Volume Title: Explorations in Economic Research, Volume 1, Number 1

Volume Author/Editor: NBER

Volume Publisher: NBER

Volume URL: http://www.nber.org/books/expl74-1

Publication Date: 1974

Chapter Title: Dating United States Growth Cycles

Chapter Author: Ilse Mintz

Chapter URL: http://www.nber.org/chapters/c4889

Chapter pages in book: (p. 1 - 113)

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Dating United States Growth Cycles

ABSTRACT: In this study the author demonstrates the existence of certain well-defined recurrent movements within the comprehensive network of diverse economic processes and shows the relative timing of these fluctuations for the principal components of the United States economy. In this way, she delineates both the similarities and the differences in the specific movements that make up the growth cycle in the economy at large. ¶ Mintz's observations indicate that recent growth cycles possess certain important characteristics of historical business cycles established in NBER studies. Thus, the major fluctuations of aggregate economic activity around growth trends are regularly associated with corresponding cycles in the sensitive indicators that tend to lead. They are also accompanied by cycles in diffusion indexes, that is, in the scope of expansions and contractions which spread gradually among the various constituent elements of the economic system. ¶ Two measures are used to identify growth cycles in this study: (1) deviations from trends (which are measured by moving averages spanning periods of over six years); and (2) step cycles (periods of varying length characterized alternately by high and low average rates of growth). A novel feature of the application of both of these methods in this study is the generally successful and encouraging use of computer programs for dating turns in both business cycles and growth cycles. ¶ Some important results of this work are the following: (1) The author demonstrates that the NBER business-cycle chronology, from 1948 to 1961, can be exactly reproduced by computerized methods, in contrast to the traditional NBER practice determining cycle turns by expert judgment. This finding argues for the feasibility of supplementing, or even replacing, traditional subjective cycle-dating by the new methods and thus enabling analysts in the

United States and abroad to obtain objective cycle chronologies without being acquainted with the intricate procedures of traditional dating. (2) A chronology of cycles in real economic activity (cycles measured in deflated dollars) was established and it was compared with the chronology of usual business cycles. The author found that one-half of the 16 turns in the two indexes for undeflated and deflated classical business cycles coincide from 1948 to 1961, while the other half of deflated-cycle turns precede the turns in undeflated cycles (with only one exception). (3) Seven growth cycles were recognized in the United States economy between 1948 and 1969, and these alternating periods of above- and below-average economic growth can be identified as clearly and confidently as traditional business cycles.

FOREWORD

In the last quarter of a century, business cycles have generally become much milder than they used to be. Indeed, in several countries and over prolonged periods since the end of World War II, recessions are discernible only as deviations from long-term growth trends rather than as absolute declines in aggregate economic activity. Plausible explanations have been offered for this recent moderation of economic fluctuations, but their systematic analysis will require further study.

At the same time, and in part as a consequence of the progress made so far, public confidence in the possibility of reaching ambitious goals of economic growth and prosperity has increased substantially, to the point that even mild economic setbacks have come to be regarded as unnecessary and disappointing. Expectations exceeding the actually achieved reductions in the relative amplitude and frequency of economic declines have been fed by the rapid growth and wide dissemination of data about the changing state of the economy, and by claims to success advanced on behalf of particular economic policies.

In fact, the problem of economic instability is by no means conquered—and would not be even if the business cycle in its old form of alternating expansions and contractions in general economic activity were somehow to be definitely eliminated. Retardations in growth, if they are diffused and long enough, involve an underutilization of resources which can be just as disturbing as mild recessions during which the levels of aggregate demand and production decline temporarily and moderately. There is cause for concern even when total employment does not decrease absolutely but fails to grow commensurately with the labor force. Moreover, retardations in aggregate growth are accompanied by absolute declines in some industries, some regions, or some types of economic activity.

In addition, the difficulties faced by economic stabilization policies have been greatly increased by the coexistence of high rates of unemployment and inflation. In the United States and other principal industrial countries, inflation persisted with unexpected stubbornness in slack phases of recent growth cycles, discouraging expansionary policies. The hardships caused by rising prices were added to the hardships of unemployment.

Considering all of this, it is not difficult to see why the recent "growth cycles" in the United States and abroad have attracted so much attention. For the most part, however, indications of a speedup in the economy at one time and of a slowdown at another have been viewed as isolated events, rather than as aspects of a single phenomenon. There has been little structured analysis and, hence, little gain in knowledge.

An important reason for this backwardness has been the lack of a reference scheme and an analytical framework. The NBER chronology of U.S. business-cycle peaks and troughs has provided benchmarks for systematic comparative studies of expansions and contractions; it is generally accepted, is widely used by economic analysts and forecasters, and is a model for similar chronologies established in a number of other countries. For U.S. growth cycles, no such sets of reference dates exist, though they are increasingly needed.

The pioneering work by Ilse Mintz, initiated just a few years ago, goes far toward filling this need. Her first effort in this area resulted in a chronology of business fluctuations for Western Germany in the post-World War II period.[1] A progress report on her research in dating postwar growth cycles in the United States was presented at the first of the NBER Fiftieth Anniversary Colloquia in September, 1970, and was published in the spring of 1972.[2] The present paper offers a revised and more complete account of the results of the U.S. growth-cycle study.

The work of Mintz, like other serious efforts to identify business-cycle chronologies, involves far more than dating the turns in some time series. It demonstrates the existence of certain well-defined recurrent movements within the comprehensive network of diverse economic processes and shows the relative timing of these fluctuations for the principal components of the U.S. economy. In this way, it delineates both the similarities and the differences in the movements that make up the growth cycle in the economy at large. Specifically, Mintz's chronology includes as low growth-rate phases each of the five recession periods (1949, 1954, 1958, 1961, and 1970) in the U.S. business-cycle chronology, plus three additional ones (1951, 1962, and 1967) that interrupted the longer business-cycle expansions. The low growth-rate phases are, however, longer than the business-cycle contractions.

Ilse Mintz's observations indicate that the recent growth cycles possess certain important characteristics of the historical business cycles established in NBER studies. Thus, the major fluctuations of aggregate economic activity around growth trends are regularly associated with corresponding cycles in the sensitive indicators that tend to lead. They are also accompanied by cycles in diffusion indexes, that is, in the *scope* of expansions and contractions which spread gradually among the various constituent elements of the economic system. These findings not only throw light on growth cycles, but also raise interesting questions concerning the classical cycles. They may help us to answer the important question, Why do some downswings result only in retardations in growth while others become recessions or depressions?

Two measures are used to identify growth cycles in this study: (1) deviations from trends (trends being measured by moving averages spanning periods of over six years); and (2) "step cycles," i.e., periods of varying length characterized alternately by high and by low average rates of growth. Each procedure has its own merits and shortcomings, and the choice between them is difficult, although the discrepancies are not large. Variants of both methods are found in the literature,[3] but their applications in this study include some important novel features, notably, a generally successful and encouraging use of computer programs for dating turns in both business cycles and growth cycles.

New concepts and new methods are, of course, always especially open to criticism. Ilse Mintz's study has already stimulated much useful discussion and is likely to continue to do so. While her arguments here counter several objections to growth cycles,[4] it is necessary to recognize that some of the methods used in this report are still in an experimental stage and that some of the results are based on limited evidence and need further testing. For example, the particular monthly dates of the upturns and downturns in the growth cycles are still tentative, whereas the number and approximate time of occurrence of high-rate and low-rate phases are already convincingly identified. Much additional work will be required to enable us to date the growth-cycle phases precisely on a current basis.

Among the important findings of this study is the need to distinguish between cycles in nominal or pecuniary indicators and those in "real" indicators (measured in constant dollars or in physical units). This distinction should prove to be of great import in times of persistent but varying inflationary pressures. It deserves, and should receive promptly, much further attention, with a view to providing cyclical chronologies for both groups of series on a regular basis.

Future developments in research are for the most part highly uncertain, but it seems relatively safe to predict that Ilse Mintz's work on growth cycles will enrich the study of causes, consequences, and policy implications of the major contemporary types of economic instability.

Victor Zarnowitz

[1] REVISING THE BUSINESS-CYCLE CONCEPT

Mildness of Modern Business Cycles

Some experts call business cycles a thing of the past, extinct as dinosaurs. Others, on the contrary, regard the current fluctuations in the United States economy as one of the most important economic and political issues. Why do these differences in views exist?

Economic fluctuations since World War II have been much milder than previous ones.[5] Nowadays, recessions in the sense of absolute and sustained declines in aggregate economic activity are rare exceptions. Alternations of periods of fast growth with periods of slow growth have replaced, in most instances, the alternations between the rise and fall of economic activity which constituted the classical business cycle. This statement holds for most countries, including the United States. In this country, recessions included less than one-sixth of the months between 1948 and 1969, and in the later part of this period, expansion was unbroken for more than eight years.

However, the mildness of the fluctuations does not prevent experts and laymen, both in the United States and abroad, from paying great attention to them, and from regarding periods of slow growth much as periods of decline were viewed in former days. In this field, as everywhere, aspirations have risen with achievements, and today rising aggregate economic activity does not preclude concern about subnormal performance.[6]

It is precisely because of this present attitude and its effect on government policies that traditional recessions have become infrequent. As a

My largest debt by far is to Geoffrey H. Moore for invaluable advice and general support. Special thanks are due also to Charlotte Boschan, without whose generous help in devising statistical techniques and in supervising their programing the study would not have been possible. Further, I am grateful for many excellent suggestions to F. Thomas Juster and Robert E. Lipsey, who directed the study during Dr. Moore's absence; to the members of the staff reading committee, Phillip Cagan, Solomon Fabricant, and Victor Zarnowitz; and to the members of the directors' reading committee, Maurice W. Lee and Robert M. Will.

Jai Eun Lee, Barry J. Geller, Dorothy O'Brien, and Antoinette Delak handled the computations and prepared the tables. H. Irving Forman applied his expertise to the processing of the charts; Muriel Moeller supervised the progress of the manuscript from stage to stage; and Ruth Ridler did the editing. I gratefully acknowledge all these contributions.

consequence, the creation of a framework which will fit past mild fluctuations and cover future ones appears useful. The generally known fluctuations of the postwar period are picked up easily by the growth-cycle definition, as will be demonstrated below.[7]

A period of low growth is, of course, quite different from a period of absolute decline in many ways. However, in other ways, the two are similar. Alternations between periods of, say, 4 per cent rises and 2 per cent falls (which qualify as classical business cycles) and alternations between periods of, say, 8 per cent rises and 2 per cent rises may be expected to show a considerable family resemblance.[8] This resemblance in duration, in pervasiveness, and in other aspects will be affirmed by the findings of this study.

The time has come to devise new tools of business-cycle analysis—tools adapted to the moderation of the cycle—and this, essentially, is the task undertaken in this study. I have tried to develop a working concept which can do for the analysis of growth cycles, as I shall call them, what the Burns-Mitchell definition has done for the analysis of classical cycles.

It seems reasonable to expect that dating the phases of growth cycles will give precision to the variety of notions now encountered and will make it possible to measure the timing relations, the durations, and the amplitudes of growth cycles in the various sectors of the economy and in aggregate economic activity.[9]

The proposed chronology will, moreover, facilitate comparisons between United States fluctuations and those in foreign economies which have had almost no experience with classical cycles since World War II.

It should be stressed that the new chronology is not intended to supplant the traditional one. The treasure we possess in our knowledge of business cycles, cast in the framework of classical cycles, will continue to be used and to be elaborated further. The goal is to combine it with a similiar body of information about growth cycles.

The Definition of Growth Cycles

If the insights gained through the new chronology are to be comparable to those provided by classical business cycles, it is important to choose a growth-cycle concept which resembles the Burns-Mitchell definition of business cycles as closely as possible.[10] The similarity between the two concepts is brought out by the new definition: A growth cycle is a fluctuation in aggregate economic activity, consisting of a period of relatively high growth rates occurring at about the same time in many economic activities, followed by a period of similarly widespread low growth rates, which merges into the high-growth phase of the next cycle.

Alternatively, the Burns-Mitchell definition could be revised by inserting the words "adjusted for their long-run trends" after "economic activities." This version brings out the identity between classical cycles and growth cycles when long-run trends are horizontal. Establishment of growth-cycle analysis will mean that Burns and Mitchell's old ideal—to have two sets of measures, "one as free as possible from trend factors, the other including intracycle trends"—has at long last been attained. Before the advent of the computer, the realization of this ideal was prevented by the expensiveness of double analysis.[11]

Important implications of using the Burns-Mitchell definition are the rejection of the definition of reference cycles as cycles in a single comprehensive aggregate, and the retention of the idea of reference cycles as fluctuations occurring at about the same time in a broad variety of economic activities, comprising inputs and outputs in physical and dollar units, measures of financial markets, prices, wages, interest rates, and so on.

The growth-cycle definition differs from the traditional one in replacing the words "expansion" and "contraction" by "period of relatively high growth rates" and "period of relatively low growth rates." This implies a change in the criterion by which the two cycle phases are distinguished. In classical cycles, this consists simply of the direction of change in economic activities. In growth cycles, the criterion is the relation of a given rate of change in economic activities to a corresponding "average" or "normal" rate.[12]

The Methods and the Plan of the Study

Because of the exploratory character of the work, two independent methods are employed in this study to distinguish between "high" and "low" growth rates. One defines growth cycles as cycles in the percentage deviations of the data from their long-run trends (deviation cycles). A rise in these deviations, i.e., growth which is more rapid than the trend rate, is classified as "relatively high." The deviations are analyzed in the same fashion as are data unadjusted for trend in the study of classical business cycles. This concept is as close as can be to the traditional one. It is, of course, open to the objection that cycles identified in trend-adjusted data vary with the selection of the trend curve.[13]

Therefore, the results are checked by those obtained with the second concept, which requires no trend fitting but which deals directly with the rate of change, rather than with the series proper. This method distinguishes between high and low rates by comparing the average rates of change during successive time periods. The "normal" rate is defined as the average rate in a full cycle. The cycle must comprise two parts: in one, the average rate of change must be significantly higher than the cycle average;

and in the other, it must be significantly lower. These alternations of periods of high growth rates with periods of low growth rates are termed step cycles.[14] (The reasons for defining growth cycles in terms of high and low rates as distinct from rising and falling rates will be explained in the section on deviation and step cycles in individual indicators.)

The two-pronged approach provides a check on the reliability and stability of the growth-cycle chronology which is most desirable at this stage. Since both methods refer to the same cycle concept, they should, and actually do, yield approximately the same growth-cycle turning dates.

Application of the two methods was rendered possible by the computerization of the entire procedure. This was done at the NBER, partly in the pioneering work on business-cycle analysis by Bry and Boschan,[15] and partly by Boschan for the present study.

The testing of the feasibility of programed cycle dating may be regarded as a second purpose of the present study. Such dating is very different, of course, from the NBER's traditional procedure, which relies for the identification of turning points on the judgment of experts guided by a set of rules.

Before accepting computerized procedures, one must know how the results obtained compare with those obtained by traditional methods. Since the latter have never been applied to growth cycles, such a comparison of findings is possible for classical cycles only; and for this reason, the programed analysis of classical cycles precedes the analysis of growth cycles in this paper (Section 4).[16] The results are most encouraging in the sense that the traditional business-cycle chronology can be almost exactly reproduced by programed methods.

Another by-product of the study is the exploration of another new cycle concept: deflated cycles, i.e., cycles adjusted for price movements. Deflated cycles are based on series in physical units or in constant dollar values, while the customary undeflated cycles are based, in addition, on current dollar values and on price data (Section 5).

To sum up, the plan of this paper is as follows. Section 2 discusses the desirability of recognizing growth cycles. Section 3 deals with the computerization of cycle dating. Sections 4 and 5 describe the results of such dating when applied to classical business cycles, undeflated and deflated. Sections 6, 7, and 8 present the analysis of growth cycles, undeflated and deflated. Section 9 summarizes the results.

[2] OBJECTIONS TO GROWTH CYCLES

Criticisms of the proposed growth-cycle concept are of two types: those objecting to its similarity to the NBER reference-cycle concept, and those objecting to its dissimilarity.

"The Truth Resides in Subindexes."[17]

One objection to the NBER concept of aggregate economic activity is that it is a "hodgepodge of different things" without real meaning. What is needed, according to this view, are subindexes for such economic processes as production, prices, financial markets, socially relevant factors, and so on.

My reply to this criticism is that the importance of subindexes is not to be denied, but that it is not called into question by the construction of an aggregate index. What the reference cycle for aggregate activity does is to tie the subindexes together, just as the realities they represent are tied together in the economy. Were the general reference cycle to be abolished, it would soon be resurrected, because one would need to relate the subindexes to each other and the reference cycle is a shortcut way of doing this. For instance, how could cycles in financial activity be evaluated without relating them to price cycles, production cycles, and so on?

It should also be noted that any subindex covers diverse items. If this were objectionable, one would have to abstain from any aggregation.

Subindexes can easily be constructed with the methods proposed in this paper. In fact, the deflated growth cycle of this study can be regarded as a type of subindex.

The GNP Gap as Sole Indicator

Another familiar objection to the NBER cycle concept suggests that a single indicator, the GNP or the GNP gap, is preferable to the NBER indicator list. The definition of growth cycles as cycles in the trend-adjusted GNP is rejected here for the same reasons for which the NBER has rejected the definition of classical business cycles as cycles in the GNP. These reasons are that investigations have shown how uncertainties in the measurement of GNP and the necessarily very frequent revisions (which often reach back a number of years) increase the likelihood of selecting the wrong turns.[18] Moreover, GNP data are not available monthly, whereas a monthly reference chronology is required.

Rejection of the concept of reference cycles as cycles in the GNP implies, a fortiori, rejection of a definition which at first glance appears most appealing: a cycle in capacity utilization or in the gap between actual and potential output. The importance of the degree of capacity utilization makes this concept meaningful and attractive.[19] However, the likelihood of error is even greater with this definition than when growth cycles are defined as cycles in the GNP. Potential output is not a fact but an estimate that varies enormously with the observer's point of view. The estimate depends on assumptions regarding potential inputs and potential productivity, which unavoidably leave much room for the analyst's judgment. Exclusive reliance on such estimates does not appear desirable.[20]

If the potential GNP were represented by the long-run trend in the actual GNP, then the GNP's deviations from its long-run trend, which is among our indicators, could be regarded as a measure of the output gap. Usually, however, the potential GNP is represented by a higher line, drawn at the estimated full-employment level.

Cycles in Real Economic Activity in Lieu of Growth Cycles?

A significant supplement to the traditional business-cycle concept has been suggested recently by Solomon Fabricant.[21] He argues that "as everybody knows, the general price level has been rising more sharply in recent years than at any other time since the outbreak of the Korean War. Statistical series measuring economic activity in terms of current-price values will be affected by these price changes to a greater degree now than in most earlier periods." He concludes that under today's conditions, only indicators measured in real terms should be used in identifying business cycles. The customary pecuniary indicators should be replaced by their deflated counterparts. Aggregate economic activity should be represented by indexes of indicators measuring real economic activity, i.e., deflated pecuniary series and series in physical units, rather than by the traditional mixture of real- and current-dollar indicators.

Fabricant realizes, of course, that the concept of a cycle in real economic activity is very different from the traditional business-cycle concept and that we cannot adequately describe what happens during business cycles, or adequately explain what occurs without referring to price changes.[22]

Fluctuations in the general price level constitute major elements in the process by which a business expansion attains momentum and gradually develops the restrictive forces that tend to bring it to a close. Similarly, prices and costs play a part in the process by which recessions breed revivals.

But despite their limitations, deflated cycles are of great interest today. Consequently, this study follows Fabricant's suggestion, presenting indexes of deflated reference cycles for comparison to the traditional ones (Chart 1, p. 23). The results show that undeflated and deflated classical business cycles have differed slightly at some points in history and materially at others, especially in 1969–70. Thus, they must be clearly distinguished from one another.

However, it would be an error to believe that deflated cycles are a substitute for growth cycles. Except, possibly, for the 1969–70 episode, postwar recessions have not been more frequent in real economic activity than in the traditional combination of real and pecuniary activities. There is no Korean War cycle in the deflated indexes, and the 1961–69 expansion remains unbroken. These facts are not surprising. The absence of recessions was not merely a matter of rising prices. It reflected a stability in real terms, and therefore one will not obtain by deflation the distinction between cycle phases that is needed as an analytic tool, and which corresponds to the general views on current fluctuations.

For this reason, Fabricant suggests investigating cycles in real and also trend-adjusted activities, i.e., deflated growth cycles. Indexes of such cycles have been constructed in the present study and it has been found that the timing of turns in deflated growth cycles is similar to, but not identical with, that of undeflated growth cycles (Charts 14 and 15).[23]

Deflation has less effect on growth cycles than on classical cycles, because price trends are removed from the former even when they are undeflated. However, the main contrast between growth cycles and classical cycles is not removed by deflation, since it is not attributable to price trends.

Cycles in Sensitive Indicators in Lieu of Growth Cycles?

Another possible reference-cycle concept which, to some experts, may appear preferable to growth cycles has been used in some countries as a basis for empirical research.[24] Its salient feature is that the direction of change is decisive, as in classical cycles. But, in contrast to the classical-cycle concept, absolute declines observed in certain selected activities suffice for recognizing recessions. Indicators of especially high cyclical sensitivity may show absolute declines despite rising trends. Other indicators fail to participate in the general trend of the economy. Declines in indicators of this type constitute a recession by this definition, the continued growth in aggregate activity notwithstanding.

The switch from a widely diffused decline in aggregate activity to a decline in selected activities involves a more radical change in concept than may at first appear. The revised concept can be defended only on one of two assumptions: either the activities selected for their absolute declines are more significant than those not declining; or else, the absolute decline in selected activities coincides with reduced growth in the rest of the economy and is significant for this reason. Even if the latter assumption should be warranted, preference for the use of absolute declines in selected activities would mean that such declines are deemed to be a better measure of retarded growth in aggregate activity than are growth rates in the majority of activities which show no absolute decline.

The concept of the business cycle described above has not been explicitly stated and advocated, as far as I know. Nor have the underlying assumptions been spelled out and investigated. Yet empirical business-cycle research in some countries is based on it. The reason is probably that it retains the classical direction-of-change criterion; and in contrast to our modified concept, it requires no revision of statistical methods. However, this simplicity is more apparent than real in view of the crucial unanswered questions that have been mentioned here.

Also, most indicators of this type are leaders and, thus, are not usable for a chronology of turning points. When we look at 1966–67 as a good example of the type of episode we want to define, we find that only the following coincident indicators declined: some (not all) measures of the labor market, interest rates, and the industrial-production index. Determination of a cycle would thus rest on thin evidence, which might easily dwindle further in the near future, so that another revision might soon be required. The concept of a widely diffused decline in aggregate activity would, of course, be abandoned by this definition.

The Difficulties of Dating Growth Cycles

One of the most serious obstacles to the general acceptance of growth cycles is their necessary reliance, first, "upon data that are not widely used and accepted"; and, second, upon controversial and untested methods.[25]

Those who hold these views are right to remind us that the new findings are still tentative and must be used with caution. However, the question is whether these findings are really rendered worthless by the weaknesses of the methodology. The impressive stability and generally reasonable character of the findings argue against their rejection.

Regarding the problem of acceptance of data in unfamiliar forms, it is encouraging to remember that the public has, in recent years, accepted the concept of seasonal adjustment, which is not any simpler than that of trend adjustment.

