking offices, except for minor adjustments for changes in the banking structure.

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Table 1

DEMAND DEPOSITS OF INDIVIDUALS, PARTNERSHIPS, AND CORPORATIONS BY TYPE OF HOLDER

(Estimates for Insured Commercial Banks, Fourth Federal Reserve District)

TYPE OF HOLDER	January 29, 1958		January 28, 1959		January 27, 1960		January 25, 1961	
	Number (thousands)	Amount (millions of dollars)	Number (thousands)	Amount (millions of dollars)	Number (thousands)	Amount (millions of dollars)	Number (thousands)	Amount (millions of dollars)
Business	**403**	**$5,004**	**409**	**$5,064**	**440**	**$5,242**	**443**	**$4,788**
Nonfinancial	385	4,379	387	4,351	414	4,492	414	4,150
Financial	18	625	22	713	26	750	29	638
Corporate	*135*	*4,164*	*137*	*4,087*	*162*	*4,130*	*157*	*3,751*
Noncorporate	*268*	*840*	*272*	*977*	*278*	*1,112*	*286*	*1,037*
Personal	**3,124**	**2,396**	**3,220**	**2,582**	**3,514**	**2,600**	**3,536**	**2,601**
Farmers, Noncorporate	**160**	**171**	**152**	**170**	**140**	**149**	**133**	**155**
All Others	**238**	**604**	**249**	**673**	**254**	**685**	**260**	**685**
TOTAL	**3,925**	**$8,175**	**4,030**	**$8,489**	**4,348**	**$8,676**	**4,372**	**$8,229**

Table 2

DEMAND DEPOSITS OF INDIVIDUALS, PARTNERSHIPS, AND CORPORATIONS PERCENTAGE DISTRIBUTION BY TYPE OF HOLDER

TYPE OF HOLDER	January 29, 1958		January 28, 1959		January 27, 1960		January 25, 1961	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
Business	**10.2%**	**61.2%**	**10.2%**	**59.7%**	**10.1%**	**60.4%**	**10.1%**	**58.2%**
Nonfinancial	9.8	53.5	9.6	51.3	9.5	51.8	9.5	50.4
Financial	0.4	7.7	0.5	8.4	0.6	8.6	0.7	7.7
Corporate	*3.4*	*50.9*	*3.4*	*48.2*	*3.7*	*47.6*	*3.7*	*45.6*
Noncorporate	*6.8*	*10.3*	*6.8*	*11.5*	*6.4*	*12.8*	*6.5*	*12.6*
Personal	**79.6**	**29.3**	**79.9**	**30.4**	**80.8**	**30.0**	**80.9**	**31.6**
Farmers, Noncorporate	**4.1**	**2.1**	**3.8**	**2.0**	**3.2**	**1.7**	**3.0**	**1.9**
All Others	**6.1**	**7.4**	**6.1**	**8.0**	**5.9**	**7.9**	**6.0**	**8.3**
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

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Business Accounts

The decline in demand deposits held by business firms accounted for virtually all of the reduction in the total of privately held demand deposits for the twelve-month period ended on January 25, 1961. At $4.8 billion on the latter date, the volume of business deposits was nearly 9 percent below the year-ago level, but only 4 percent below the figure on January 29, 1958.

Despite a sharp drop in the most recent twelve-month period, business deposits continue to account for the largest single share of the total volume of privately held demand deposits. On the survey date in 1961, such deposits amounted to 58 percent of the total; in 1960, the comparable figure was 60 percent, while in 1958 it was 61 percent.

A breakdown of business accounts by type of business shows that the demand deposits of nonfinancial enterprises, which include mainly manufacturing and trade firms, declined by a smaller percentage in the twelve months preceding January 25, 1961, than did the deposits of financial businesses. However, the same development can not be found for a longer time span. Thus, when compared with other types of depositors, the relative position of financial businesses was about the same in 1961 as in 1958, while the relative position of nonfinancial businesses declined to 50 percent of the total in 1961 from 54 percent in 1958. (These relationships are shown in Table 2.)

Still another breakdown of business accounts reveals that demand deposits held by corporations were reduced relatively more than those of noncorporate firms. Demand deposits held by corporations have been in a downtrend in recent years. This development is revealed in both the shrinking volume (see Table 1) and in the declining relative share (Table 2) of the total of demand deposits held by corporations. It has been suggested by a number of observers that much of this development is due to the disposition of corporate money managers to hold working balances, i.e., demand deposits, at a minimum level, and, at the same time, to put temporarily excess balances to work by obtaining earning assets.

Personal Accounts

Personal accounts held by individuals represented nearly 81 percent, or 3.5 million, of the total number of privately held demand deposit accounts on January 25, 1961. Individual accounts have tended to grow steadily in recent years, both in the number and in the volume of deposits. Over the latest twelve-month period, however, the volume of demand deposits held by individuals remained practically unchanged while the number of such accounts continued to increase. (It should be noted that over the same period, the volume of savings deposits of individuals at such institutions increased markedly.)

While the number of personal accounts was in excess of those of all other holders combined, the former represented less than 32 percent of the total deposit volume. However, personal demand deposit balances accounted for a larger share of the total volume of deposits in January 1961 than in any other recent year, a gain which was made chiefly at the expense of declining business deposits.

The number of demand deposit accounts of unincorporated farmers continued to decline between the 1960 and 1961 survey dates, although the volume of deposits in such accounts advanced 4 percent. The year-to-year rise in volume was the first increase reported since the survey date in January 1957. Demand deposits held by unincorporated farmers was the only type of account that increased in dollar volume during the survey year ended January 25, 1961. The deposit volume of all other ownership groups either declined, as in the case of deposits of business holders, or remained unchanged, as in the case of personal accounts and accounts of "all other" holders. (The category of "all other" holders includes deposits of nonprofit organizations, trust funds of banks and deposits of foreigners.)

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