It is true, of course, that deviation cycles depend on the selection of the trend curve, "the type of trend that is fitted, what period is used in fitting it, how it is extrapolated, and how deviations from it are measured."[26]

We try to meet this objection in various ways, which are described in detail in Section 6. Thus, the formula used (a long-term moving average) is the same for all indicators, so that subjective judgment does not enter into the adjustment of individual ones. In this respect, the approach is similar to that applied in seasonal adjustment, which also is objective in the sense that once a method has been adopted, the adjustment of individual series is prescribed.

Moreover, the use of a number of indicators, each adjusted by its own trend, renders the choice of the trend curve less dangerous than it is when business cycles are defined by the gap between potential and actual GNP and everything depends on *one* trend.

But, most important, the deviation cycles are checked by the second approach: the step cycles. The good agreement between cycles obtained with the two quite different approaches shows that the results of both are not due to chance, and that the choice of the trend curve does not, in general, distort them. The economic movements being measured—and this is one of the main points brought out by the study—are solid facts, not easily suppressed or simulated by minor deficiencies in the treatment of the data. This is not to deny that there may be much room for future improvements in methodology.[27]

Another difficulty inherent in the growth-cycle concept is the relatively long interval between occurrence and recognition of turning points. In classical cycles, indicators can be classified as rising or falling as soon as the data become available. In growth cycles, indicator movements must be compared to "normal" growth, and what growth is "normal" in the period around the turn in question can be determined only after a certain time has elapsed.

Thus, to set a turn in deviation cycles, one must be able to estimate the trend prevailing at the time of the turn; and in order to set a turn in step cycles, one must estimate the average rate of change in the following period. Whatever the method, it is in the nature of growth cycles that the recognition lag tends to be longer than that for classical cycles. The effect of programed dating on recognition lags will be explained in the next chapter.

The Terminology

One difficulty with the introduction of the growth cycle as a second cycle concept is that the existence of the two chronologies can easily create confusion. It is important to guard against this, because the progress which has been made at the NBER in the analysis of business cycles would have been impossible without Burns and Mitchell's insistence on the use and application of precisely defined concepts. Labeling a period as a "recession" is not just a matter of semantics. It implies that this period is covered by all generalizations about classical recessions. Applied to a growth-cycle phase, the term is misleading, since measures of duration, amplitude, and so on, when based on the growth-cycle concept, differ from their counterparts based on the traditional concept. If both types of measures were to be termed measures of "recession," it would be necessary to add to each statement, and to each table, a note explaining which concept of recession is intended.

It is necessary, therefore, to use different terms for the two types of cycles and for their phases and turning points. The terms used in this study leave much to be desired and should be replaced as soon as more apt ones suggest themselves. For the time being, economic fluctuations described by the revised definition (p. 6) are called growth cycles. The word is chosen for want of a better one, despite the disadvantage of its having served previously to designate certain long cycles. The growth cycle consists of a high-rate phase and a low-rate phase, terms suggested to me by Leonard H. Lempert. The end points of the phases are termed growth downturns and growth upturns, rather than peaks and troughs.

The Inflationary Effect

The most serious argument against the growth-cycle concept concerns its effect on economic policy. Labeling a period as a low-rate phase may be interpreted as a call for an easier monetary policy or a budget deficit, while the same situation, labeled classical expansion, would not be interpreted in this fashion. Hence, the recognition of growth cycles could impart an inflationary bias to economic policy.

Needleess to say, classification of a period as one phase or the other involves no value judgment. Two observers who accept the same classification may hold opposite views regarding the desirability of a certain state of the economy. Which phase of a growth cycle is deemed preferable depends on the level of employment, the rate of inflation, and other circumstances, and on the observer's evaluation of these factors.

The big question is whether the public and the policymakers can be convinced that low-rate phases are not necessarily undesirable. Careful use of terms may help. "The new definition ought to be 'defused.' It should be defused in the sense that any current policy implications should be removed as clearly as possible."[28] Low-rate phases should be distinguished clearly from classical recessions.

However, even exercising all due care, it may sometimes be impossible to prevent excessively expansionary policies in low-rate phases. Should this circumstance be blamed on the growth-cycle concept rather than on other much more powerful and more deep-seated factors? Certainly, exclusive attention to classical business cycles is no guarantee against inflation, and it is doubtful that the headline "NBER declares low-rate phase" would induce overly stimulative policies if such policies were not in the offing anyway.[29]

In the absence of proinflationary attitudes, low-rate phases can, at times, be regarded as desirable. In Germany, for instance, they are not generally condemned. On the contrary, such phases are often termed "recovery of economic stability" and "cooling-off period," while high-rate phases may be designated as "imbalanced" and "overstraining." In short, it is not suppression of information on growth cycles but a change in the public's attitudes that is needful if policies with inflationary effects are to be avoided.

[3] COMPUTERIZED CYCLE DATING AND THE SELECTION OF INDICATORS

Programed Determination of Turning Points[30]

Traditionally, the determination of cycle turns by the NBER relies on a set of rules devised by Burns and Mitchell.[31] These rules, however, were meant to aid, not to replace, the analyst's judgment. This applies to determination of "specific" turns in individual times series, while the role of judgment is even greater when it comes to selecting reference dates. In the latter case, decisions are required, for instance, on the weight to be attached to each economic class of indicators and to each series within a class. Thus, it takes the long experience of members of the NBER staff to select the business-cycle turns which have come to be accepted not only nationally but all over the globe.

The flexibility of the traditional method was virtually indispensable as long as precise information on business cycles was lacking. Even today it has certain advantages over rigid mechanical procedures. Obviously, however, the necessity of relying upon subjective interpretation by specialized experts, and the consequent irreproducible nature of the selections, have their disadvantages, as critics have not failed to point out.

These disadvantages would be far greater in the case of growth cycles than in the dating of classical cycles. Because of the novelty of the concept, growth-cycle dating cannot rely on tradition and experience. Thus, if it could not be done by mechanical methods, it would be strongly affected by personal preferences.

Computerization may also be expected to induce an increased use of the NBER technique, since analysts no longer have to invest their time in acquiring specialized and detailed knowledge of procedures, and in gaining experience with their application, as is the case with the traditional method.[32]

All of which is not to deny that in some respects programed dating is inferior to traditional dating. The main weakness of the former is that the time required for the recognition of current turns will often be longer than with traditional dating. The program "requires evidence for four or more months after the occurrence of a cyclical turn in the component series."[33]

Judgmental dating may be accelerated by the use of evidence that is not incorporated in the program for one reason or another. Its use, of course, increases the likelihood of error and is not an unmixed blessing. (In the case of growth cycles, the recognition lag due to mechanical procedures is compounded by the lag inherent in the growth-cycle concept, as explained in Section 2.)

Nonetheless, it would not make sense to reject programed dating because of late identification of current turns. Nothing prevents an analyst from selecting tentative current turns by traditional methods, as before. The difference is that the new technique enables him to check his decisions objectively later.

The large accumulation of knowledge about business cycles gained during many years of cycle dating, and the possibility of using computer programs to simulate—in part, at least—the traditional procedures, have led Bry and Boschan of the NBER to experiment with a programed selection of indicator turns.[34] The results are most encouraging in the sense that the dates selected formerly by the NBER analysts are, in general, reproduced by the programed procedures.

Bry and Boschan also have taken the first steps toward the programed dating of reference cycles, an experiment which is carried further by the present study. Reference-cycle turns are defined as turns in composite indexes and diffusion indexes, and these indexes are derived by combining selected indicator series. As will be explained in detail later on, the composite index is an average of modified and standardized indiicators, while the diffusion index is based on a count of the number of indicators rising and falling during a given month.

Before the new methods are used for the identification of growth cycles, they are tested by applying them to the dating of classical business cycles, where turns can be judged by comparison to those set by traditional methods. According to this test, the new methods are highly successful in that they exactly reproduce each of the eight handpicked turns, 1948–61. This suggests that in growth cycles, too, the dates of our programed turns are those that would have been selected by traditional methods.

Identification of growth cycles proceeds by the same rules that are applied to classical cycles by the Bry-Boschan program. As regards durations of phases and cycles, this means minimum lengths of five months for a cycle phase and fifteen months for a full cycle.[35]

It may be noted that the relative length of the two phases of the classical cycle will differ from those of the growth cycle. In a growing economy, high-rate phases must always coincide with expansions of classical cycles, while low-rate phases may coincide with either classical-cycle phase. Conversely, classical expansions may be times of high or of low rates in growth cycles. Classical recessions, on the other hand, must be low-rate phases, since negative rates of change are necessarily below the normal rising ones. Thus, high-rate phases will tend to be shorter than expansions, and low-rate phases will tend to be longer than recessions. To put it another way, growth downturns will tend to lead peaks, and growth upturns will tend to lag troughs.

Regarding amplitudes and diffusion, no specific requirements have been set up in the traditional NBER procedure, although the general requirement is imposed that cycles should be widely diffused and should not be divisible into shorter cycles of similar character with amplitudes approximating their own.

Neither the Bry-Boschan program nor the method of this study specifies amplitude minima, since such a criterion is very difficult to introduce. The degree of diffusion, on the contrary, is decisive in the computerized determination of reference cycles, which relies on diffusion indexes and composite indexes.

The Selection of Indicators

Mechanical reference cycle dating involves a difficult problem: the selection of a fixed list of indicators. How many series to include, which ones to select, and what weights to apply must be determined.

These questions did not arise when the traditional method was applied. Its flexibility enabled the analyst to vary the implied weights of a series as the situation required. He was free to disregard an otherwise reliable indicator if there was reason to believe that its movements in a particular case were due to special, noncyclical forces, as occasionally happens.[36]

In the mechanical determination of reference turns, on the contrary, a fixed list of indicators must be used—at least in the present stage of the experiment. Making up such a fixed list involves problems which have not heretofore been encountered in cycle dating, but which are similar to problems met before in selecting so-called short lists of indicators. Actually, these short lists can be regarded as precursors of the fixed list (and the latest ones are so regarded).[37]

Only by experimentation can the effects of the various necessary choices be detected. For this reason, the lists on which most of the present study is based may not be the ultimate ones.

As far as this study is concerned, the problems of the indicator lists are entirely a matter of the mechanization of the procedure and are not caused by the introduction of growth cycles. The latter had no effect on the selection for the simple reason that before the setting of benchmarks for growth cycles there was no precise information on the behavior of individual indicators in these cycles. The selected list, therefore, is based on the indicators' performance in classical cycles, on the assumption, confirmed by the study of German growth cycles, that the timing of individual indicators in growth cycles tends to be similar to that in classical cycles.

The results for United States cycles support this idea. With few exceptions, the short leads or lags exhibited by some of the indicators used at classical turns are found again at growth-cycle turns. However, this does not mean that an analysis of indicators other than those used might not disclose differences in timing between trend-adjusted and unadjusted series. It could turn out, for instance, that indicators with strong trends, which for this reason are not useful in dating classical cycles, score high in the dating of growth cycles. Conversely, other indicators may fail to reflect the more subtle growth cycles although their sensitivity suffices for classical ones.

In the future, when the framework of the growth-cycle reference dates provided by this study can be used to analyze a large number of indicators, such differences should be revealed. At present, however, the best working hypothesis is to assume similarity in an indicator's relation to the two types of cycles. Thus, we expect series which coincide with classical cycles to coincide also with growth cycles, and so on.

On this assumption, we accepted the classification of indicators which underlies the NBER dating of classical cycles and chose indicators from the large collection of series whose cyclical properties have been thoroughly analyzed and evaluated at the NBER, mainly in the work of Geoffrey H. Moore and Julius Shiskin.[38]

The following are some of the difficult choices confronted in selecting a fixed list: How many indicators should be included? Taking a small group has the advantage that the selection can be limited to the highest-scoring coincident indicators. On the other hand, even the best indicators are imperfect, and this argues for a longer list, which will reduce the effect of the vagaries of an individual series on the results. We have experimented with lists of 7, 12, 17, and 19 indicators and have settled tentatively on a 12-indicator list. The selections are described in Section 4 and the series are shown in Table 1.

The next question which arises is whether to include only roughly coincident indicators or also leading and lagging ones.[39] Although the former are naturally the most important for cycle dating, leading and lagging series can also be helpful when they represent important aspects of the economy not represented by the coincident ones. In cases of double peaks and troughs, for instance, leading and lagging indicators may contribute to decision making.

Moreover, it would be wrong to assume that turns in averages of indicators classified as "roughly coincident" coincide exactly with the handpicked classical reference turns. The truth is that the roughly coincident series lead far more often than they lag. This reflects the NBER principle of late dating, of which more below. If such series are used exclusively, the combined index has a tendency to lead at reference dates.

To compensate for this, one or more lagging series must be included.

A third issue concerns the inclusion of quarterly series, which may be deemed inappropriate for determining monthly reference turns.[40] However, "it would not do to neglect quarterly series entirely. GNP, plant and equipment expenditures, new capital appropriations, changes in business inventories, and corporate profits, all of which are quarterly, are far too important."[41] These series are helpful in deciding the existence of a cycle in doubtful cases and in determining the neighborhood of turns. Therefore, three quarterly series are included in the 12-indicator list.

However, the assumption that quarterly series turn in the center month of the quarter may impart a bias toward center-month turns to the reference dates. Such bias has been avoided by interpolating the quarterly series by a smooth graduated curve.[42]

How should one choose among all the possible indicator lists that would fit the aforementioned general considerations? Our main criterion in evaluating a list is its performance in dating classical business cycles. The chronology obtained when our mechanical methods are applied to the list in question should be as similar as possible to the generally accepted NBER chronology obtained by traditional subjective methods. The idea is that a list which yields the "right" classical turns will also yield the "right" growth-cycle turns. This is certainly open to question, but, at present, it is the best working hypothesis. Moreover, use of such a list warrants the assumption that the relations found between classical and growth cycles are not attributable to the choice of indicators.

The task then, is to put together a list of indicators, on the basis of which our mechanical methods can reproduce the classical NBER cycle chronology. Outsiders may think that this is easy, that any combination of high-rated indicators will fill the bill. But this is not so. Because the indicators are imperfect, the turns of indicator averages vary with the indicator mix. Moreover, some indicators on which the chronology is based were revised substantially after the determination of the presently used dates. Considerable experimentation with combinations of indicators deemed representative of the economy is needed to discover a list with which the computer program can reproduce each of the eight classical-cycle turns, 1948–61.

Our selected 12-series list is nearly perfect by this standard. The diffusion index based on this list hits five of the target turns precisely and misses three by one month each, while the composite index hits six and misses two by one month each.[43] This, of course, does not rule out revision of the list in the light of future experience. The next section discusses the classical reference dates obtained with different indicator lists.

[4] CLASSICAL BUSINESS CYCLES DATED BY COMPUTERIZED METHODS

Seasonal Adjustment and Modification of Indicators

The first step in preparing the data for cyclical analysis is to adjust them for seasonal fluctuations. This adjustment is made either at the data source or at the Bureau of Economic Analysis by the X-11 seasonal adjustment program, and the adjusted indicators are published in *Business Conditions Digest* (BCD).[44] We do not use the series in their published form, however, but a modified version which is also produced by the X-11 program, and which is designed to eliminate extremes from the irregular component of the series.[45] Modification could be dispensed with in the analysis of classical cycles but it is necessary in the analysis of rates of change where, otherwise, large erratic movements would be too disturbing. It is not to be denied that modification, like seasonal adjustment, may shift turns in undesirable ways at times; but this disadvantage is minor in comparison with some quite unacceptable results obtained with unmodified series in the analysis of growth cycles.

Selection of Turning Points in Indicators

The turning points of the adjusted and modified series are selected by the aforementioned Bry-Boschan computerized method.[46] This method consists, essentially, in first identifying major cyclical swings, then delineating the neighborhoods of their maxima and minima, and finally narrowing the search for turning points to specific calendar dates. All procedures are performed on the seasonally adjusted modified data.

This stepwise approach to the selection of turns is necessary because most time series are much too choppy for direct mechanical selection of cyclical maxima and minima. Such a procedure would give a large number of highs and lows, most of which would indicate only a brief fluttering of the data rather than a cyclical turn. For this reason, the existence of cycles must first be determined in a smoothed form of the series before the precise date can be selected in the unsmoothed data.

The first curve from which turning points are determined is a twelve-month moving average of the seasonally adjusted, modified data. This is a convenient means for eliminating fluctuations of subcyclical duration or of very shallow amplitude. The rule for selecting turning points is this: any month whose value is higher than those of the five preceding months and the five following months is regarded as the date of a tentative peak; analogously, the month whose value is lower than the five values on either side of it is regarded as the date of a tentative trough. These tentative turns are tested for compliance with a set of constraint rules concerning alternation of phases and duration of phases and cycles.

The next step in the process is the determination of tentative cyclical turns on the Spencer curve of the seasonally adjusted modified data. The Spencer curve is selected as the next intermediary curve because its turns tend to be closer to those of the unsmoothed data than are those of the twelve-month moving average.[47]

Basically, the program searches, in the neighborhood (defined as plus or minus five months) of the turns established on the twelve-month moving average, for like turns on the Spencer curve. That is, in the neighborhood of peaks, it searches for the highest of the eleven points on the Spencer curve; in the neighborhood of troughs, for the lowest. The Spencer curve turns thus located are then subjected to several tests.

A turn is rejected when it is (1) less than six months from either end of the series; (2) one of a pair of like turns less than fifteen months apart; or (3) one of a pair of like turns without an intervening opposite turn.

The accepted turns in the Spencer curve provide the basis for the next step in the search for turns in the unsmoothed data. In this step, the series is smoothed by a three- to six-month moving average. The exact number of months depends on the time it takes for the cyclical component to exceed the irregular component in the particular series analyzed.

The method of deriving turning points in this moving average is practically the same as that for the Spencer curve. The highest peaks on the moving-average curve within a span of five months from the dates of the peaks on the Spencer curve are selected and the troughs are chosen correspondingly.

The last step of the procedure is to find the peak and trough values in the unsmoothed, seasonally adjusted modified data which correspond to the short-term moving-average turns previously established. This search is analogous to the previous ones. The program establishes the highest values in the unsmoothed data within a span of plus or minus five months from the peak in the short-term moving average curve; similarly, the lowest value of the unsmoothed data in the neighborhood of moving-average troughs is established.[48]

Any turns not complying with the rules having been eliminated, the remaining ones are the final programed turning points of the series.

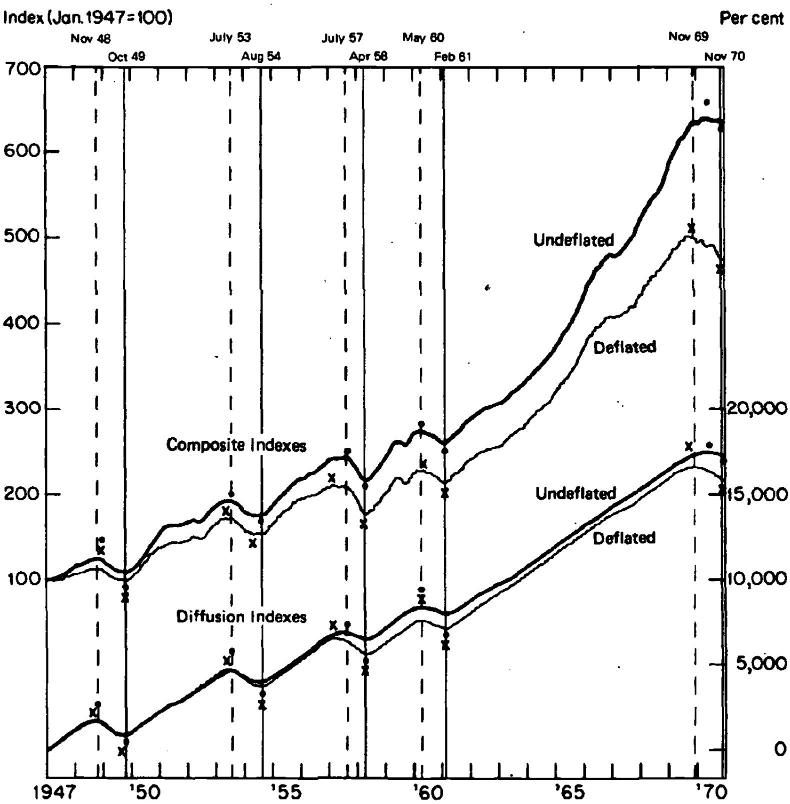
It should be noted that the computer program does not utilize directly any information on the amplitude of cycles. The only way in which amplitude plays a role is that the moving averages, especially the initial twelve-month moving average, tend to iron out minor swings (though only if they are also brief).[49] But there is no specification of amplitude minima, because setting them would involve problems that would greatly complicate the program. One major difficulty is that the "typical" amplitude of a series changes over time, so that standards derived from an earlier period may be entirely inappropriate in a later one. The program's disregard for amplitudes makes the good agreement between programed and traditional specific cycles even more remarkable, because amplitudes are among the factors considered in selecting turns by traditional methods although no minimum amplitudes are prescribed.

The computer program's rules are followed in the present study with one exception: the case of "double turns." The term designates two nearly equal peaks or troughs occurring within a short interval. When the series' standings at the two competing turns are exactly equal, double turns are no problem. According to the program's basic rules, the later date is selected. But when the standings differ, however slightly, the higher peak or lower trough is chosen by the program which may, of course, be the earlier one of the two. The timing of turns in two series thus may seem to differ widely although their double peaks coincide, because in one series, the standings are equal so that the later peak is selected; while in the other series, the standings are unequal and the earlier one is picked. But whether standings are exactly equal or not is often a matter of chance. Divergencies can be due, for instance, to the degree of rounding in the published data. For this reason, I have found it desirable to amend the program rule by requiring that in order to be selected as the peak, the earlier point must be at least 0.1 per cent above the later one, and correspondingly for troughs. By this rule, at least the most extreme cases of meaningless discrepancy are eliminated and, therefore, a number of turns in this study differ somewhat from those chosen by the program.

Construction of Indexes Representing Reference Cycles

For the present study, two indexes representing reference cycles have been constructed: diffusion indexes and composite indexes. The diffusion index is based on the indicators' turning points. It is constructed by counting, in each month covered, the number of indicators in their high-rate phase. The phase may be a classical expansion or a growth-cycle phase. An indicator is classified as being in a high-rate phase during the months between its upturn and its downturn, exclusive of the upturn month and inclusive of the downturn month. (The low-rate phase is defined correspondingly.) The excess of the number of indicators in high-rate phase over the number in low-rate phase is expressed as a percentage of the total number of indicators covered. This percentage is termed the "historical diffusion index." A downturn in this index—the reference-cycle downturn—is located in the month in which the number of indicators in the high phase

CHART 1 Composite and Diffusion Indexes in Classical U.S. Business Cycles, 1947–70



NOTES: Solid vertical lines indicate business-cycle troughs, broken vertical lines business-cycle peaks. Dots denote turns in undeflated series, crosses denote turns in deflated series.
Diffusion indexes are constructed by cumulating the excess of the percentage of indicators in expansion over the percentage in contraction. For definition of composite indexes, see text.
Undeflated indexes are based on 12 indicators, deflated indexes are based on 9 indicators (see text and Table 2, lines 18 to 21).

exceeds the number in the low phase and which precedes a month in which indicators in the low phase outnumber those in the high phase. The index thus crosses the zero line between the downturn and the following month. The upturn is determined in corresponding fashion. In order to show cycle turns, as customary, at the highest and lowest points of cycle curves, rather than at the crossing of the zero line, the index is usually shown in cumulated form (see Chart 1).[50]

Second, reference cycles are represented by composite indexes which do not require identification of indicator turns. These "amplitude-adjusted" indexes were developed by Julius Shiskin and are constructed as follows:[51] first, the month-to-month percentage changes in each indicator are obtained, using as base the average of the two months rather than the initial month (to assure symmetrical treatment of increases and decreases). Second, these percentage changes are standardized so that their average, without regard to sign, is equal to unity (1.0 per cent per month) for each indicator, January 1947–December 1970. Third, the adjusted percentages for a given month are averaged over the several indicators, which are given equal weights. Fourth, these averages are adjusted so that they too will equal 1.0 per cent per month, January 1947–December 1970. Finally, the adjusted average percentage changes are cumulated into a monthly index. Turning points in composite indexes are selected by the same method by which turning points in individual indicators are determined.

Opinions will differ regarding the acceptance or rejection by the program of borderline cases, i.e., relatively mild cycles. Since drawing the line here is a matter of subjective judgment, and since the turns selected by the program seem sensible to us, we have not attempted any modifications.

Timing of Different Chronologies at Traditional National Bureau Business-Cycle Turns

The list of indicators used to represent "the business cycle" should, when treated by the proposed program, yield turning dates close to the traditional handpicked ones. In order to select the best possible list with the means at our disposal, we determined turns in 28 different groups of indicators comprising from 5 to 19 series. Turns in indexes constructed from some of these lists are shown in Table 2.

The composition of the indicator lists will be found in Table 1 and brief characterizations of the indicators in the notes to Table 2. Most of the series are coincident indicators from the NBER 1966 list, with preference for those included in the "short list."[52] A few leaders and laggers from the short list are added in some instances. One series, imports, was included in some lists because of its recent high conformity although it is not on the NBER list. Many alternatives were tried, such as replacing total unemployment by long-duration unemployment (series 44), manufacturing and trade sales by sales of retail stores (series 54), Treasury bond yields by the Treasury bill rate (series 114).

The winning list (Table 1, columns 18, 19) covers 12 series and is satisfactory in the sense that the eight turns in its composite index, 1948–61, diverge only twice from traditional turns and the discrepancies are only one month each (Table 2, line 18). No other index in the table scores as high although the Shiskin-Moore composite index (line 4) comes very close. The fact that the turning dates of the composite index and the diffusion index for the 12 series are almost identical bolsters confidence in these dates and in the 12-indicator list. No such consensus is found in any of the other pairs of these indexes in Table 2. Since it performs better than all other lists tested, it was selected as the basis of the growth-cycle chronology.

Included in the selected list are 6 out of 7 coincident indicators from the short list and 5 other coinciders. There is, further, 1 lagging series from the short list to compensate for the coinciders' tendency to lead slightly. Out of the 12 series, 4 are in physical units, 5 in current dollars, 1 in constant dollars, 1 is a price index, and 1 represents interest rates. Nine series are monthly and 3 quarterly. The 12-indicator index includes the 5 indicators in the Shiskin-Moore index (nonfarm employment, unemployment rate, industrial production, personal income, and manufacturing and trade sales). The other 7 are nonfarm man-hours, labor income in manufacturing, mining and construction, industrial wholesale prices, Treasury bond yields, plant and equipment expenditures, and gross national product in current and in constant dollars.

A further point to be noted in favor of the 12-indicator list is the extraordinary smoothness of the indexes based on it (see Chart 1), which greatly reduces the uncertainty of turning dates. The month-to-month percentage change of the irregular component of the composite index is only 0.29 as compared to 0.43 for the Shiskin-Moore index. The ratio of the irregular to the cyclical change is 0.31 for the 12-indicator index, compared to 0.57 for the Shiskin-Moore index.[53] One of the reasons for the greater smoothness, apart from the larger number of component series, is that 3 of the 12 are quarterly series interpolated monthly by a graduated curve.

The dates of from 4 to 6 out of 8 turns in indexes constructed for this study from other than the selected lists differ from the traditional ones, and the total discrepancies amount to from 5 to 12 months.[54] One of the indexes (line 9) uses simply the 7 coincident indicators of the short list. Its performance is quite unsatisfactory. It leads at 4 out of 8 traditional turns. This reflects the fact that more than half of the timing relationships of the individual indicators are leads and the average timing of every one of them is leading (measured by the median timing at the 8 turns).

The indexes on lines 10, 14, and 15 use the same number of indicators as the selected list but differ from it by including corporate profits, job vacancies, and retail sales in lieu of wages and salaries, wholesale prices, and bond yields.[55] The timing of the composite index of this list is like that of the above-mentioned composite index of 7 coincident indicators, except for the 1957 peak, which is shifted from the end of the start of a flat ceiling by the addition of series with early downturns. Diffusion indexes derived from the same 12 indicators (lines 14, 15) also lead at the majority of turns, and the leads are on the average longer than those of the composite indexes. Expansion of the coverage of the indexes to 17 or 19 indicators

TABLE 1 Listing of Indicators Used in Table 2 (asterisk signifies that indicator was used)

BCD No.[a]	Line Numbers in Table 2 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
16								*	*	*	*	*	*	*	*				
19										*	*				*				
40						*													
41	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
42						*													
43		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
45						*													
46						*													
47	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
48								*	*	*	*	*	*	*	*	*	*	*	*
49								*	*	*	*	*	*	*	*				
51			*	*	*														
52	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
53						*			*	*	*			*	*	*	*		
54			*	*	*	*	*	*	*	*	*	*	*	*	*				
55				*	*	*			*	*	*			*	*	*	*		
56		*					*	*				*	*			*	*		
57	*					*													
61								*	*	*	*	*	*	*	*	*	*		
62									*	*	*			*	*				
71									*	*	*			*	*				
72										*	*				*				
114									*	*	*			*	*				
115																*	*		
200				*	*	*		*	*	*	*	*	*	*	*	*	*		
205						*	*	*	*	*	*	*	*	*	*	*	*	*	*
512									*	*	*			*	*				
52D																		*	*
53D																		*	*
56D																		*	*
61D																		*	*

[a]Key to *Business Conditions Digest* series identification numbers:
16 Corporate profits after taxes
19 Index of stock prices, 500 common stocks
40 Unemployment rate, married males, spouse present
41 Number of employees on nonagricultural payrolls
42 Total number of persons engaged in nonagricultural activities

reduces the average duration of the discrepancies, at least, if not their number (lines 11, 12, 13, 16, 17).

In addition to the indexes constructed for this study, Table 2 also shows indexes made up by others for purposes other than the determination of business-cycle turns (lines 4 to 8). Furthermore, the table includes, for comparison, the reference chronologies of Cloos and Trueblood, which are based not on mechanical methods but on judgments, similar to those applied to the traditional NBER turning points (lines 2 and 3; see source note to table).

Others' chronologies are like the specially constructed ones in differing at some points from the traditional NBER dates. Such differences occur at from 3 to 6 of the 8 turns covered, and involve leads and lags adding up to from 5 to 11 months (Table 2, last columns). Except for lags at the 1957 peak, almost all discrepancies are due to leads of the chronologies relative to the traditional NBER dates.

But stress on the discrepancies between programed and handpicked turns should not suppress the most important feature of Table 2: the stability of the cycle dates. There is not a single instance in which the measures would suggest omission of a turning point. There are also no additional turns in any of the indexes. Moreover, nearly 90 per cent of the turns of the indexes in Table 2 are in the same month or within one or two months of the traditional turns. This agreement is all the more striking as

43 Unemployment rate, total
45 Average weekly insured unemployment rate, state programs
46 Index of help wanted advertising in newspapers
47 Index of industrial production
48 Man-hours in nonagricultural establishments
49 Nonagricultural job openings unfilled
51 Bank debits outside New York City
52 Personal Income
53 Wage and salary income in mining, manufacturing, and construction
54 Sales of retail stores
55 Index of wholesale prices, industrial commodities
56 Manufacturing and trade sales
57 Final sales
61 Business expenditures for new plant and equipment
62 Index of labor cost per unit of output
71 Manufacturing and trade inventories, total book value
72 Commercial and industrial loans outstanding
114 Discount rate on new issues of 91-day Treasury bills
115 Yield on long term Treasury bonds
200 Gross national product in current dollars
205 Gross national product in 1958 dollars
512 General imports, total
52D 52 deflated by NBER
53D 53 deflated by NBER
56D 56 deflated by NBER
61D 61 deflated by NBER

SOURCE: See Notes to Table 2.

TABLE 2 Leads and Lags of Turns in 20 Chronologies of U.S. Classical Business Cycles at NBER Reference Turns, 1948–61
(CI = Composite Index; DI = Diffusion Index)

Line No.	Type of Index	No. of Indi-cators	Lead (−) or Lag (+) in Months at the Following Peaks (P) and Troughs (T) in U.S. Business Cycles (Year and Month): P 48	T 49	P 53	T 54	P 57	T 58	P 60	T 61	Total Dis-crepancies No.	No. of Months	Author (See notes for full references)
1			11	10	7	8	7	4	5	2			
			Others' Indexes										
2	No index used		−1	−3	0	−3	+1	0	0	0	4	8	Trueblood
3	Median	4	−1	−3	−1	−3	+1	0	0[a]	0	5[b]	9[c]	Cloos
4	CI	5	−1	0	0	0	+1	0	−3	0	3	5	Shiskin-Moore
5	CI	6	−1	0	0	−3	+1	0	0	0	3	5	Shiskin
6	DI	8	−1	0	−2	−1	0	0	−1	0	4	5	Shiskin
7	DI	8	−2	+1	0	−4	+1	−1	0	0	5	9	Shiskin
8	DI	15	−2	0	−1	−2	−4	0	−1	0	5	10	Bry-Boschan

						Experimental Indexes								Mintz
9	CI	7	−1	0	−2	−3	+1	0	−1	0	5	8		
10	CI	12	−1	0	−2	−3	−5	0	−1	0	5	12		
11	CI	17	−1	0	−1	−1	+1	+1	−1	0	6	6		
12	CI	19	−1	0	−2	−1	+1	+1	−1	0	6	7		
13	CI	19	−1	0	−1	0	+1	+1	−1	0	5	5		
14	DI	12	−2	0	−2	0	−4	−1	−1	0	5	10		
15	DI	12	−2	−2	−1	−3	−3	0	0	0	5	11		
16	DI	17	−1	−2	−1	0	+1	0	−1	0	5	6		
17	DI	19	−2	−2	−1	0	0	0	−1	0	4	6		
						Final Indexes								Mintz
18	CI	12[d]	0	0	0	0	+1	0	−1	0	2	2		
19	DI	12[d]	−1	0	0	0	+1	0	−1	0	3	3		
20	CI	9[e]	0	0	−2	−3	−5	0	0	0	3	10		
21	DI	9[e]	−2	−1	−1	0	−4	0	−1	0	5	9		

[a]Alternatively: +2.
[b]Alternatively: 6.
[c]Alternatively: 11.
[d]Represents the undeflated cycle.
[e]Represents the deflated cycle.

NOTE: For a listing of the individual series included in each index, see Table 1.

SOURCES AND COVERAGE FOR TABLE 2.

Line No.

1 The standard NBER business-cycle chronology.

2 Source: Norman C. Trueblood, "The Dating of Postwar Business Cycles," *Proceedings of the Business and Economic Statistics Section of the American Statistical Association, 1961, pp. 17-19.*

3 Source: George W. Cloos, "How Good Are the National Bureau's Reference Dates?" *Journal of Business,* January 1963, pp. 14-32.
Coverage: Roughly coincident indicators.

4 Source: Julius Shiskin and Geoffrey H. Moore, "Leading Indicator Indexes." Paper prepared for a meeting of the International Statistical Institute, London, September 1969, mimeographed, p. 7. This is series 820 in Department of Commerce, *Business Conditions Digest.*
Coverage: 5 roughly coincident indicators from the NBER 1966 Short List.

5 Source: Julius Shiskin, *Signals of Recession and Recovery* (New York: NBER, 1961), p. 180.
Coverage: 6 roughly coincident indicators from the NBER 1960 Short List.

6 Source: Same as for line 5, p. 185.
Coverage: 8 roughly coincident indicators from the NBER 1960 Short List. Diffusion index is current for one-month span.

7 Source and coverage same as for line 6.
Diffusion index is current for 3-month span.

8 Source: Gerhard Bry and Charlotte Boschan, *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs* (New York: NBER, 1971), Table 5.
Coverage: 14 roughly coincident indicators from NBER 1966 Short List and Full List.
Diffusion index is historical.

9 to 21 Source: Constructed for this study.

9 Coverage: All (7) roughly coincident indicators from the NBER 1966 Short List. Nonmodified series.

10 Coverage: Same indicators as in line 9, plus 1 leader and 1 lagger from same list, plus 3 roughly coincident indicators from NBER 1966 Full List. Nonmodified series.

11 Coverage: From the NBER 1966 Short List: 6 roughly coincident indicators, 1 leader, 3 laggers. From the NBER 1966 Full List: 6 roughly coincident indicators and 11 unclassified series. Modified series.

12 Coverage: Same as in line 11, except that 1 leader and 1 lagger are added. Modified series.

13 Same as line 12, except that index is rounded.

14 to 21 All diffusion indexes are historical.

14 Coverage: Same as line 10. Nonmodified series.
15 Coverage: Same as line 10. Modified series.
16 Coverage: Same as line 11. Modified series.
17 Coverage: Same as line 12. Modified series.

18 and 19 Coverage: See text and Table 1. Represents the undeflated cycle.

20 and 21 Coverage: See text and Table 1. Represents the deflated cycle.

the programed turns use the latest version of the indicators, while the traditional turns are based on earlier, unrevised versions.

[5] DEFLATED BUSINESS CYCLES AND THE RECESSION OF 1969–70[56]

Cycles in Real Economic Activity

After having agreed for some 20 years, the judgmental and mechanical approaches to cycle dating yield different results in 1969–70. The NBER experts picked November 1969 as the peak, while the composite and diffusion indexes based on the 12-indicator list turn down 7 months later, in June 1970. (See Table 3.) This discrepancy appears puzzling at first, but it is easily explained. The National Bureau's judgmental method yielding the November 1969 peak took account of the prevailing inflation, while the computerized procedure pointing to June 1970 was not so adjusted. In the inflationary situation of 1969, the Bureau experts gave relatively little weight to the continued increases in price series and current dollar values but focused attention instead on the downturns in measures of "real" economic activity, i.e., series in constant dollars or in physical units. Clearly a peak selected on this basis may, in a period of sharply rising prices, differ from a peak selected by the methods that do not discount inflation.

In such a period, price indexes and indexes in current dollar values (e.g., income in current dollars or sales in current dollars) may continue to rise even at times when constant dollar values decline. When cycles in "real" magnitudes are to be determined, one should, therefore, not "follow the traditional procedure of using pecuniary as well as real indicators or economic activity" but focus "on the indicators of real economic activity to avoid being misled in our judgment by the continuation of price inflation."[57] When turning points are selected by judgment in the traditional NBER fashion, a shift of emphasis from one group of indicators to another poses no difficulty, since, in any case, fixed weights are not assigned to indicators.

Elimination of the effect of price and income changes from fluctuations defined as business cycles would, of course, represent an important revision of the cycle concept, since formerly they were treated as one of the main features of business cycles. Interpretation of findings obtained with new standards requires information on the effects which the same standards would have had on earlier cycles. Can the new results be treated simply as continuation of the old ones? Although the recent inflation may have been steeper and longer lasting than earlier ones, it is certainly not the first one to occur. Prices and wages have also risen during previous cycles and have risen at times despite falling real economic activity.

Cycles in real activity need to be defined and measured in order to tell how much they differ from traditional cycles in quantities, value aggregates, *and* prices. For simplicity, cycles based solely on data in physical units or in constant dollars will henceforth be termed "deflated," and cycles based on physical unit or current dollar series and also on price indexes and interest rates will be called "undeflated." The 12-indicator list represents undeflated cycles. A list representing deflated cycles has been derived from it by dropping the price and interest rate series and one current dollar series, and by replacing four other current dollar series by their constant dollar counterparts. The remaining 9-indicator list (see Table 1, columns 20 and 21) was used to obtain a chronology of deflated classical business cycles. The concept of deflated cycles that is implied by the 9-indicator list is, of course, a tentative one. It serves, in this study, as a first experiment with such cycles, and the experience gained with it may well lead to its revision in later work.

For convenience a composite index and a diffusion index for deflated cycles are shown in Table 2, lines 20 and 21 and in Chart 1. It must be noted, however, that these indexes must be interpreted differently from the others in the table. The others were constructed in order to find that group of indicators which best represents undeflated cycles. The function of the indexes for deflated cycles is not to duplicate the traditional turns but to reveal the differences between turns in deflated and undeflated cycles. For this purpose, the deflated list has to be as similar as possible to the undeflated list.

The relation between turns in undeflated cycles and turn in deflated cycles depends on the behavior of prices. When prices move with real economic activity, turns in the two kinds of cycles will coincide. When prices move opposite to real activity but the changes in the former are smaller than those in the latter, deflated and undeflated cycles still move together and turn at the same dates. But when price movements are opposite to *and* larger than movements in deflated cycles, the turns will differ.

This is likely to occur shortly before peaks in undeflated cycles, when a moderate decline in real activity is often accompanied by a substantial rise in prices. Hence, one expects peaks in deflated cycles to show a tendency to lead those in undeflated cycles. Conversely, at troughs, continued inflation could produce an upturn in the undeflated cycle before the deflated cycle has turned around. In periods of downward price trends, the opposite sequences would be expected, so that undeflated cycles would lead deflated cycles at peaks and lag them at troughs.

TABLE 3 Summary: Reference Chronologies of U.S. Classical Business Cycles

		Month of Turn		
		Undeflated Cycle		Deflated Cycle
Peak (P) or Trough (T)	Year of Turn	Traditional NBER Turns	12-Indicator Composite Index	9-Indicator Composite Index
P	1948	November	November	November
T	1949	October	October	October
P	1953	July	July	May
T	1954	August	August	May
P	1957	July	August	February
T	1958	April	April	April
P	1960	May	April	May
T	1961	February	February	February
P	1969	November		October
	1970		June	
T	1970	November	November	November

SOURCE: See text and notes to Table 2, lines 1, 18, 20.

What we find for the period 1948–61, is that one-half of the 16 turns in the composite and diffusion indexes for deflated and undeflated cycles coincide, while the deflated turn precedes the undeflated one with one exception in the other half. Leads of turns in deflated cycles predominate at peaks as expected. The longest such lead occurred in 1957, when the deflated composite index turned 6 months, and the diffusion index 5 months, before the corresponding undeflated indexes. There were no occasions when a downturn occurred in a deflated cycle but not in an undeflated one.[58]

The 8-month lead of the peak in the deflated cycle relative to the peak in the undeflated cycle in 1969–70 thus appears consistent with the historical record, considering the degree of inflation in these years. The peak date selected by the NBER experts, November 1969, clearly is more closely related to our chronology of deflated classical business cycles than to the chronology of undeflated cycles. This is in full accord with Fabricant's view: ". . . if the effect of inflation on the indicators of pecuniary activity were to be ignored, and these indicators given as much weight relative to the indicators of real activity as had been given to them in earlier decisions on business-cycle expansions and contractions (when inflation was less of a problem), the decline in aggregate economic activity so measured would be milder still. Indeed, the case for indentifying 1969–70 as a business-cycle contraction could then not be sustained."[59]

In sum, the deflated chronology, 1948–61, although broadly similar to the undeflated one, differs altogether by 13 months according to the composite index, and by 8 months according to the diffusion index. Therefore, if future cycle dating is to be based on deflated and quantity indicators, a chronology of past deflated cycles is needed for meaningful comparisons. For instance, the 1957 peak should be shifted from August back to February, the 1954 trough from August to May, and so on. Going further back in history, the large price movements in 1920–21 and in the 1930's also may have caused divergences between turns in deflated and undeflated cycles.

The Recession of 1969–70

Returning now to 1969–70, both the diffusion and composite indexes based on the deflated 9-indicator list have their peaks in October 1969, close to the handpicked peak in November 1969 and 8 months ahead of the peak in the undeflated cycle in the 12-indicator indexes. In view of the large price rise in this period, this lead appears to be in line with the showing of the past described above.

So far, the statistical finding that—when no account is taken of inflation—the 12-indicator indexes reached a peak in June 1970 has been accepted without question. Now, however, it is necessary to explain the exceptional character of this peak, which could be not merely shifted but entirely eliminated by a minor revision of the data.

The precarious nature of the downturn is due to the extreme mildness and short duration of the downward movement by which it was followed. Especially in the months from June to August, the economy moved more or less sideways, so that the standing of the undeflated indexes in August was only slightly below that in June. This in itself cannot be called peculiar, however. Flat areas around peaks or double peaks have occurred before. In the normal case, the peak would simply be shifted from June to August if data revision so ordained.

The unique feature of this peak is that it cannot be shifted to a later date but must be recognized before July or not at all. This is due to the fact that the economy was definitely in classical expansion from November 1970 on, so that the latest possible peak date is June 1970 if the recession is to last 5 months, the minimum duration stipulated by our programed rules. Whether there was, or was not, a recession in the undeflated cycle in 1970 thus hinges on the behavior of the indexes between June and August.

Should recognition of the recession really hinge on such a "formality" as the 5-month minimum duration? This question implies a misunderstanding concerning the function of rules, programed or otherwise. Basing the decision on rules is not to suppress the role of "real" happenings, but to summarize them in a prescribed fashion, thus insuring consistency among evaluations of varied and partly contradictory changes as they occur in each historical episode.

Concerning the rule in question here—the 5-month minimum duration of a cycle phase—it should be pointed out that no phase of less than 6 months was accepted in traditional NBER dating, so that the 5-month minimum enforced in programed dating is on the low, rather than on the high, side (see footnote 35).

The briefness and mildness of the decline of the composite index in 1970 reflects the briefness and mildness, by historical standards, of the *average* fall in United States economic activity. Of the 12 indicators in the undeflated index, 5 continued to rise in this period, which is most unusual after a peak. Out of the 48 indicator movements following the 4 preceding peaks, *altogether* ony 7 were rises. Similarly, the composite index fell by only 0.11 per cent, just enough for determining a peak according to our rules.

The unusual character of the June 1970 peak is reflected also in the brevity and mildness of the entire subsequent recession. Its duration of 5 months was the minimum admitted, and it was far shorter than the shortest previous recession since World War II, which lasted 9 months (1957–58). The recession's amplitude as measured by the composite index, was less than 2 per cent against 6 per cent in 1960–61, 10 per cent in 1953–54, 13 per cent in 1957–58, and 15 per cent in 1948–49.

In evaluating the mildness of the decline in 1970 one must also take into account the effect of the automobile strike in the period September to November. There is no doubt that the strike contributed substantially to the decline in economic activity. This does not argue against the selection of November as the trough date, because the effects of strikes that occur in the vicinity of business-cycle troughs are not excluded in dating cycle turns by traditional NBER procedures.[60] However, the borderline character of the recession stands out even more sharply when one sees it as consisting of 2 months of minute decline followed by 3 months of decline under the influence of a major strike. Even in these latter months, the number of rising series did not fall below 5 out of the 12 indicators.

It is also worth noting in this connection that not only the decline in the undeflated cycle, but even that in the deflated one, was exceptionally mild. In the 5 months from October 1969 to March 1970, first 4 and then 3 of the 9 indicators continued to rise, among them deflated dollar series and employment series. The composite index for the 9 indicators of the deflated cycle fell by only 3.5 per cent in this recession, half as much as in 1960–61, when the recession decline was only half as much as the average decline in the three preceding ones.

The designation of the 1970 decline as "very mild" may appear to contradict certain of its characteristics, especially the relatively sharp rise in unemployment. It must be remembered, however, that the measures cited refer to changes in aggregate economic activity and need not characterize developments of particular aspects of the economy. A thorough and excellent analysis of the behavior of the various parts of the economy and of the mildness of the 1969–70 recession has been presented by Solomon Fabricant.[61] Here one point only may be noted, namely, that the indicator which is most in the public eye, the unemployment rate, has for quite a while been out of line with the rest of the indicators for reasons which, as yet, are not entirely clear.

To summarize the 1969–70 experience: analysis of the deflated and the undeflated cycles reveals peaks in October 1969 and June 1970, respectively. The discrepancy between the two peaks is not in contradiction with historical experience. Turns in the two types of cycles have differed also on previous occasions.

The recession in deflated economic activity was unusually mild. In undeflated activity, as measured by our 12-indicator index, it was so mild that it must still be designated as tentative, because it could be erased by a slight change of the underlying data.

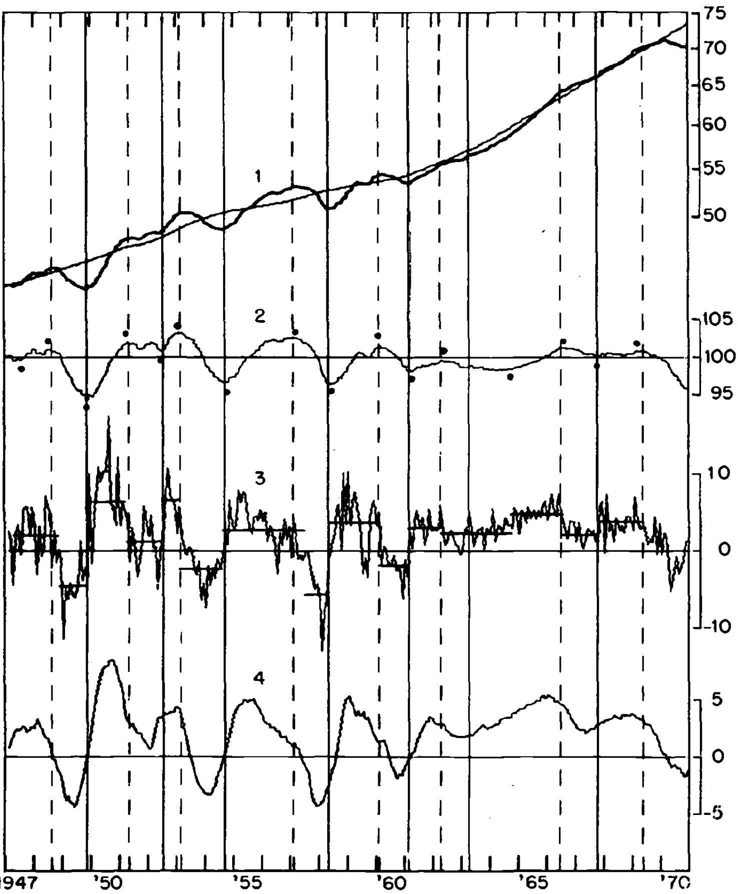
[6] DEVIATION AND STEP CYCLES IN INDIVIDUAL INDICATORS

Procedures for Deviation Cycles

The first of our two growth-cycle definitions is: growth cycles are cycles in a series' deviations from its long-run trend. This definition implies that the identification of growth cycles and the dating of their turning points depends crucially on the selection of trend curves. The unavoidable arbitrariness of this selection is a serious and valid objection to reliance on trend-adjusted data. It is the reason why we have run a complete second analysis based on another growth-cycle definition which is entirely independent of the choice of trends, and which thus provides a check on the deviation cycles. As to the trend adjustment itself, we try to reduce errors by adjusting each indicator by its own trend, rather than removing the trend from a composite of not detrended indicators. There is thus a chance of some offsetting of errors, and the method is less dangerous than resting an entire analysis upon a single trend curve. The trends are shown in the top panels of Charts 2 to 13.[62]

Further, in order to reduce the arbitrariness of the trend adjustment as far as possible, we apply the same formula, a long-term moving average, to all

CHART 2 Number of Employees (millions) on Nonagricultural Payrolls (BCD No. 41)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

16 indicators.[63] (See Table 4.) Such uniformity would not have been feasible with fitted trends, because of the diversity of long-run movements among indicators. In some instances, a series' movements have shifted over time and two or more trends would have had to be fitted to a single indicator. Since it is inadvisable to fit several trends to a period of only twenty-three years, and even more inadvisable to adjust different indicators in different ways, we decided on using a moving average which is flexible enough to cope with the diversity of trends. In order to iron out most

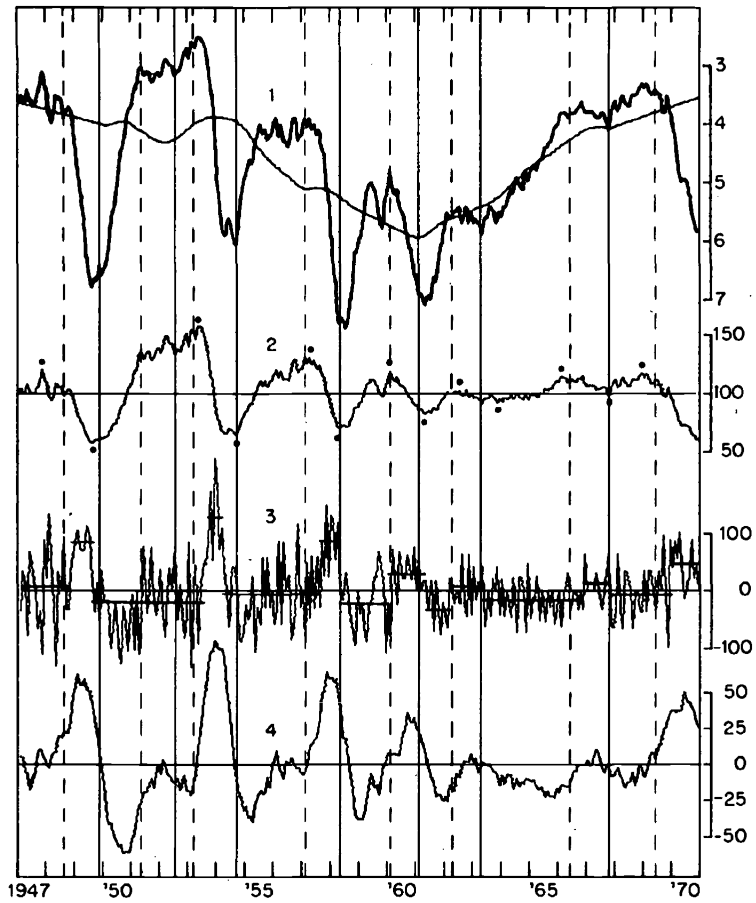
TABLE 4 Average Amplitude of Indicators in Deviation Cycles and Step Cycles, November 1947–July 1970

BCD[a] No.	Indicator Title 16 Indicators	Deviation Cycles: Phases Low Rate (1)	Deviation Cycles: Phases High Rate (2)	Deviation Cycles: Cycles Downturn to Downturn (3)	Step Cycles: Phases Low Rate (4)	Step Cycles: Phases High Rate (5)	Step Cycles: Cycles Downturn to Downturn (6)	Ranks: Col. (3) (7)	Ranks: Col. (6) (8)
41	Number of employees on nonagricultural payrolls	−3.70	+3.66	7.36	−5.69	+5.93	11.62	2	1
43	Unemployment rate, total	−46.47	+45.98	92.45	−77.35	+75.32	153.67	16	16
47	Index of industrial production	−9.04	+9.11	18.15	−21.31	+21.36	42.67	10	12
48	Man-hours in nonagricultural establishments	−4.74	+4.70	9.44	−7.18	+7.23	14.41	4.5	4
52	Personal income	−5.08	+4.63	9.71	−7.00	+6.53	13.53	6	3
52D	Personal income	−3.27	+3.25	6.52	−6.44	+6.76	13.20	1	2
53	Wage and salary income in mining, manufacturing, and construction	−9.89	+9.36	19.25	−16.26	+15.37	31.63	11	10
53D	Wage and salary income in mining, manufacturing, and construction	−8.28	+8.20	16.48	−15.17	+14.97	30.14	8	8.5
55	Index of wholesale prices, industrial commodities	−5.72	+5.18	10.90	−8.78	+7.56	16.34	7	6
56	Manufacturing and trade sales	−10.17	+10.04	20.21	−16.40	+16.00	32.40	12	11
56D	Manufacturing and trade sales	−8.87	+8.20	17.07	−15.04	+15.10	30.14	9	8.5
61	Business expenditures for new plant and equipment	−22.00	+20.72	42.72	−23.47	+23.83	47.30	14	13

61D	Business expenditures for new plant and equipment	−23.32	+22.50	45.82	−24.83	+24.33	49.16	15	14
115	Yield on long-term Treasury Bonds	−13.39	+13.82	27.21	−29.13	+30.79	59.92	13	15
200	Gross national product in current dollars	−4.48	+4.45	8.93	−9.03	+8.71	17.74	3	7
205	Gross national product in 1958 dollars	−4.54	+4.90	9.44	−7.89	+7.71	15.60	4.5	5
	MEDIANS								
	12 indicators for undeflated cycles	−7.38	+7.14	14.52	−12.64	+12.04	24.68		
	9 indicators for deflated cycles	−8.28	+8.20	16.48	−15.04	+14.97	30.14		

[a]The series identification used in *Business Conditions Digest*.
NOTE: For definition of amplitudes see text; D signifies preceding series, deflated by NBER.

CHART 3 Unemployment Rate, Total—Panels 1 and 2: Inverted; Panels 3 and 4: Not Inverted (per cent) (BCD No. 43)

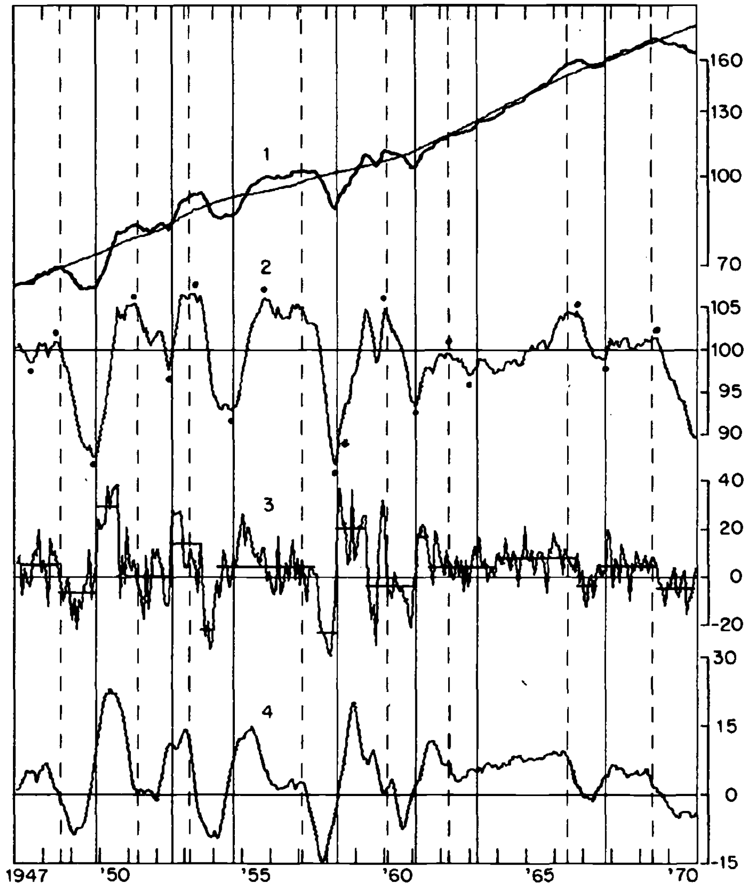


NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.

1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

cyclical swings, a term of six to seven years is required. We chose a 75-month moving average as a convenient figure that fits the requirement. The missing 37 months at the beginning of the moving average are estimated with the help of the average rate of change during the first two years and the missing months at the end by the rate in the last two years for which it is available. This method of extrapolation implies that the series

CHART 4 Index of Industrial Production (1957–59 = 100) (BCD No. 47)

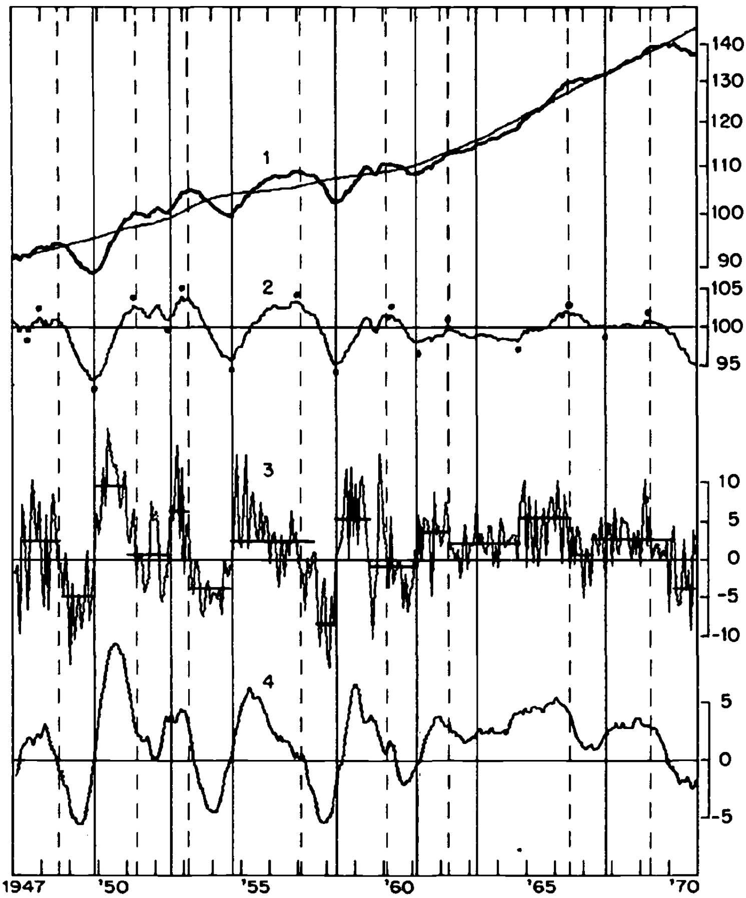


NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

proper is assumed to duplicate its pattern during the first years or the last years which are covered by the data in the period not covered by the data. With the experience gained, it should be possible to replace this assumption with a better one and thus to improve the extrapolation of the trends in future work.

The percentage deviations of the series from their moving-average trends represent the deviation cycles of the indicators (the second panels on Charts 2 to 13).[64]

CHART 5 Man-hours in Nonagricultural Establishments (annual rate, billion man-hours) (BCD No. 48)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.

1: Seasonally adjusted data and seventy-five month moving average.

2: Data as percentages of seventy-five month moving average.

3: Change from month to month, per cent, annual rate.

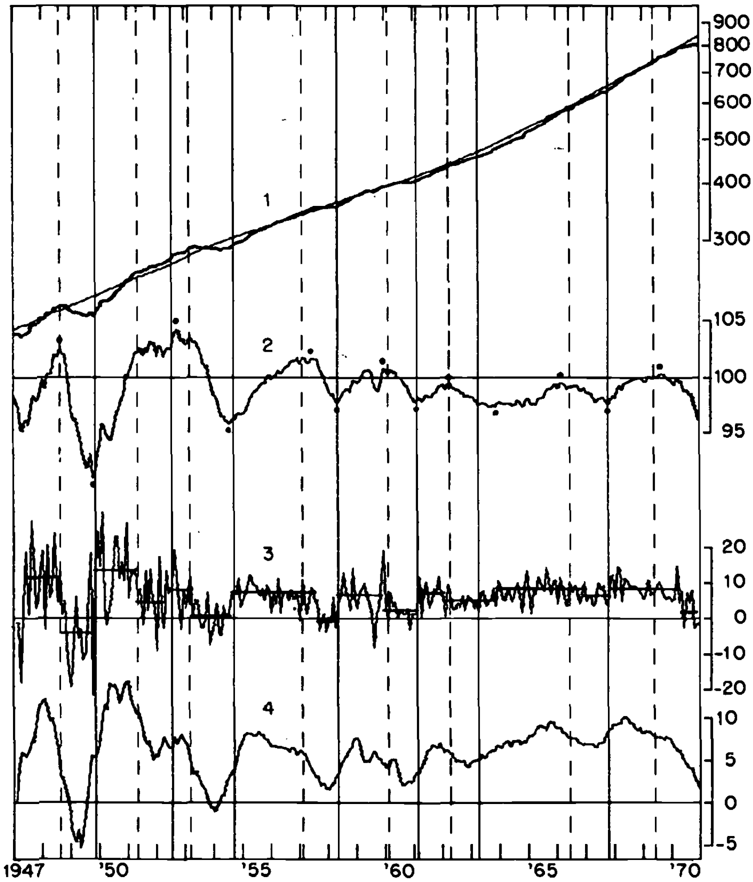
4: Centered twelve-month moving average of curve 3, per cent.

The turning points are selected by the computer program described in the preceding section.

Findings on Deviation Cycles

Inspection of Charts 2 to 13 shows that, in general, the trend-adjusted indicators move in clear-cut cycles with unmistakable turning points.[65] Out of the 12 indicators used in undeflated cycles, 9 trace between 6 and 8

CHART 6 Personal Income (annual rate, billion dollars) (BCD No. 52)

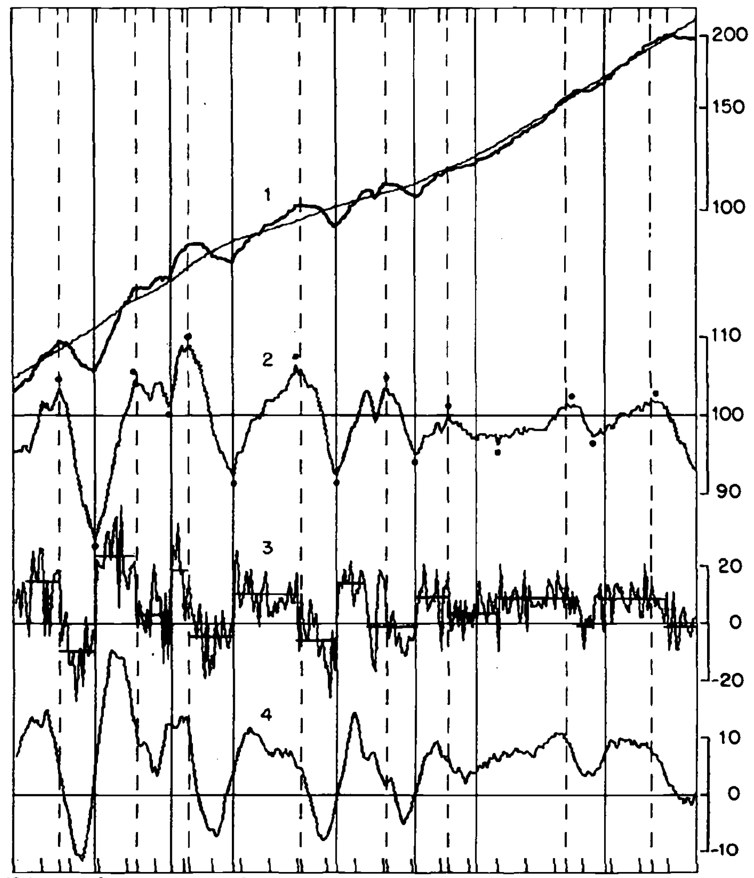


NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

deviation cycles, 1948–70. Wholesale prices and expenditures on plant and equipment have only 5 cycles and interest rates have 9.

As expected, the detrended series turn more frequently than the original ones (except for the unemployment rate). The difference is largest in steeply rising series, as in gross national product, which has 17 turns in deviation cycles against only 6 turns in classical cycles; or in personal income, with 13 turns against 4. On the contrary, prices, expenditures on plant and equipment, either deflated or undeflated, and deflated manufac-

CHART 7 Wages and Salary Income in Mining, Manufacturing, and Construction (annual rate, billion dollars) (BCD No. 53)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

turing sales, show only 2 or 3 extra turns in deviation cycles. The slope of the trend is, of course, not the only factor determining the difference between the numbers of turns in the two types of cycles.

The charts also show the wide variations in amplitudes of deviation cycles between different series and over time in a given series. Measures of these amplitudes and of the smoothness of the curves are shown in Tables 4 and 5. The amplitude of a deviation-cycle phase is defined as the

TABLE 5 Smoothness of Deviation Cycles (standard deviations of 16 trend-adjusted indicators from their Spencer curves, 1947–70)

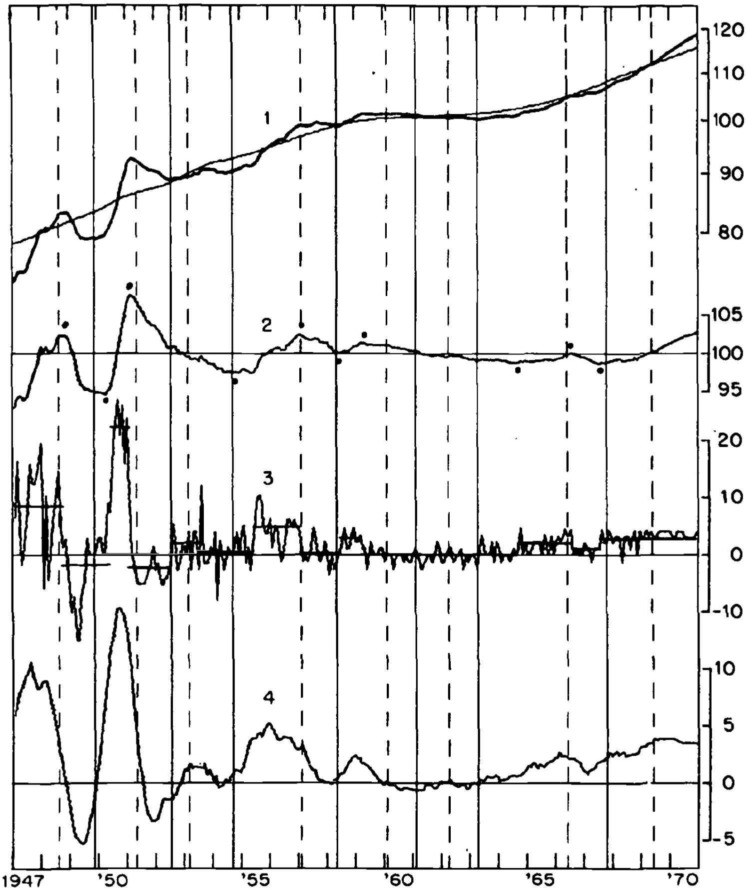
BCD[a] No.	Indicator Title 16 Indicators	Standard Deviation (1)	Ranks: Standard Deviation (2)	Ranks: Amplitude of Cycles (3)
41	Number of employees on nonagricultural payrolls	0.34	1.5	2
43	Unemployment rate, total	2.49	16	16
47	Index of industrial production	0.57	11	10
48	Man-hours in nonagricultural establishments	0.41	5	4.5
52	Personal income	0.45	6	6
52D	Personal income	0.48	7	1
53	Wage and salary income in mining, manufacturing, and construction	0.52	8	11
53D	Wage and salary income in mining, manufacturing, and construction	0.54	10	8
55	Index of wholesale prices, industrial commodities	0.38	3.5	7
56	Manufacturing and trade sales	0.66	14	12
56D	Manufacturing and trade sales	0.63	13	9
61	Business expenditures for new plant and equipment	0.53	9	14
61D	Business expenditures for new plant and equipment	0.59	12	15
115	Yield on long term Treasury bonds	1.22	15	13
200	Gross national product in current dollars	0.34	1.5	3
205	Gross national product in 1958 dollars	0.38	3.5	4.5

[a]The series identification numbers used in *Business Conditions Digest.*

NOTE: The Spencer curve is a smooth, flexible moving average of the seasonally adjusted series, which represents the cyclical component. Column (3) equals Column (7) of Table 4. D signifies preceding series deflated by NBER.

difference, expressed in percentage points, between the indicator's ratios to its trend at successive turns. Except for the unemployment rate, the mean rises or falls of the 12 indicators range from as low as 4 percentage points to as high as 23 percentage points for the period 1948–69. The unemployment rate moves by twice as much. Mild cycles are shown, e.g., by the number of employees and by gross national product; large cycles, by expenditures on plant and equipment. The median of the average amplitudes of the 12 indicators in a deviation-cycle phase is about 7 percent-

CHART 8 Index of Wholesale Prices, Industrial Commodities (1957–59 = 100) (BCD No. 55)

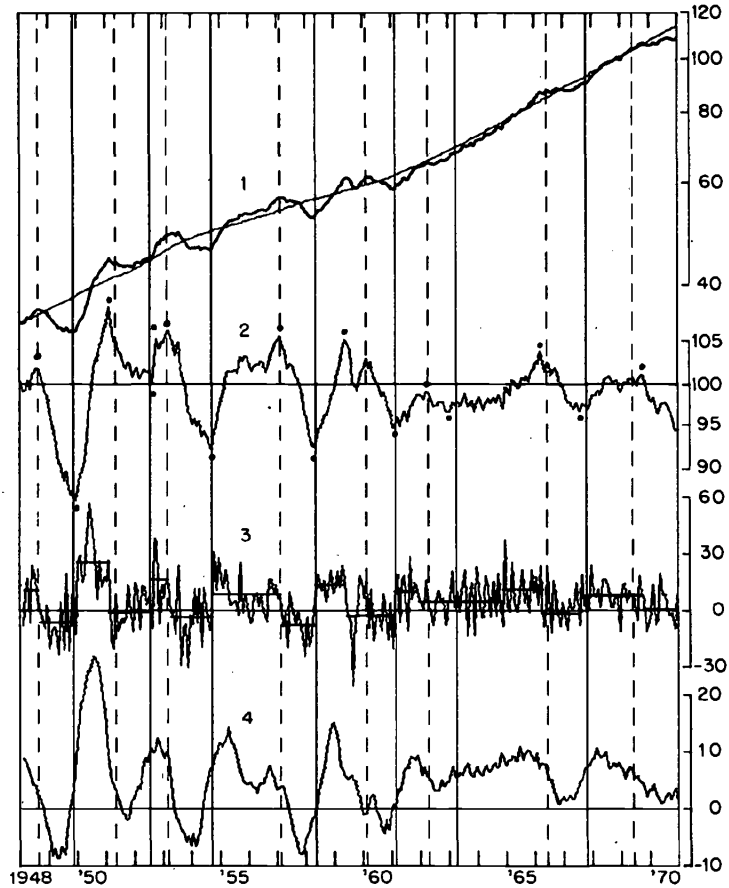


NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

age points and the corresponding figure for the 9 indicators is about 8 points. (Since the trend is removed, the amplitudes of high-rate phases and low-rate phases are nearly equal.)

In all series, the amplitudes of deviation cycles which correspond to classical business cycles are much larger than those of cycles which do not. This implies that the amplitudes are smaller in the 1960's than in the 1950's. The flattest movements are, in most instances, the downswing from 1962 to 1963 or 1964 and the upswing from 1967 to 1969.

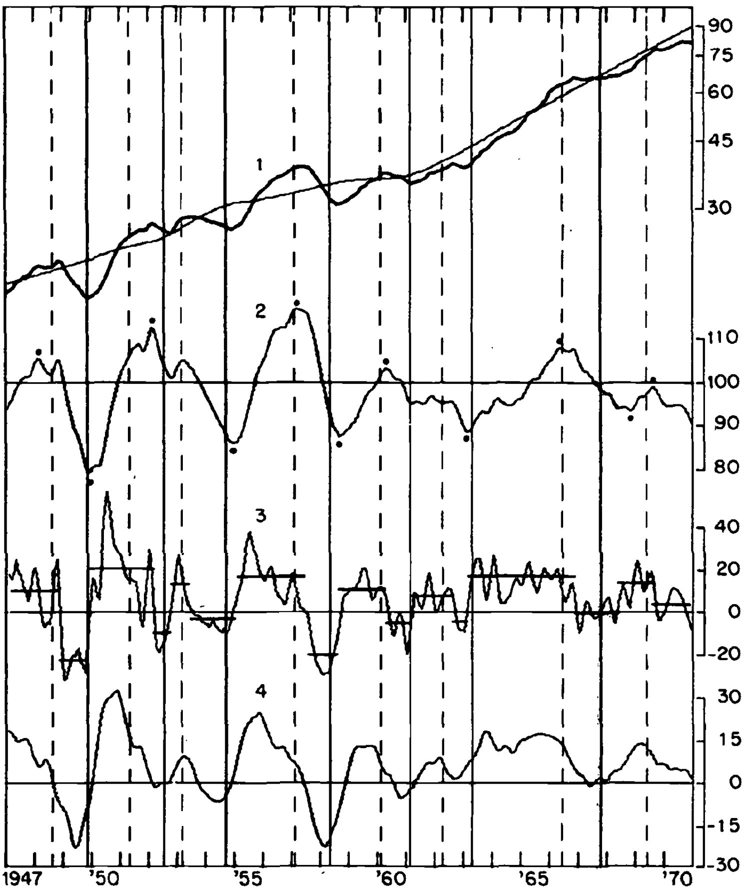
CHART 9 Manufacturing and Trade Sales (billion dollars) (BCD No. 56)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

In these borderline cases, existence of a deviation cycle may well be questioned. However, omitting flat cycles would require specification of amplitude minima, which, as previously explained in Section 4, has not been attempted in the turning-point program. (The charts show clearly the difficulties posed by wide variations in amplitudes.) When doubt arises concerning the validity of recognizing relatively shallow cycle phases, it must be remembered that, according to the program rules, each such phase represents a prolonged movement in one direction. Moreover, and

CHART 10 Business Expenditures for New Plant and Equipment (annual rate, billion dollars) (BCD No. 61)



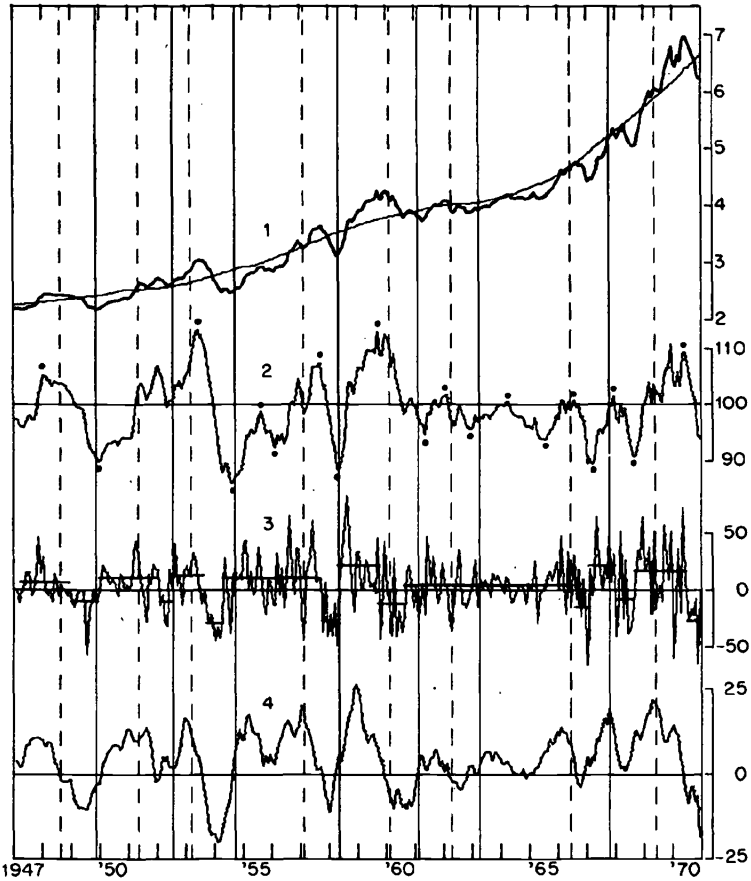
NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and 25-quarter moving average.
2: Data as percentages of 25-quarter moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

most important, there is remarkable consilience among indicators, even in marginal cycles. This last point will be a topic of the next section.

Selecting cycles is greatly helped by the close rank correlation between amplitudes of cyclical and erratic indicator movements. Smooth series are usually characterized by mild cyclical swings, while series with large irregular fluctuations tend to have wide cyclical amplitudes.

Irregular movements of trend-adjusted series are here measured by the

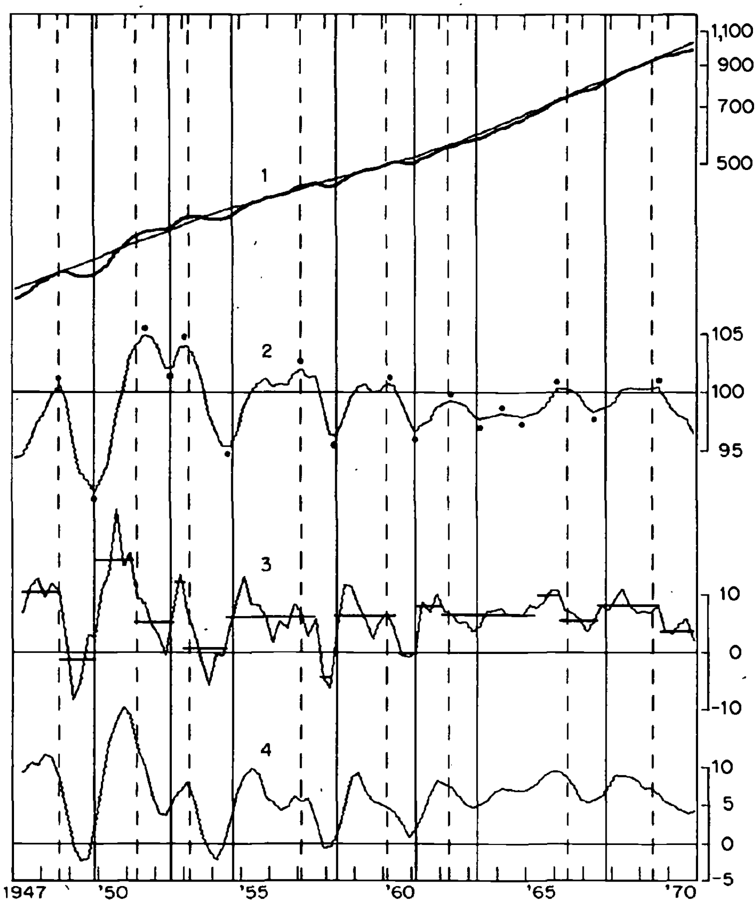
CHART 11 Yield on Long-Term Treasury Bonds (per cent) (BCD No. 115)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and seventy-five month moving average.
2: Data as percentages of seventy-five month moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

standard deviation of the data from a Spencer curve fitted to them.[66] Table 5 shows how closely the rankings of these deviations agree with the amplitude rankings. Thus, indicators with mild deviation cycles—such as the number of employees, prices, and gross national product—are easily dated, in most instances, because of their smoothness. On the other hand, the jagged curves representing the unemployment rate or interest rates cause no problem because of their wide rises and falls.

CHART 12 Gross National Product in Current Dollars (annual rate, billion dollars) (BCD No. 200)



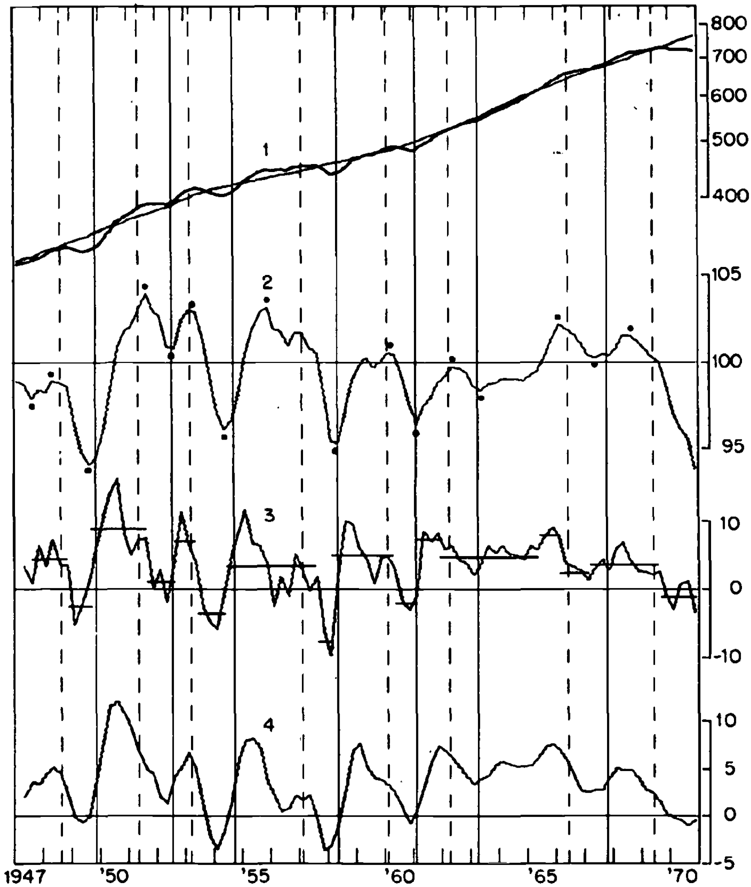
NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and twenty-five-quarter moving average.
2: Data as percentages of twenty-five-quarter moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

Further analysis of deviation cycles requires introduction of the second type of growth cycle investigated in this study: step cycles.

Procedures for Step Cycles

Our second definition—growth cycles are alternations between periods with relatively high rates of change and periods with relatively low rates of change—has the advantage of focusing on that aspect of economic change

CHART 13 Gross National Product in 1958 Dollars (annual rate, billion dollars) (BCD No. 205)



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines growth-cycle downturns; based on the undeflated composite index for deviation cycles. Dots denote turning points.
1: Seasonally adjusted data and twenty-five-quarter moving average.
2: Data as percentages of twenty-five-quarter moving average.
3: Change from month to month, per cent, annual rate.
4: Centered twelve-month moving average of curve 3, per cent.

which today attracts the greatest interest. Moreover, it is independent of subjective trend selections. However, the disadvantage of the approach, for our purposes, is that growth rates have to be analyzed by a technique different from the one usually applied to the original series.

The crucial point is that, in the case of rates of change, cycle phases which are to correspond to expansions and contractions cannot be defined by rises and falls but must be defined by high and low levels. This was found by Milton Friedman and Anna Schwartz in their work on money. As has been stated earlier on, they have termed the alternations of high and low rates "step cycles."[67] To avoid misunderstanding, it should be noted that the special treatment of rates of change is not based on their exhibiting step patterns, which may or may not be the case.[68] The reason for the step-cycle concept is, rather, that the timing of rises and falls in growth rates differs from the timing of the underlying series. Growth tends to be most rapid when it starts from a low base, i.e., shortly after the end of a period of low growth or decline. Conversely, rates tend to be lowest shortly after the termination of rapid-growth periods, and thus toward the beginning or middle, rather than at the end, of a low-growth period. This behavior of rates of change means that large parts of business expansions are characterized by high but falling rates and large parts of business contractions by low but rising ones.

This growth rate pattern is illustrated by the third curve on Charts 2 to 13, and there is ample evidence for it in the literature. For instance, the rate of increase of U.S. gross national product in constant dollars was 60 per cent higher, on the average, in the first halves of the seven expansions (1921–38, 1949–61) than in their second halves. The rate of fall in the corresponding seven contractions was twice as large in the earlier part as in the later one.

Furthermore, the average monthly rate of change of thirty-four comprehensive American series before 1938 was more than twice as high between business-cycle troughs and the first third of expansions than in later expansion stages. The average rate of decline was largest in the first half of contractions.[69]

Thus, if cycle phases were defined by growth-rate peaks and troughs, they would tend to lead business cycles by one-half to nearly a full phase. Expansions, for instance, would usually include only the beginning of a high-growth period, while most of this period would be included in the contraction phase. Since this would run counter to generally accepted ideas on business cycles, peaks and troughs in growth rates cannot serve to delimit cycle phases in the usual sense. Instead, the downturn must be defined as the end of a period of relatively high growth and the upturn as the end of a period of relatively low growth.

Growth rates are classified as "high" or "low" by comparisons of average rates in each of three successive cycle phases. The average rate during a high step must exceed the average rates during the preceding and succeeding low steps. The main difference between deviation cycles and step cycles thus lies in the definition of the "normal" growth rate which serves as the standard for distinguishing high and low rates. In deviation cycles, the normal rates are given by the long-run trend. In step cycles, the normal rate in each cycle is the average rate for that cycle. For each cycle phase the average rate is measured against two "normal" rates: the average rate of the cycle beginning with that phase and the average rate of the cycle ending with that phase.

Because the two cycle concepts are similar, the timing of step cycles is, in most instances, the same as, or very close to, that of the trend-adjusted series. This agrees with the Friedman and Schwartz findings and will be shown below.

Analysis of rates of change also presents another problem, especially in monthly series. Month-to-month percentage changes are often highly jagged series with a sawtooth appearance, revealing at first glance neither cycles nor cyclical turns. The rate of change in industrial production in Chart 4 is a good illustration.[70] To deal with this problem, we first find by inspection the approximate dates when a period of high growth ended and a period of low growth began, or vice versa, on a chart showing the twelve-month moving average of the rates of change. It is noteworthy how clearly the underlying cyclical movements stand out in the smoothed rates of change of the fourth curve in Charts 2 to 13, even for rates as choppy as those for industrial production. Selecting the zone where a step turn is likely to have occurred is not difficult in most instances. The exact month of the step turn is then tentatively identified by inspection of the chart of the unsmoothed rates.

At this point the computer program takes over.[71] Each tentative cycle, i.e., each period between two like tentative step-turns is broken into two parts (steps) at every intervening month. For each of these possible breaking points the mean standing of the series is computed. These are the two step means. The difference between each of these means and the full period (cycle) mean is squared and weighted by the number of months in the step. The program then selects as turning point that breaking point at which the sum of the two weighted, squared differences is greatest, i.e., the point which yields the largest variance between the two steps.[72] For instance, if a tentative cycle had a duration of twenty-four months, the program would test the variance between the mean rates of change for partitions into six and eighteen months, seven and seventeen months, eight and sixteen months, and so on.

One reason for maximizing the variance, rather than the simple difference, between alternative step means is that the latter neglects the influence of the step length. Doubtful months would be assigned to the longer step, because this would increase the difference between step means even if the standing of the series in the month in question were much closer to the average rate of the short step than to that of the long one.

If the computed turning point differs from the tentatively selected one, every analysis which used the latter must be repeated with the former. This procedure is continued until each upturn has been confirmed as the correct partition between the adjacent downturns, and each downturn as the correct partition between the adjacent upturns. Each turn thus has to be confirmed by three computations. It must be valid (1) as the end of one cycle; (2) as the beginning of the next cycle; and (3) as the correct partition between two adjacent turns of the opposite type.

When a tentative cycle cannot be validated in this manner, it cannot be recognized. The analysis then proceeds on the basis of the finding that a cycle did not occur in the period in question. The validation procedure thus enables us to distinguish between fluctuations which are large enough to meet the objective standards set up for recognition and those which are not. The objective criterion greatly reduces the subjective element adhering to the analyst's initial selection of the tentative turns.

The step turns in the 16 indicators and in the conformity indexes of this study have all been confirmed as described above. In the case of some quarterly indicators, all tentative turns were validated at the first trial. For some very erratic series, on the other hand, up to fifty periods had to be partitioned before some twelve steps meeting the requirements could be identified.[73]

Findings on Step Cycles

The timing of the step cycles agrees with that of the deviation cycles in the sense that nearly every turn in one type of cycle matches a turn in the other type (Tables 6 and 11). (The steps are indicated in Charts 2 to 13 by horizontal lines drawn at the average level of the step. The dates of the turns can be obtained from Table 11.) Out of 226 deviation-cycle turns, November 1947 to July 1970, only 8 have no counterpart in step cycles and 17 out of 235 step-cycle turns do not match a turn in deviation cycles. Almost half of the nonmatching turns occur in the mild cycle 1951–53, which is skipped in the deviation cycles but not in the step cycles of five indicators.[74]

Of the matching turns, nearly one-half coincide exactly and 72 per cent coincide roughly. This correspondence is impressive when one considers the difference in methods used, the large erratic component of the movements analyzed, and the numerous borderline cases. Similarity of the results obtained with the two methods is, of course, an argument in their favor.

However, it must also be stressed that 62, or 28 per cent, of the matching turns in the two types of cycles occur more than 3 months apart. There are a number of reasons for these discrepancies. One is the occurrence of flat bottoms and ceilings or of double turns. In such instances, it can easily happen that the two methods pick different dates. The 1951 downturn in industrial production provides a good illustration (Chart 4).

The downturn in the deviation cycle is the later, the step-cycle downturn the earlier, of a pair of double peaks.

Other discrepancies reflect differences between the trend on which the deviation cycle is based and the trend implicit in the average growth rates on which the step cycles are based. The downturns 1955–57 are the main case in point. In these years, the 75-month moving average rises steeply enough in many series to produce early downturns, while the rate of change remains—for nearly two years, in some instances—distinctly higher than in the low-rate phases of 1954 and 1958. Since this type of discrepancy is systematic, it is reflected in the reference turns; the problems it creates will be taken up in the next section.

The number of discrepancies between the two types of cycles also varies greatly among indicators. While 87 per cent of the turns in the number of employees, in wages and salaries, and in manufacturing sales coincide roughly, only 46 per cent of the turns in the unemployment rate do so. In terms of exact coincidences, the range is between 80 per cent of turns in wages and salaries and in manufacturing sales, and 27 per cent in the unemployment rate.

A large irregular component might be suspected of being one of the factors in an indicators's poor performance in this respect, but the evidence contradicts this guess. There does not seem to be a relation between smoothness of a series and the degree of agreement between its deviation and step turns.

Some remarks on timing relations between the two types of growth cycles at individual cycle turns will be found in Section 8.

Turning now to another aspect of cycles, their amplitudes, we find further evidence of a close relationship between deviation and step cycles.

Step-cycle amplitudes are defined as differences between step levels, i.e., between the average growth rates during high and low steps. For instance, the entry "-21.31" in Table 4, column "low-rate phase," for the index of industrial production, means that this index's average month-to-month change at an annual rate was 21.31 percentage points lower during low-rate phases than during high-rate phases. The entry "42.67" in the column "cycles, downturn to downturn," for the same series means that the sum of the average cyclical falls and rises in the rate of change of industrial production amounted to 42.67 percentage points.

From the foregoing definition, it is clear that amplitudes of deviation cycles and of step cycles are not directly comparable, one being a difference in ratios to trend and the other a difference in rates of change. But this does not rule out comparing the ordering of the 16 indicators by amplitudes, which reveals an extremely close similarity of deviation and step cycles (Table 4, columns 7 and 8). In other words, an indicator's growth-cycle amplitude ranks almost exactly as high among the 16 indi-

TABLE 6 Comparison of Turning Points in Deviation Cycles (DC) and Step Cycles (SC), Sixteen U.S. Indicators, November 1947–July 1970

		Number of Turns						Per Cent of Matched Turns		
		Covered			Coinciding		Differing	Coinciding		Differing
BCD[a] No.	Indicator Title	DC	SC	Matched	Exactly	Roughly[b]	4 Months or More	Exactly	Roughly[b]	4 Months or More
41	Number of employees on non-agricultural payrolls	15	15	15	6	13	2	40	87	13
43	Unemployment rate, total	13	13	13	4	6	7	30	46	54
47	Index of industrial production	15	15	15	5	8	7	33	53	47
48	Man-hours in nonagricultural establishments	15	15	15	6	9	6	40	60	40
52	Personal income	13	15	13	8	10	3	62	77	23
52D	Personal income	14	15	14	8	11	3	57	79	21
53	Wage and salary income in mining, manufacturing, and construction	15	15	15	12	13	2	80	87	13
53D	Wage and salary income in mining, manufacturing, and construction	14	15	14	9	10	4	64	71	29
55	Index of wholesale prices, industrial commodities	10	12	10	3	9	1	30	90	10
56	Manufacturing and trade sales	15	15	15	12	13	2	80	87	13
56D	Manufacturing and trade sales	14	15	14	8	10	4	57	71	29
61	Business expenditures for new plant and equipment	11	15	11	3	7	4	27	64	36
61D	Business expenditures for new plant and equipment	11	15	11	3	6	5	27	55	45

115	Yield on long-term Treasury bonds	19	15	13	8	10	3	62	77	23
200	Gross national product in current dollars	17	15	15	5	11	4	33	73	27
205	Gross national product in 1958 dollars	15	15	15	4	10	5	27	67	33
Summary	16 indicators	226	235	218	104	156	62	48	72	28

[a] The series identification numbers used in *Business Conditions Digest*.
[b] Includes the exactly coinciding turns.
NOTE: D signifies preceding series deflated by NBER.

cators' growth-cycle amplitudes when the comparison is based on deviation cycles as when it is based on step cycles.

The important conclusion is that the growth cycles resulting from the two different approaches are similar, both in the timing of their turns and in the relative magnitudes of their swings.[75]

[7] A CHRONOLOGY OF UNITED STATES GROWTH CYCLES

Growth cycles in the general economy are determined on the basis of the growth cycles in the indicators. For this purpose, the indicators are combined into two types of indexes: composite indexes and diffusion indexes.[76]

Each type of index is constructed for deviation cycles and for step cycles; consequently, with a given list of indicators, four reference chronologies are obtained and, dealing with undeflated and deflated cycles, we have eight chronologies.

For convenience, the corresponding findings for undeflated and deflated growth cycles are treated together in this chapter. However, the reader should bear in mind that the reliability of the two analyses differs, as explained in Section 5. The investigation's main aim is the analysis of undeflated growth cycles and the indicators are selected for this purpose. The list of indicators used in the analysis of deflated cycles is a mere adaptation of the list for undeflated cycles. Therefore, we regard the analysis of deflated cycles as highly tentative.

The outstanding feature of all of the sets of reference dates is their similarity (Tables 7 and 8). In none is a cycle skipped or an extra cycle registered, despite the different approaches used. Each set consists of 15 turning points, 8 downturns and 7 upturns, for the period 1948–69. Nine of these turns correspond to classical peaks and troughs, 2 turns mark the Korean War cycle, 4 the two growth cycles, 1961–67.[77] Most observers would probably have expected the number and location of growth-cycle turns to be approximately as we find them.

It is important and reassuring that the cycles marked off in the different chronologies also resemble each other in another respect: their amplitudes. When the seven cycles in a composite index are ordered according to the wideness of their swings, the ranks so obtained are quite similar whether the indexes are based on deviation cycles or on step cycles (Table 9).[78]

The seven cycles stand out as clearly as one might wish in the four diffusion indexes on Chart 14. (The amplitudes of the cycles on this chart, it should be remembered, do not indicate amplitudes of indicator movements, but reflect the duration and degree of diffusion of these move-

TABLE 7 Growth Cycle Reference Turns and Their Relations to Turns in Classical Business Cycles, in Three Undeflated Growth Cycle Indexes, and in Leading Indicators, 1948–70

Date of Growth Cycle Reference Turns[a]		Leads (−) and Lags (+) in Months of Turns in:									
		Classical Cycles[b]		Diffusion Indexes: Deviation Cycles		Diffusion Indexes: Step Cycles		Composite Indexes: Step Cycles		Composite Indexes: Leading Indicators	
Upturns (U)	Downturns (D)	U	D	U	D	U	D	U	D	U	D
	Aug. 1948		+3		−1		+1		+2		(−7)[c]
Nov. 1949		−1		0		0		0		−5	
	May 1951				+3		−1		−3		−4
July 1952				−1		0		0		0	
	March 1953		+4		0		+2		+2		−2
Sept. 1954		−1		0		−1		−2		−6	
	Feb. 1957		+6		0		+6		+6		−17
May 1958		−1		0		−1		−1		−1	
	Feb. 1960		+2		0		−2		+2		−9
Feb. 1961		0		+1		0		0		−2	
	April 1962				0		−2		0		—
April 1963				+7		+16		−1		—	
	June 1966				0		+1		+4		−3
Oct. 1967				0		−3		−6		−6	
	June 1969		+12		+2		+5		+2		−2

[a]Composite index of undeflated deviation cycles.
[b]Composite index of undeflated classical business cycles (Table 3, line 18).
[c]Tentative.

ments.) The growth cycles are clearly drawn also in the composite indexes based on deviation cycles although these indexes are less smooth than the diffusion indexes and have a long, nearly horizontal stretch in 1963–64 (Chart 15). In the composite indexes based on rates of change, the reference cycles are represented by the horizontal step lines. The cycle turns are at the end of the steps, i.e., at the ends of periods of high or low rates.

Although the occurrence of the seven growth cycles is confirmed by each of the eight chronologies, the exact turning dates differ in many instances. Hence, in order to present one set of reference dates, for each type of cycle (undeflated and deflated) it is necessary to decide which of the indexes to use. To work with more than one set of dates, however

TABLE 8 Leads and Lags of Turns in Classical Business Cycles, in Three Deflated Growth Cycle Indexes, and in One Undeflated Growth Cycle Index, at Deflated Growth Cycle Reference Turns, 1948–70

Date of Deflated Growth Cycle Reference Turns[a]		Leads (−) and Lags (+) in Months of Turns in:									
		Classical Cycles[b]		Deviation Cycles		Step Cycles		Step Cycles		Undeflated Deviation Cycles	
				Diffusion Indexes				Composite Indexes			
Upturns (U)	Downturns (D)	U	D	U	D	U	D	U	D	U	D
	July 1948		+4		−3		+3		+3		+1
Oct. 1949		0		0		+1		+1		+1	
	June 1951				−2		−6		−6		−1
June 1952				0		0		+1		+1	
	March 1953		+2		0		0		0		0
Aug. 1954		−3		+1		0		0		+1	
	Feb. 1957		0		−2		+6		+6		0
May 1958		−1		−1		−1		−1		0	
	Feb. 1960		+3		0		−8		0		0
Feb. 1961		0		0		0		0		0	
	Apr. 1962				0		−2		0		0
March 1963				+2		+8		0		+1	
	June 1966				0		+1		0		0
Oct. 1967				0		−3		0		0	
	March 1969		+7		−3		+6		+5		+3

[a]Composite index of deflated deviation cycles.
[b]Composite index of deflated classical business cycles (Table 3, line 20).

similar to each other, would obviously be awkward and confining.[79] Comparison of the different chronologies should help in making this difficult choice.

Composite and Diffusion Indexes Compared

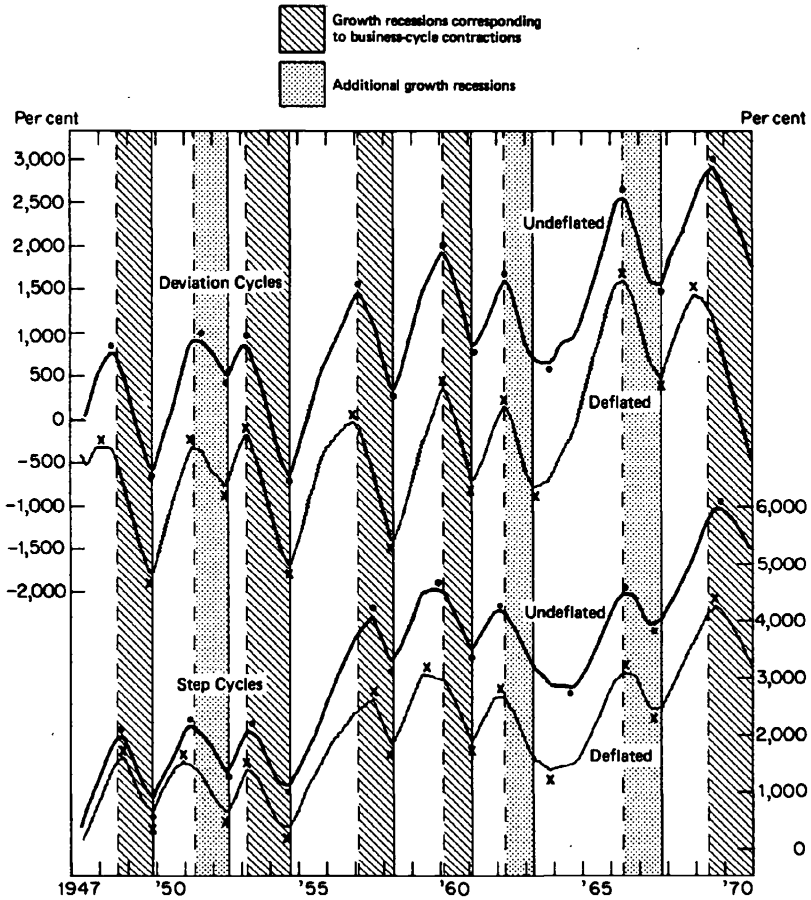
Examination of agreements and disagreements among the chronologies discloses that for a given type of cycle, the turning dates are not very different whether they are based on the composite index or on the diffusion index.

TABLE 9 Amplitudes of Undeflated Composite Indexes in Individual Deviation Cycles and Step Cycles

Date of Growth Cycle[a]		Deviation Cycles				Step Cycles			
D	U	D to U	U to D	D to D	Rank of D to D	H to L	L to H	H to H	Rank of H to H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1948 8	1949 11	−29.2	+39.8	69.0	7	−5.6	+10.0	15.6	7
1951 5	1952 7	−9.0	+9.2	18.2	3	−6.2	+2.5	8.7	4
1953 3	1954 9	−30.2	+27.9	58.1	6	−5.4	+4.2	9.6	5
1957 2	1958 5	−26.7	+20.4	47.1	5	−6.6	+6.9	13.5	6
1960 2	1961 2	−15.0	+6.5	21.5	4	−4.1	+4.3	8.4	3
1962 4	1963 4	−4.5	+11.6	16.1	2	−1.7	+1.8	3.5	1
1966 6	1967 10	−7.9	+5.0	12.9	1	−2.3	+2.0	4.3	2
1969 6	1970 12[b]	−16.3[b]				−2.7[b]			
Average Amplitudes		−17.50	+17.20	34.70		−4.56	+4.53	9.09	

[a]Dates are for deviation cycles. Step cycle amplitudes are for corresponding step cycles.
[b]Latest data covered and amplitude to this date.
NOTE: D = downturn; U = upturn; H = high step; and L = low step. Rank 1 designates the smallest amplitude.

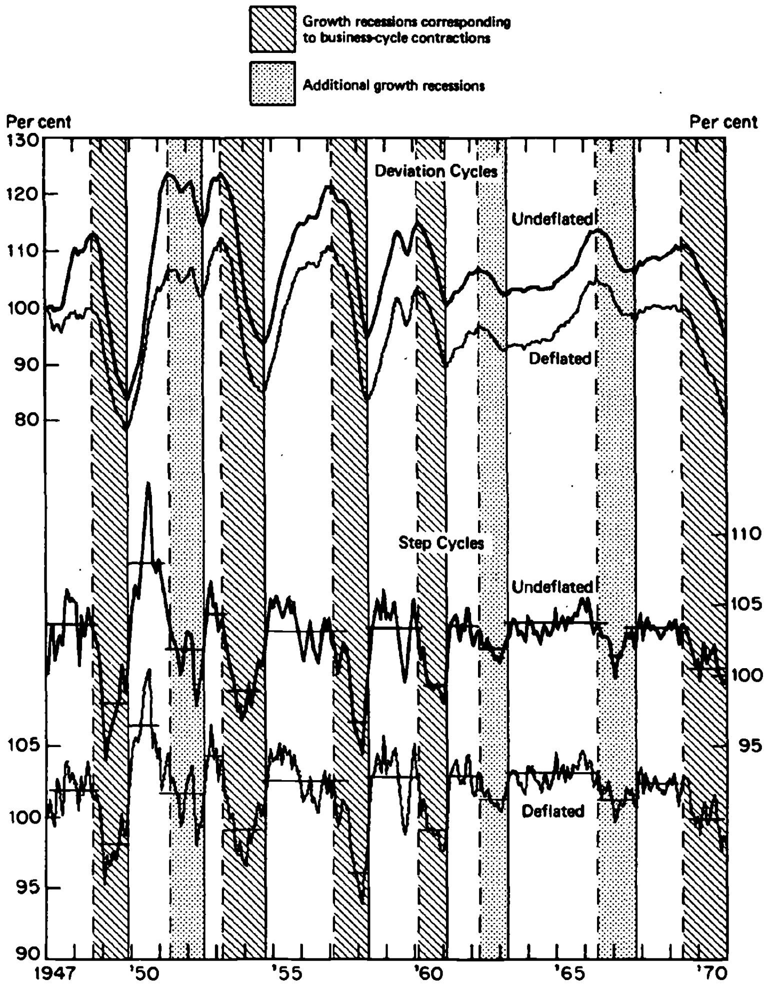
CHART 14 U.S. Growth Cycles, 1947–70: Diffusion Indexes



NOTES: Solid vertical lines indicate growth-cycle upturns; broken vertical lines, growth-cycle downturns; based on the undeflated composite index for deviation cycles.
Dots denote turns in undeflated series, crosses denote turns in deflated series.
Diffusion indexes are constructed by cumulating the excess of the percentage of indicators in their high-rate phase over the percentage in their low-rate phase.
For explanation of deviation cycles, step cycles, undeflated, and deflated, see text.

Looking first at the *deviation* cycles, one finds that the majority of turns in the two undeflated indexes coincide exactly and all but one turn coincide at least roughly. The exception is the upturn occurring in April 1963 in the composite index and in November 1963 in the diffusion index. This upturn is the most difficult to date because the economy grew over many months at a nearly constant rate. All turns in the two indexes for deflated deviation cycles coincide roughly and the majority coincide exactly.

CHART 15 U.S. Growth Cycles, 1947–70: Composite Indexes



NOTES: Solid vertical lines indicate growth-cycle upturns, broken vertical lines, growth-cycle downturns, based on the undeflated composite index for deviation cycles.
Horizontal lines on step-cycle curves are average standings in step.
For explanation of composite indexes, deviation cycles, step-cycles, undeflated and deflated, see text.

Agreement between composite and diffusion indexes for *step* cycles is a little less close than for deviation cycles. Still, all but 2 out of the 15 turns in the undeflated indexes coincide roughly, and 6 coincide exactly. The same number of rough coincidences and 8 exact coincidences are found in the corresponding deflated indexes. The exceptions in the undeflated, as well as in the deflated, step cycles are again the troublesome 1963–64 upturn and, in addition, the downturn of 1959–60, when the diffusion index leads the composite index.

Deviation Cycles and Step Cycles Compared

Not surprisingly, the differences between the dates of deviation-cycle turns and step-cycle turns tend to be greater than those between indexes for a given type of cycle. In each of three deviation-cycle indexes (undeflated composite and diffusion indexes and the deflated composite index), 3 out of the 15 turns are more than 3 months removed from their step-cycle counterparts. The fourth pair of indexes, the deflated diffusion indexes, have as many as 6 discrepancies of over 3 months. Exact coincidences of deviation and step-cycle turns are rare, except for the composite indexes for deflated cycles, where as many as 8 turns coincide exactly. The median discrepancies between deviation-cycle and step-cycle turns are 2 months in deflated and undeflated diffusion indexes and in undeflated composite indexes.

Most of the larger discrepancies are due to relatively flat movements of the indexes, which make the selection between two or more alternative dates dependent upon tiny differences between standings. For instance, the diffusion indexes for deviation cycles and step cycles identify different turns in the flat bottom of 1963–64 in either undeflated or deflated cycles. The date of the 1951 downturn differs among composite indexes for the same reason.

The 1957 downturn is a different case. All four diffusion indexes trace a sharp triangle here, and the long lags of the step-cycle peaks as against the deviation-cycle peaks reflect the differences in the trend curves. The flatter trend implicit in the step cycles gives a later downturn. Since this lag occurs in half of the indicators, among which are the most essential ones, it would not be eliminated by a change in the indicator mix.

The difficult choice for the final growth-cycle chronology is, therefore, that between deviation cycles and step cycles. One criterion to be considered in making this choice is the smoothness of the indexes. (Smoothness reduces the likelihood of error in identifying turning points.) Judged by the composite indexes, deviation cycles are far superior to step cycles in this respect, since rates of change are always more erratic than the series from which they are drawn. Thus, the cyclical components are about twice as large as the irregular components in the composite indexes for the deviation cycles, while the opposite relation prevails in the step-cycle indexes, whose irregular components are double the cyclical ones.[80]

The smoothness of the diffusion indexes gives no clue as to the advantages of deviation cycles or step cycles, since there is practically no countercyclical movement in any of them (Chart 14).

Comparison of cycle amplitudes, another conceivable criterion in deciding between deviation and step cycles, is not very helpful. Amplitudes of composite indexes are not comparable, as has been noted above. In cumulated diffusion indexes, there are large differences in amplitudes of individual cycle phases between deviation and step cycles and also between undeflated and deflated cycles. However, the average amplitudes of the four indexes for the entire period are not too different. The cumulated average net percentage rising per phase is 1,203 and 1,244 for undeflated and deflated deviation cycles, and 1,182 and 1,131 for undeflated and deflated step cycles. Thus, deviation cycles have a slight edge over step cycles in this respect, the former's amplitudes being somewhat larger.

On the other hand, step cycles rate above deviation cycles when the evaluation is based on the degree of diffusion, as measured by the number of indicator turns matching reference-cycle turns. If each of the 16 indicators used turned in the neighborhood of every one of the 15 growth-cycle turns, there would be 240 such matching turns. The actual figure is, for step cycles, an amazingly high 233. In other words, all growth-cycle turns are accompanied by turns in practically all indicators. For deviation cycles, the figure is somewhat lower, namely 218, a result due mainly to the relatively poor showing of the specific deviation cycles in 1951–52 (derived from Table 13, column 7).

Measured another way, the degree of diffusion also does not differ much between deviation and step cycles, deflated or undeflated. As a rule, there is a period in a cycle phase during which all indicators rise or all indicators fall. The number of exceptional phases in which this high degree of diffusion is not reached is 4 in deviation cycles and 3 in step cycles. The low-rate phase of 1951–52 is one of these exceptions in both types of cycle.

Other reasons for preferring step cycles are that they are independent of the subjective selection of a trend curve, and that they rely directly on the relevant growth rates. The advantage of the deviation cycles, on the other hand, is that they are easily understood and are quite similar in concept to classical business cycles.[81]

My tentative decision is to use the deviation cycles. Given this decision, it does not make much difference whether we use the diffusion index or the composite index. I have tentatively chosen the composite index because it takes account of amplitudes of changes in the indicators, while the diffusion index registers only their direction.

From here on, the term growth cycles will refer to the composite index based on deviation cycles, unless otherwise indicated.

Description of Growth Cycles

One important aspect of growth cycles is their timing relative to classical cycles. One expects classical troughs to lead growth-cycle upturns and classical peaks to lag growth-cycle downturns, and this is confirmed by all signs of the timing relations for undeflated and deflated cycles, except for one coincidence in the former and three coincidences in the latter (Tables 7 and 8). The leads at the upturns are remarkably regular and also very short. Upturns were too sharp for the removal of the trend to have much effect. Lags at the downturns are longer, averaging three and a half months for undeflated cycles and two and a quarter months for deflated ones for the period 1948–60.

The lag in the deflated classical cycles at the 1969 peak relative to the deflated growth-cycle downturn was 7 months, which greatly exceeds any of the four preceding lags. The cause of this excessive interval could be that too early a date is set for the deviation-cycle downturn (March 1969), because we have extrapolated too steep a trend curve. This interpretation is strengthened by the fact that the corresponding step-cycle downturn is identified 5 months later than the one in deviation cycles.

An even longer lag (one year) occurred between the downturn in undeflated growth cycles and the classical peak in 1970. Before this date, the longest such lag was only 6 months. The long delay in the occurrence of the classical peak reflects, of course, the effect of continued inflation on undeflated indicators (see Section 5).

As to the *durations* of growth-cycle phases, the timing relations imply that high-rate phases must be shorter than classical expansions and low-rate phases longer than contractions. But the main factor in the different distribution of time between the two cycle phases is, of course, that parts of classical expansions become low-rate phases in growth cycles. Thus, high-rate phases lasted, on the average, 21 months, while classical expansions averaged 52 months for the period 1948–69. For low-rate phases and contractions, the figures are 14 months against 12 months (Table 10). In other words, while the lengths of classical expansions average four and a half times that of contractions, the lengths of high-rate phases are only one and a half times those of low-rate phases.

The average duration of growth cycles as a whole—about three years—is, of course, much shorter than that of classical cycles, which were of 46 months average duration for the period 1948–60; and 63 months, 1948–69.[82]

TABLE 10 Duration of Growth Cycles, 1948–69[a]

Dates of Growth Cycles		Months of Duration			
		Phases		Cycles	
Upturn	Downturn	High Rate	Low Rate	Upturn to Upturn	Downturn to Downturn
12 Indicators, Undeflated					
	Aug. 1948		15		33
Nov. 1949	May 1951	18	14	32	22
July 1952	Mar. 1953	8	18	26	47
Sept. 1954	Feb. 1957	29	15	44	36
May 1958	Feb. 1960	21	12	33	26
Feb. 1961	Apr. 1962	14	12	26	50
Apr. 1963	June 1966	38	16	54	36
Oct. 1967	June 1969	20			
9 Indicators, Deflated					
	July 1948		15		35
Oct. 1949	June 1951	20	12	32	21
June 1952	Mar. 1953	9	17	26	47
Aug. 1954	Feb. 1957	30	15	45	36
May 1958	Feb. 1960	21	12	33	26
Feb. 1961	Apr. 1962	14	11	25	50
Mar. 1963	June 1966	39	16	55	33
Oct. 1967	Mar. 1969	17			
Average, 12 indicators:		21.1	14.6	35.8	35.7
Average, 9 indicators:		21.4	14.0	36.0	35.4

[a]Defined by composite indexes of undeflated and deflated deviation cycles.

Turning now to the description of growth-cycle *amplitudes,* we find great contrasts among the seven cycles (Table 9).[83] Measured by the differences in index standings at turning points, the largest cycle (1948–51, downturn to downturn) is more than six times as large as the smallest one (1961–63, upturn to upturn). As expected, large amplitudes characterize cycles that match classical business cycles. On the average, the swings of such growth cycles are more than twice as large as the swings of the others. The average amplitude of the cycles, 1948–60, is three times that of the cycles of the 1960's. During the twenty-three years covered, growth-cycle amplitudes exhibited an unmistakable downward trend.[84]

In the absence of a stipulated minimum amplitude, one may object to the acceptance of some of the seven fluctuations as growth cycles. Does the flattest of the movements deserve that name? The answer is, of course, a matter of judgment, but in my opinion, recognition of all seven cycles is indicated.

Consider the cycle with the smallest amplitude, 1961–63. The following arguments favor its acceptance: first, it is identified in all eight growth-cycle indexes,[85] and also in every experimental index based on different indicator lists. Second, it is a well-diffused cycle, so that if it were rejected, the majority of indicators would show a cycle not matched by a reference cycle. (Such "extra" cycles are rare exceptions otherwise.) Third, the duration of this cycle, although short, exceeds by a few months that of the shortest cycles. For all these reasons, it seems preferable to accept the 1961–63 growth cycle.

Another cycle that might be questioned is the Korean War cycle, 1951–53. The weak points of this cycle are its poor diffusion and its short duration. Out of the 12 undeflated indicators, 5 fail to trace this cycle; and 2 indicators out of the 9 deflated ones skip it. The cycle is also the shortest of the seven growth cycles, lasting only 22 months against a 26-month duration of the 1961–63 cycle. However, in amplitude, the 1951–53 cycle exceeds two others. Moreover, it is identified in all of the indexes. On balance, the evidence again seems to argue for acceptance.

Focusing attention on amplitudes of cycle phases rather than on entire cycles, one finds that the largest growth occurred in the high-rate phase, 1949–51, which is concurrent with the first part of a classical expansion. The two next largest rises also took place during phases matching classical ones. At the other end of the scale, the smallest rise was the last one (1967–69).

The deepest falls took place during the first three classical recessions. In the fourth, 1960–61, the decline was near the average amplitude of the seven low-rate phases and much larger than the decline in the two latest ones.[86]

How does the amplitude of the latest low-rate phase compare to earlier ones? The answer must be tentative because identification of the upturn date is impossible within the period covered. However, the decline from June 1969 to December 1970 in the undeflated phase is probably very close to the true figure. According to this measure, the amplitude of the latest low-rate phase was close to the average amplitude of the preceding seven such phases—similar to the decline of 1960–61, decidedly smaller than the three large declines, and decidedly larger than the three small ones. (Measured by the composite index for step cycles, the latest decline was relatively smaller than on the deviation-cycle basis. Its amplitude was smaller than that of all but the two preceding low-rate phases.)

The step-cycle analysis also reveals another feature of growth cycles which should be noted: The levels of the last five high-rate phases are strikingly similar and the variability among levels of high-rate phases is decidedly smaller than the variability among levels of low-rate phases for the entire period (Chart 15).[87]

A further aspect of growth cycles which is of interest is the relative timing of undeflated and deflated cycles. In the composite indexes for deviation cycles, the undeflated and deflated turns differ by no more than one month (except in one instance) and the average lag of undeflated turns against deflated turns is only 0.5 month (0.6 month at upturns and 0.4 month at downturns). Comparing all four undeflated growth cycle indexes with their deflated counterparts, one finds that about one-half of the turns in deflated cycles lead those in undeflated cycles, while the remaining undeflated and deflated turns coincide. Leads are somewhat more frequent at downturns than at upturns. Using four indexes with 15 turns each, yields 60 observations, of which 32 are coincidences, 24 are leads of deflated turns, and 4 are lags.

The foregoing results are quite similar to corresponding ones obtained for classical cycles. In this case, there are two indexes with 8 turns in each, or 16 observations, of which 8 are coincidences, 7 are leads, and 1 is a lag of the deflated turn.

A count of the months by which deflated turns lead reveals the likeness between classical and growth cycles even more strikingly than does the count of the number of occurrences. The average length of the lead of the deflated to the undeflated turn is 1.0 months for the 60 observations on growth cycles, and 1.2 months for the 16 observations on classical cycles.

This result is somewhat surprising. Upward trends in prices cannot affect undeflated growth cycles, which are based on trend-adjusted data. Therefore, one would expect undeflated and deflated growth cycles to be considerably more similar to each other than are undeflated and deflated classical cycles. However, the findings on timing do not confirm this expectation. Evidently, it is the effect of deflation on cyclical price changes, rather than its effect on longer-run price trends, that is the main cause of discrepancies between the dates of undeflated and deflated cycle turns. One must recall, however, that the comparison of our deflated and undeflated indexes is not strictly a comparison of identical indicators in deflated and undeflated form. Price and interest rate series are included in the latter but not in the former.

Leading Indicators and Growth Cycles

How useful the growth-cycle chronology can be in clarifying cyclical relationships is illustrated by its effect on the evaluation of the *leading* indicators. One of the main objections to the usefulness of the leaders is that they give "false signals." It does not help us much that the leaders

TABLE 11 **Leads (−) and Lags (+), in Months, of Deviation-Cycle (DC) and Step-Cycle (SC) Turns in Sixteen U.S. Indicators at Individual U.S. Growth-Cycle Turns January 1948December 1970**

BCD No.[a]	Indicators	Type of Turn	Aug. 1948 Down-turn	Nov. 1949 Up-turn	May 1951 Down-turn	July 1952 Up-turn
41	Number of employees on nonagricultural payrolls					
		DC	−1	0	−1	−1
		SC	+4	0	−2	0
43	Unemployment rate, total, inverted					
		DC	−9	−3	N.C.	N.C.
		SC	+3	−4	N.C.	N.C.
47	Index of industrial production					
		DC	−2	−1	−2	−1
		SC	−1	0	−9	−1
48	Man-hours in nonagricultural establishments					
		DC	−8	0	−1	−1
		SC	+1	0	−5	−1
52	Personal income (current $)					
		DC	0	−1	N.C.	N.C.
		SC	0	−1	−1	−3
52D	Personal income (constant $)					
		DC	N.C.	−1	+3	−6
		SC	+3	−4	−15	−3
53	Wages and salaries in mining, mfg., and constr. (current $)					
		DC	0	0	−1	−1
		SC	0	0	−1	−1
53D	Wages and salaries in mining, mfg., and constr. (constant $)					
		DC	N.C.	−1	−1	−1
		SC	+3	−1	−6	−1
55	Index of wholesale prices, industrial commodities					
		DC	+3	+5	−3	N.C.
		SC	+1	+7	−4	0
56	Manufacturing and trade sales (current $)					
		DC	0	+1	−3	+1
		SC	0	+1	−3	+1
56D	Manufacturing and trade sales (constant $)					
		DC	N.C.	+1	−9	−7
		SC	−1	+1	−9	−7

TABLE 11 (continued)

Mar. 1953 Down-turn	Sept. 1954 Up-turn	Feb. 1957 Down-turn	May 1958 Up-turn	Feb. 1960 Down-turn	Feb. 1961 Up-turn	Apr. 1962 Down-turn	Apr. 1963 Up-turn	June 1966 Down-turn	Oct. 1967 Up-turn	June 1969 Down-turn
−1	+1	+1	+1	0	+2	+1	+18	+1	0	−3
−1	−1	+6	0	0	0	0	+18	+1	0	0
+2	0	+2	−1	0	+3	+3	+7	−4	0	−6
+5	−6	+6	−1	0	+3	−2	+1	+5	0	+5
+2	−1	−16	−1	−1	0	0	−3	+4	0	+1
+4	−8	+6	−1	−9	0	−9	+7	+4	−4	+1
−3	0	−2	0	+2	+1	0	+17	0	0	−1
0	−1	+6	−1	−8	+1	0	+17	0	−6	+9
−6	−2	+6	0	−2	0	0	+7	−3	0	+2
0	−2	+6	−1	−2	0	−3	+7	+6	0	+11
0	−2	−5	−1	−1	0	−4	+6	−6	0	−9
0	−3	−12	−1	−10	0	−4	+6	−6	0	−9
0	0	−2	0	0	0	0	+9	+2	−5	+2
0	0	−2	0	−9	0	0	+9	+5	−5	+6
0	0	−2	0	0	0	0	0	0	−5	−6
0	0	−2	0	−9	0	0	−2	+6	−5	+4
N.C.	+1	0	+1	−9	N.C.	N.C.	+17	+1	−3	N.C.
+5	+9	−1	+1	−11	N.C.	N.C.	+16	+1	−3	N.C.
0	0	0	−1	−9	0	−1	−3	−3	−3	+4
0	0	0	−1	−9	−1	−5	+19	−3	−3	+4
0	−1	−14	−1	−9	0	−1	−3	−3	−3	−7
0	0	−22	−1	−9	−1	−5	+19	−3	−3	+3

TABLE 11 (continued)

BCD No.[a]	Indicators	Type of Turn	Aug. 1948 Down-turn	Nov. 1949 Up-turn	May 1951 Down-turn	July 1952 Up-turn
61	Bus. expenditure on new plant and equip. (current $)					
		DC	−5	+1	+9	N.C.
		SC	+3	0	+9	+2
61D	Bus. expenditure on new plant and equip. (constant $)					
		DC	+1	+1	+9	N.C.
		SC	+2	+1	+1	+4
115	Treasury bond yields					
		DC	−7	+1	N.C.	N.C.
		SC	+4	+1	+8	0
200	Gross national product in current dollars					
		DC	0	0	+4	0
		SC	+1	0	−2	0
205	Gross national product in 1958 dollars					
		DC	−2	−2	+3	0
		SC	+2	−3	+3	0

predict classical business-cycle turns correctly, so the argument goes, since they also predict turns which never occur. This argument is no longer valid when growth cycles are recognized and false signals become right signals. Even though the leaders were picked to lead classical cycles, each of the 13 turns in the leading-indicator index matches and leads a growth-cycle turn, except for one coincidence (Table 7). The only remaining blemish on the leaders' record is that they fail to predict the smallest of the growth cycles (1962–63), and even this shortcoming might not be found if the leading-indicator index were tailored to growth cycles rather than to classical cycles.[88]

Relating the leaders to growth cycles rather than to classical cycles also reduces another of their weaknesses: the variability of the lengths of their leads. For 9 classical turns, the average deviation from the mean lead is about 5 months; for 13 growth-cycle turns, it is about 3 months. If the exceptionally long lead at the 1957 downturn is excluded, the deviations are reduced to 3.2 months for classical cycles, and to 2.4 months for growth cycles. Leads of leaders are, of course, shorter at the upper turning points and longer at the lower turning points in growth cycles, as compared to classical cycles.

To cite just one more example of the uses of growth cycles, the analysis of fluctuations in the quantity of money may be mentioned. Every turn in

TABLE 11 (continued)

Mar. 1953 Down-turn	Sept. 1954 Up-turn	Feb. 1957 Down-turn	May 1958 Up-turn	Feb. 1960 Down-turn	Feb. 1961 Up-turn	Apr. 1962 Down-turn	Apr. 1963 Up-turn	June 1966 Down-turn	Oct. 1967 Up-turn	June 1969 Down-turn
N.C.	+4	+1	+4	+3	N.C.	N.C.	−1	−1	+13	+2
+2	+4	+5	+3	+2	+1	+4	−2	+5	+7	+2
N.C.	+4	+2	+5	+3	N.C.	N.C.	−1	+4	+12	+2
+2	+4	+6	+1	+3	0	+4	−2	+5	+7	+13
+3	−1	+7	−1	−5	+3	−2	−4	+1	−7	+12
+5	−5	+7	−1	−5	−6	N.C.	N.C.	+1	−9	+12
−2	−2	0	−1	+2	0	+2	+3	−2	−4	+2
−3	−3	+6	−2	+2	0	−4	+25	−3	−5	+2
+1	−4	−15	−1	+2	0	+2	+1	−3	−5	−10
+2	−5	+6	−2	+2	0	−5	+25	−4	−7	+2

[a]The series identification numbers used in *Business Conditions Digest*.

NOTE: The growth-cycle turns are those in the composite index for undeflated deviation cycles. N.C. signifies no comparison.

the rate of change of the money supply matches and (with one exception) leads a growth-cycle turn.[89] With the help of the growth-cycle chronology, many other cyclical relationships can undoubtedly be clarified.

[8] CONSENSUS OF INDICATOR TURNS AND REFERENCE TURNS IN GROWTH CYCLES

Averages for All Turns and All Indicators

In the preceding chapter, it was shown that, as a rule, all 16 indicators turn at about the time a growth cycle occurs. This finding indicates the high degree of diffusion of growth cycles, but it is imprecise because it does not reveal whether the indicator turns occur in the same months as the growth cycles, or precede or follow by many months. Since the function of the indicators in this study is to identify reference cycles, not to predict them, the interval between indicator turns and reference-cycle turns should be as short as possible. It is, therefore, satisfactory to find that in about 70 per cent of the possible comparisons, the dates of turns in the deviation cycles of individual indicators are within 3 months of the corresponding growth-cycle turns, i.e., are roughly coincident (Table 14, line 2).[90]

In the following discussion, indicator turns are related to turns in the composite index of undeflated deviation cycles. Relating everything to a single reference chronology has, of course, its disadvantages. However, it greatly simplifies the presentation and moreover, brings out the results which one obtains with this particular chronology.

Considering, then, that the reference dates are based on deviation cycles, the proportion of roughly coinciding step-cycle turns of the indicators, namely, 58 per cent, is also rather high.

This judgment is supported by a comparison with the frequency of rough coincidences between turns in coincident indicators and classical business-cycle turns. Of the turns in the 25 coincident indicators making up the full list of 1967, only 53 per cent coincided roughly with the classical reference dates; and even for the turns of 7 indicators on the short list, the figure is only 59 per cent.[91]

It may also be noted that turns in deviation cycles and step cycles of 21 German indicators coincided roughly with German growth-cycle turns in 53 per cent and 49 per cent of the comparisons, respectively.[92]

The frequency of exact coincidences of deviation-cycle and step-cycle turns is also relatively high. It amounts to 22 per cent or 23 per cent of the comparisons, whereas the turns in the 25 indicators of the aforementioned full list coincide with classical business-cycle turns in only 16 per cent of observations.[93]

The closeness between indicator turns and growth-cycle turns can be measured, further, by the length of the intervals between them. The median such interval, or deviation, has been computed for each growth-cycle turn; and from these, the median for all turns has been derived. The resulting median deviation between the turns in the deviation cycles of the individual indicators and the growth-cycle turns is 2 months for undeflated, and 1 month for deflated, cycles. For step cycles of the indicators, the distance is considerably longer, because the growth-cycle chronology against which it is measured is based on the deviation cycles, rather than on step cycles. For undeflated indicators, it is 3.5 months; and for deflated indicators, 4.0 months (Table 14, line 10).

Thus, turns in the deviation cycles of indicators not only match growth-cycle turns, but tend to take place within a few months from them, while turns in step cycles of indicators are dispersed somewhat more widely, relative to deviation-cycle-based reference dates.

TABLE 12 Summary of Table 11 by Dates of Growth-Cycle Turns

Line		8/48	11/49	5/51	7/52	3/53	9/54	2/57	5/58	2/60	2/61	4/62	4/63	6/66	10/67	6/69
	12 Undeflated Indicators[a]															
1	Mean lead (−) or lag (+)															
	DC	−2.6	+0.1	+0.6	−0.4	−0.4	−0.3	−1.5	0	−1.4	+0.9	+0.5	+5.7	−0.6	−1.2	+0.5
	SC	+1.5	+0.1	+0.6	−0.3	+1.6	−1.5	+4.2	−0.5	−3.9	−0.2	−2.4	+1.3	+1.5	−2.9	+4.9
2	Median deviation from growth cycle turns[a]															
	DC	2.0	1.0	3.0	1.0	2.0	1.0	2.0	1.0	2.0	0	1.0	5.5	2.0	3.0	2.0
	SC	1.0	0.5	3.0	1.0	2.0	3.5	6.0	1.0	3.5	0	3.5	16.0	3.5	5.0	4.0
3	Median discrepancy between DC and SC turns[c]	3.0	0	1.0	0	1.5	1.0	4.0	0.5	0	0	5.0	1.0	0.5	0.5	3.0
4	Number of indicators skipping the turn															
	DC	0	0	3	5	2	0	0	0	0	2	2	0	0	0	1
	SC	0	0	1	1	0	0	0	0	0	1	2	1	0	0	1
	9 Deflated Indicators[a]															
1	Mean lead (−) or lag (+)															
	DC	−3.5	−0.7	+0.1	−2.4	+0.1	−0.3	−5.4	+0.1	−0.4	+0.7	+0.1	+4.7	−0.8	−0.1	−4.3
	SC	−1.8	−1.1	−4.7	−1.1	+1.3	−2.2	0	−0.7	−4.7	+0.3	−2.3	+1.1	+0.9	−2.0	+3.1
2	Median deviation growth cycle turns[b]															
	DC	2.0	1.0	2.5	1.0	1.0	1.0	2.0	1.0	1.0	0	1.0	3.0	3.0	0	6.0
	SC	2.0	1.0	5.0	1.0	1.0	3.0	6.0	1.0	8.0	0	4.0	7.0	4.0	4.0	4.0
3	Median discrepancy between DC and SC turns[d]	4.5	0	4.5	0	0.5	1.0	7.0	0	0	0	2.5	2.0	0	0	10.0
4	Number of indicators skipping the turn															
	DC	3	0	1	2	1	0	0	0	0	1	1	0	0	0	0
	SC	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0

[a] For lists of indicators, see Table 1, columns 18–21.
[b] Without regard to sign.
[c] The medians of the median discrepancies are (in months): all turns: 1.0, upturns: 0.5, downturns: 2.3.
[d] The medians of the median discrepancies are (in months): all turns: 0.5, upturns: 0, downturns: 3.5.

TABLE 13 Summary of Table 11 by Individual Indicators

BCD No.	Indicator	Number of: Long Leads (1)	Short Leads (2)	Exact Coinci-dences (3)	Short Lags (4)	Long Lags (5)	Rough Coinci-dences (6)	Unrelated Turns in: Growth Cycles (7)	Indi-cators (8)	Average Months: Median Lead or Lag (9)	Median Devia-tion (10)
41	Number of employees on non-agricultural payrolls										
	DC	0	5	3	6	1	14	0	0	0	1
	SC	0	3	8	1	3	12	0	0	0	0
43	Unemployment rate, total, inverted										
	DC	3	2	3	4	1	9	2	0	0	3
	SC	2	2	2	3	4	7	2	0	+1.0	3
47	Index of industrial production										
	DC	1	8	3	2	1	13	0	0	−1.0	1
	SC	5	3	2	1	4	6	0	0	−1.0	4
48	Man-hours in nonagricultural establishments										
	DC	1	5	6	2	1	13	0	0	0	1
	SC	3	3	4	2	3	9	0	0	0	1
52	Personal income (current $)										
	DC	1	4	5	1	2	10	2	0	0	2
	SC	0	7	4	0	4	11	0	0	0	2

52D	Personal income (constant $)										
	DC	5	4	3	1	1	8	1	0	−1.0	2.5
	SC	7	3	3	1	1	7	0	0	−3.0	4
53	Wages and salaries in mining, mfg., and constr. (current $)										
	DC	1	3	8	2	1	13	0	0	0	0
	SC	2	3	7	0	3	10	0	0	0	1
53D	Wages and salaries in mining, mfg., and constr. (constant $)										
	DC	2	4	8	0	0	12	1	0	0	0
	SC	3	4	5	2	1	11	0	0	0	2
55	Index of wholesale prices, industrial commodities,										
	DC	1	2	1	4	2	7	5	0	+1.0	3
	SC	2	2	1	3	4	6	3	0	+1.0	3.5
56	Manufacturing and trade sales (current $)										
	DC	1	6	5	2	1	13	0	0	0	1
	SC	2	5	4	2	2	11	0	0	0	1
56D	Manufacturing and trade sales (constant $)										
	DC	5	6	2	1	0	9	1	0	−3.0	3
	SC	5	5	2	2	1	9	0	0	−1.0	3
61	Bus. expenditures on new plant and equip. (current $)										
	DC	1	2	0	4	4	6	4	0	+2.0	3
	SC	0	1	1	7	6	9	0	0	+3.0	3

TABLE 13 (continued)

BCD No.	Indicator	Number of: Long Leads (1)	Short Leads (2)	Exact Coinci-dences (3)	Short Lags (4)	Long Lags (5)	Rough Coinci-dences (6)	Unrelated Turns in: Growth Cycles (7)	Indi-cators (8)	Average Months: Median Lead or Lag (9)	Median Devia-tion (10)
61D	Bus. expenditures on new plant and equip. (constant $)										
	DC	0	1	0	5	5	6	4	0	+3.0	3
	SC	0	1	1	6	7	8	0	0	+3.0	3
115	Treasury bond yields										
	DC	4	3	0	4	2	7	2	6	−1.0	3
	SC	4	1	1	2	5	4	2	2	+1.0	5
200	Gross national product in current dollars										
	DC	1	4	5	4	1	13	0	2	0	2
	SC	2	5	3	3	2	11	0	0	0	2
205	Gross national product in 1958 dollars										
	DC	4	4	2	5	0	11	0	0	−1.0	2
	SC	4	2	2	5	2	9	0	0	0	3

[a]The series identification numbers used in *Business Conditions Digest*.

NOTES: Column (6): the sum of columns (2) (3) (4).
Column (10): the median deviations from the growth cycle turns.

TABLE 14 Summary of Table 11 by Groups of Turns and Indicators: Deviation Cycles (DC) and Step Cycles (SC)

	12 Undeflated Indicators				9 Deflated Indicators			
	DC		SC		DC		SC	
	(A) Numbers and Per Cent of All Comparisons							
Line No.	No. 1	% 2	No. 3	% 4	No. 5	% 6	No. 7	% 8
All comparisons (lines 3–8)	180	100	180	100	135	100	135	100
Rough coincidences (lines 3–5)	129	72	105	58	95	70	78	58
Exact coincidences	41	23	39	22	30	22	29	22
Short leads	48	27	37	20	39	29	26	19
Short lags	40	22	29	16	26	19	23	17
Long leads	19	11	26	14	21	16	29	22
Long lags	17	9	42	23	10	7	26	19
Unmatched growth-cycle turns	15	8	7	4	9	7	2	1
Umatched indicators turns	8	—	2	—	0	—	0	—

	(B) Median Deviations from Growth Cycle Turns (Months)			
	9	10	11	12
All indicator turns	2.0	3.5	1.0	4.0
Group I turns[a]	2.0	2.0	1.0	2.0
Group II turns[b]	2.5	3.5	1.8	4.0
Upturns	1.0	1.0	1.0	1.0
Downturns	2.0	3.5	2.0	4.0

[a]Turns matching turns in classical business cycles.
[b]Turns not matching turns in classical business cycles.

Comparison Between Growth-Cycle Turns Which Do and Those Which Do Not Correspond to Classical Business-Cycle Turns

As one would expect, the agreement of indicator turns and growth-cycle turns is much better at reference turns which are close to classical business-cycle turns (Group I) that at the 6 turns in 1951, 1952, 1962, 1963, 1966, and 1967 (Group II), which are not.

A sharp contrast is revealed, first, in the number of matching turns. There are 14 instances when one or another of the 12 trend-adjusted, undeflated indicators fails to turn in the Korean War cycle or in the 1961–63 cycle. But each of the 12 indicators turns at all other growth-cycle reference turns, with the sole exception of wholesale prices, which fail to turn down in 1969 (Tables 11 and 12, line 4).

The turns in deviation cycles of the 9 deflated indicators miss altogether 9 out of 135 opportunities to match growth-cycle turns. Again, all growth-cycle turns of Group I, and also the turns in 1966 and 1967, are matched by all indicators, except for missed downturns in 3 deflated series in 1948. The downturns in these series came so early that they could not be recognized within the period covered by this study.[94]

Diffusion of the 2 weaker growth cycles, on the other hand, is incomplete when measured by the number of corresponding indicator turns. The turns in 1951–52 are skipped by the deviation cycles of as many as 5 undeflated indicators. Also 2 of the 9 deflated indicators miss these turns. The unemployment rate is included in both these counts. The growth-cycle downturn in 1962 and the upturn in 1963 have no counterparts in deviation cycles of 2 undeflated and 1 deflated indicator.

If the foregoing analysis had been based on the indicators' step cycles instead of on their deviation cycles, the contrast between different types of growth-cycle turns would not come out as strongly, because, altogether, only 7 growth-cycle turns have no counterpart in the step-cycle turns of the undeflated indicators, and a mere 2 have no counterpart in those of the deflated indicators (Tables 11 and 12, line 4). (These results would not be changed if the growth-cycle chronology were based on step cycles.) However, the results agree with those from deviation cycles in that only 1 of the 7 missing turns of undeflated indicators is at a Group I reference-cycle turn (again, prices in 1969); 2 are in 1951–52 (again, the unemployment rate); and 4 are in 1962–63 (prices and interest rates).

The contrast between Group I and Group II cycles shows up also in the dispersion of indicator turns around reference turns. The median distance of the former from Group I reference turns is only 1 or 2 months for undeflated and deflated deviation and step cycles (Table 14, lines 11, 12). Each of the corresponding figures for Group II reference cycles is higher (2 to 4 months). This shows again that indicator movements agree more closely with those growth cycles which correspond to classical business cycles than with other growth cycles.[95]

Comparison Between Upturns and Downturns of Growth Cycles

There is a distinct difference between upturns and downturns of growth cycles. Indicator turns are clustered much more closely around upturns than around downturns. At upturns, each of the 4 median deviations are only 1 month (Table 14, line 13). At downturns, they are much larger: 2 months for undeflated and deflated deviation cycles, and 3.5 to 4 months for undeflated and deflated step cycles (line 14).[96]

That there is more regularity of behavior at upturns than at downturns is confirmed also by the much better agreement between deviation-cycle turns and step-cycle turns at the former. One would expect, of course, that turns in the two types of cycles would coincide at sharply drawn turns; and would diverge the more, the more hesitant the economy was in changing direction. When upper and lower turns are combined, the median distance between the 15 pairs of turns is 1 month for undeflated cycles and 0.5 months for deflated cycles. But when upturns alone are considered, the median divergence is reduced to 0.5 months for undeflated cycles and zero for deflated ones; while for downturns, the corresponding measures are 2.3 and 3.5 months (derived from Table 12, line 3).

Among the largest individual discrepancies between deviation-cycle and step-cycle turns are those at the ends of the period, in 1948 and 1969. (As mentioned earlier the likelihood of error is greater at the ends than in the center of the period.) Since both ends are downturns, their inclusion increases the average deviation for downturns, as well as the contrast between them and upturns. However, exclusion of 1948 and 1969 would only reduce, but not eliminate, the difference between upturns and downturns.[97]

The Timing of Turns in Individual Indicators

Closeness of Turns in Individual Indicators to Growth-Cycle Turns Some of the 16 indicators used in this study turn at the growth-cycle reference dates or very close to them, while others are either less regular or lead or lag systematically. For a rough idea of timing differences, one may classify the indicators by the average distance of their turns from the growth-cycle turns. Two measures of this distance are used: the median deviation of the turn in the indicator from the corresponding growth-cycle turn, and the number of rough coincidences between the two kinds of turns (Table 13, columns 6 and 10).

Indicators whose deviation-cycle and step-cycle turns (a) coincide roughly with at least 10 out of the 15 growth-cycle turns and (b) are, on the average, not more than 2 months away from the reference turns may be said to perform best in this respect. The 7 indicators which satisfy these conditions are: the number of nonfarm employees; man-hours; personal income, undeflated; wage and salary income, undeflated and deflated; manufacturing and trade sales, undeflated; gross national product in current dollars.

At the other end of the scale there are 4 indicators with median deviations of 2.5 to 5 months and 8 or fewer rough coincidences. These indicators are: personal income, deflated; expenditures on plant and equipment, deflated; wholesale prices; and bond yields.

Two indicators are, by these standards, "medium good," namely, the unemployment rate and deflated manufacturing and trade sales. Finally, 3 indicators have different records depending on whether their deviation cycles or their step cycles are considered. Two of these, industrial production and gross national product in constant dollars, are among the best series on the basis of their deviation cycles but rate low or medium on the basis of their step cycles. Expenditures on plant and equipment, on the contrary, turn more closely to growth cycles in step cycles than in deviation cycles.

Leads and Lags of Indicators at Growth-Cycle Turns Large deviations of indicator turns from growth-cycle turns may signify irregularity in the cyclical behavior of the series, or they can be caused by regular leads or lags. The emergence of systematic leads or lags is not in contradiction to the fact that virtually all of our indicators are of the roughly coincident class. First, this classification is based on the indicators' timing at classical business-cycle turns, while the present analysis deals with growth cycles. Second, some roughly coincident indicators tend to lead or lag, although by short spans, also at classical-cycle turns. Finally, the 4 deflated series among the 16 indicators may be expected to lead reference cycles based on undeflated indicators.

Inspecting the median leads and lags of individual indicators (Table 13, column 9), one finds that the turns in the deviation cycles and step cycles of the 7 indicators termed "best" in the preceding section, coincide exactly with growth-cycle turns, on the average. The same cannot be said of any of the other 9 indicators. Three of these are leaders and 3 are laggers, both in their deviation and in their step cycles. The leaders are the deflated series for personal income, that for manufacturing and trade sales, and the industrial production index.

The laggers are, first, expenditures on plant and equipment, a series included from the list of lagging indicators to compensate for leading ones; and second, the deflated version of this indicator, which lags as much as the undeflated one. The third lagging indicator is the wholesale price index.

Finally, there are 3 indicators whose timing differs between their deviation and their step cycles. Turns in the deviation cycles of the unemployment rate and in the step cycles of the GNP in constant dollars coincide, on the average, with growth-cycle turns, while lagging and leading respectively, in the other type of cycle. The only series whose median has a different sign for deviation cycles than for step cycles is that for bond yields. As has been mentioned previously, this is one of our most irregular series; although even in this one, 8 turns coincide exactly in deviation and step cycles.

These measures of the performance of the individual indicators in the two indicator lists and the foregoing comparisons among different kinds of growth-cycle turns provide much information on the nature of growth cycles. This should help to improve the methods used and the selection of indicators in future work.

[9] CONCLUSIONS

My essential aim has been an analysis of growth cycles, but the study also sheds some new light on undeflated and deflated classical business cycles. Furthermore, it is an experiment in dating reference cycles by computerized procedures, in contrast to the traditional NBER practice of determining cycle turns by expert judgment.

Starting with this latter topic, the study demonstrates that the NBER business-cycle chronology, 1948–61, can be almost exactly reproduced by *computerized methods*. After much experimenting, 12 indicators were selected to represent aggregate activity. Turns in two indexes (diffusion and composite) constructed from these indicators were determined by a programed process. The notable result is that all 16 turns in the two indexes, 1948–61, occur in the same or an adjacent month previously selected by the NBER's procedures and generally accepted as the United States business-cycle chronology. This argues for the feasibility of supplementing, or even replacing, traditional subjective cycle-dating by the new methods and thus enabling analysts in the United States and abroad to obtain objective cycle chronologies without being acquainted with the intricate procedures of traditional dating. Another implication is that the traditional procedures were, after all, reproducible.

A further result of the study is a chronology of *cycles in "real" economic activity* and the comparison of these cycles with the usual business cycles. The latter are based not only on measures in constant dollars and in physical units, but also on measures in current dollars, on price indexes, and interest rates. The continuous rise in the price level during recent years has raised questions concerning the usefulness of a cycle chronology based on both real and other measures of economic activity. During inflation, it is pointed out, current dollar series may continue to rise while real economic activity declines, so that traditional cycles may give a distorted picture.

This issue is clarified by analysis, in the study, of "deflated" cycles, defined as cycles in composites of 9 indicators, all measured in physical units or in deflated dollars. Prices, interest rates, and so on, are excluded.

Turns in deflated cycles will differ from turns in undeflated cycles when price movements are opposite to and larger than movements in real activity. This is likely to occur in the months that precede peaks in undeflated cycles when a moderate decline in real activity is often accompanied by a substantial rise in prices. Hence, one expects peaks in deflated cycles to show a tendency to lead those in undeflated cycles.

What we find is that one-half of the 16 turns in the two indexes for undeflated and deflated classical business-cycles coincide, 1948–61. The other half of deflated-cycle turns precede the turns in undeflated cycles (with one exception). Leads of turns in deflated cycles predominate at peaks, as expected. The longest of these leads, extending to 6 months, occurred in 1957.

These findings are helpful in *interpreting the recession of 1969–70.* In October 1969, a peak is identified in both composite and diffusion indexes for deflated cycles. In the indexes representing the traditional undeflated cycle, the peak came only 8 months later, in June 1970. In view of the large price rise in this period, an 8-months' lag is not inconsistent with the showing of the past.

It should be borne in mind, however, that the June 1970 peak in our indexes for the traditional business cycle is of such a precarious nature that it might be eliminated by a very minor revision of the data. This is due to the extreme mildness and short duration of the subsequent downward movement which lasted only 5 months and measured less than 2 per cent in amplitude, as against amplitudes of 6 per cent in 1957–58, and 15 per cent in 1948–49. If data revision should eliminate the 1970 peak in our index for the undeflated business cycle, the 1969 peak in the deflated cycle would be the first such turn since 1948 that was not matched by a turn in the undeflated index.

The analysis of *growth cycles,* the principal purpose of this study, was undertaken for the same reasons that originally led Mitchell and Burns to the dating of classical cycles, namely, to provide the basis for measuring and analyzing economic processes of the greatest importance. Now that classical cycles play a smaller, and growth cycles a larger, role, it becomes necessary to provide for the latter the kind of information that has been accumulated for classical cycles.

The United States growth-cycle chronology also facilitates international comparisons. Since World War II, absolute declines in aggregate economic activity, that is, classical cycles, have been rare exceptions in a number of foreign countries, so that comparisons between their economic fluctuations and United States economic fluctuations can be made only in terms of growth cycles.

The findings on growth cycles may be summarized as follows: First and foremost, growth cycles, defined as alternating periods of above- and below-average economic growth, can be identified as clearly and confidently as the traditional business cycles. All our measurements lead to the recognition of 7 such cycles in the United States economy between 1948 and 1969.

Because of the exploratory nature of the study, the measurements have been obtained by two independent statistical methods. Both lead to essentially the same results, which is an important and reassuring fact. The first method uses the long-run trend of economic activities to distinguish between their "high" and "low" growth rates. Growth which is more rapid than the trend is classified as "relatively high." This method involves fitting a trend to the indicators and analyzing the deviations from this trend, the "deviation cycles." The second method requires no trend fitting. It focuses directly on rates of change and distinguishes between high and low rates by comparing average rates of change in economic activities during successive time periods. The alternations between high- and low-rate periods are termed "step cycles."

Both statistical procedures have been applied, first, to the 12 indicators used to reproduce the classical NBER chronology and, second, to the 9 indicators basic to the deflated classical cycles. The 7 growth cycles stand out clearly in the two resulting chronologies of undeflated and deflated growth cycles, attesting to the stability of the results. Moreover, 12 of the 15 turns identified by each of the two methods (deviation cycles and step cycles) are within 3 months of each other in either deflated or undeflated growth cycles.

Perhaps the most important feature of the growth cycles is their wide diffusion among economic activities. With very few exceptions, the reference turns are matched by turns in each of the indicators used, and 70 per cent of these matching indicator turns occur within 3 months of the growth-cycle turn.

In order to evaluate this result roughly, it may be compared with a corresponding measure for classical business cycles. This shows that rough coincidences between turns of the 7 coincident indicators of the short list and classical reference turns, 1948–61, were relatively less frequent, representing only 59 per cent of the timing comparisons.

As regards another feature of growth cycles, the amplitudes of their swings, we find large differences from cycle to cycle. The largest of the undeflated deviation cycles (the downturn to downturn cycle 1948 to 1951) is more than six times as large as the smallest one (the upturn to upturn cycle, 1961 to 1963). Amplitudes of those growth cycles that match classical business cycles are, on the average, more than twice as large as those of the others. The average amplitude of the cycles of the 1950's (more exactly, of the years 1948 to 1960) is three times that of the 1960's and the two swings, 1962–69, were less than half the average of the 7 growth cycles.

When individual growth-rate phases rather than entire cycles are considered, one finds that the largest growth occurred in the high-rate phase, 1949–51, which is concurrent with the first part of a classical expansion. The two next largest rises were during phases matching classical ones. At the other end of the scale, the smallest rise was observed in the latest high-rate phase, 1967–69.

Not surprisingly, the deepest falls took place during the first three classical recessions. In the fourth, 1960–61, the decline was near the average amplitude of the 7 low-rate phases and much larger than the decline in the 2 following ones. As to the latest undeflated low-rate phase, 1969–70, its amplitude was—according to a tentative measure—similar to the decline of 1960–61.

The average duration of growth cycles, whether deflated or undeflated, is almost exactly 3 years, ranging from 22 to 54 months for the latter and about the same for the former. By comparison, the duration of classical cycles was 46 months, 1948–60, and as much as 59 months, 1945–69.

The distribution of time between the two cycle phases is, of course, quite different in the two types of cycles. High-rate phases lasted, on the average, 21 months, while classical expansions averaged 52 months, 1948–69. For low-rate phases versus contractions, the figures are 14 as against 12 months.

In conclusion, some relations of the leading indicators to the growth-cycle chronology may be cited as examples of its usefulness. First, turns in the currently most discussed leading series, the rate of change of the money stock, lead growth-cycle turns in 11 out of 12 instances, 1949–69. Conversely, all growth-cycle turns, except for the Korean War cycle, match turns in the rate of change of money.

Second, 12 out of 13 turns in the commonly used index of leading indicators match and lead growth-cycle turns. It has always been regarded as the main weakness of the leaders that they not only correctly predict the actual cyclical turns but also falsely predict turns that never occur. This argument does not apply when the leaders are related to growth cycles because what are false signals for classical cycles are correct signals for growth cycles. The one remaining blemish on the leaders' record is that they failed to predict the smallest growth cycle—1962–63. The mean lead of the leaders at growth-cycle turns, although shorter than at classical turns, is still 5 months. The agreement of the timing of turns in the leaders and in the growth cycles argues in favor of both chronologies.

The findings suggest that growth cycles should be identified in all of the indicators which regularly lead, coincide with, or lag classical business cycles. Furthermore, other time series, not now regarded as cyclical indicators because their cyclical fluctuations are obscured by their secular trends, should be analyzed in the growth-cycle framework. Some of them may be found to be good indicators of growth cycles. New insights into the cyclical behavior of specific economic activities and of aggregate economic activity could be obtained in this fashion and new light thrown especially on the fluctuations of the last decade or so when only two classical cycles occurred.

APPENDIX

The Appendix presents the 16 trend-adjusted indicator series on which the determination of growth cycles in this study is based and two composite indexes representing growth reference cycles (deviation cycles and step cycles). The construction of the composite indexes is explained in Section 4 and in footnote 76. The trend-adjusted indicator data are percentage deviations of the original data from the 75-month moving averages. The 37 months at the beginning and end of the series are extrapolations as explained in Section 6. It should be noted that the selection of indicator turning points is based on more decimal places than are shown in the Appendix tables. Therefore, these selections appear to be inconsistent with the data in a few instances.

The source of the original indicator data is the NBER data bank.

The indicator data for undeflated indexes are shown on Charts 2 to 13, Section 6, and the composite indexes are shown on Chart 15 in Section 7. The list of the 12 indicators included in the indexes for undeflated cycles is as follows: number of employees on nonagricultural payrolls: unemployment rate, total, inverted; index of industrial production; man-hours in nonagricultural establishments; personal income (current \$); wages and salaries in mining, manufacturing, and construction (current \$); index of wholesale prices, industrial commodities; manufacturing and trade sales (current \$); business expenditure on new plant and equipment (current \$); Treasury bond yields; gross national product in current dollars; gross national product in 1958 dollars.

TABLE A-1 Number of Employees on Nonagricultural Payrolls (BCD No. 41) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.0	100.1	100.0	99.5	99.6	99.7	99.5	99.8	100.1	100.4	100.5	100.8
1948	100.9	100.5	100.6	100.4	100.3	100.7	101.0	100.7	100.8	100.5	100.4	100.1
1949	99.0	98.5	97.8	97.3	96.7	96.1	95.6	95.6	95.1	94.8	94.4	95.0
1950	94.8	95.0	95.3	96.0	96.5	97.2	97.8	99.1	99.4	99.7	99.9	100.8
1951	100.9	101.3	101.6	101.8	101.6	101.7	101.6	101.2	101.0	101.0	101.4	101.5
1952	101.6	101.8	101.7	101.6	101.0	100.8	100.8	101.2	101.9	102.3	102.7	103.0
1953	102.9	103.2	103.1	102.9	102.6	102.4	102.2	101.7	101.3	101.0	100.3	99.7
1954	98.9	98.6	98.1	97.8	97.4	97.1	96.8	96.7	96.7	96.7	97.1	97.3
1955	97.4	97.7	98.2	98.7	99.3	99.8	100.0	100.1	100.3	100.6	100.9	101.3
1956	101.5	101.9	101.9	102.1	102.2	102.3	101.9	102.1	102.0	102.3	102.3	102.5
1957	102.3	102.5	102.6	102.3	102.1	101.9	101.8	101.6	101.2	100.8	100.3	99.8
1958	99.2	98.0	97.3	96.6	96.4	96.4	96.5	96.8	97.2	97.1	97.8	98.0
1959	98.8	99.0	99.4	100.0	100.4	100.6	100.3	100.1	99.7	100.0	100.4	100.9
1960	101.1	101.4	101.2	101.2	101.1	100.8	100.6	100.5	100.1	99.9	99.5	98.9
1961	98.7	98.3	98.3	98.2	98.4	98.6	98.7	98.8	98.7	98.7	99.0	99.0
1962	99.0	99.1	99.1	99.4	99.5	99.3	99.3	99.4	99.3	99.2	99.1	98.8
1963	98.6	98.6	98.6	98.8	98.8	98.6	98.7	98.7	98.7	98.4	98.4	98.4
1964	98.3	98.5	98.4	98.4	98.3	98.3	98.4	98.4	98.4	98.4	98.6	98.7
1965	98.6	98.7	98.8	98.9	99.1	99.2	99.3	99.4	99.5	99.6	99.8	100.1
1966	100.1	100.3	100.6	100.7	100.8	101.1	101.2	101.1	101.0	101.0	101.0	101.0
1967	100.9	100.9	100.7	100.5	100.3	100.3	100.2	100.2	100.1	99.9	100.2	100.4
1968	100.1	100.5	100.4	100.4	100.2	100.3	100.2	100.3	100.2	100.3	100.4	100.4
1969	100.4	100.7	100.7	100.7	100.7	100.6	100.4	100.3	100.1	100.2	99.9	99.9
1970	99.6	99.5	99.4	99.0	98.3	97.7	97.4	96.9	96.5	96.1	95.9	95.7

TABLE A-2 Unemployment Rate, Total, Inverted (BCD No. 43) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.8	104.0	101.4	100.8	108.0	102.3	99.8	100.1	106.1	109.5	120.5	112.1
1948	110.4	99.1	94.4	97.1	108.5	105.8	106.1	98.2	101.1	104.1	101.7	96.8
1949	90.3	82.9	78.1	73.9	69.6	63.5	59.0	58.3	60.2	59.6	62.4	60.7
1950	61.8	63.0	63.8	69.0	72.5	73.6	79.3	87.9	89.8	94.1	102.9	107.0
1951	108.3	118.8	119.8	132.3	137.4	129.6	134.9	136.0	128.6	131.1	136.2	138.5
1952	134.6	139.2	148.9	148.8	143.4	142.9	133.3	138.1	135.7	139.1	147.9	152.0
1953	140.4	155.3	154.1	147.3	158.0	157.3	150.5	144.2	133.8	115.7	110.7	91.3
1954	79.0	74.6	68.1	65.9	66.1	69.9	67.7	65.7	64.9	70.0	75.7	81.0
1955	83.5	88.1	91.2	90.5	100.3	104.1	110.8	106.8	110.6	106.4	109.9	110.9
1956	117.4	121.4	113.5	120.0	112.4	113.1	111.4	120.5	127.7	128.8	117.5	120.9
1957	121.3	131.0	125.9	131.0	124.6	127.5	121.4	124.4	116.0	113.5	100.3	98.6
1958	88.7	80.8	77.6	70.7	71.1	72.5	71.0	72.4	75.9	80.8	87.8	88.1
1959	91.3	93.2	98.6	106.6	109.0	111.5	109.7	107.9	102.3	99.1	97.7	107.4
1960	109.8	119.4	112.8	111.1	113.7	107.8	106.1	104.6	99.6	96.7	95.3	89.8
1961	89.8	86.0	85.9	84.4	82.9	84.8	83.2	87.8	86.0	88.1	93.4	94.6
1962	97.5	102.4	100.3	100.0	101.6	101.4	103.1	97.5	99.1	102.5	96.7	99.8
1963	95.8	96.9	95.2	95.0	91.4	96.0	95.7	98.8	96.6	96.1	92.2	95.0
1964	92.8	95.5	94.8	95.9	98.8	96.1	101.1	98.3	95.6	94.9	100.0	95.2
1965	98.6	98.9	99.3	96.7	100.4	99.9	103.8	103.2	105.0	104.3	108.6	110.7
1966	109.9	114.9	114.2	113.4	109.7	111.8	111.0	110.4	112.7	112.0	114.5	107.9
1967	107.4	107.0	106.7	106.6	103.7	103.6	106.3	106.4	103.9	99.1	104.4	109.7
1968	112.3	106.0	108.4	114.2	110.6	107.2	106.8	112.5	112.1	111.7	114.5	117.6
1969	113.7	116.7	112.8	109.2	108.8	111.6	108.0	107.6	98.7	98.3	106.4	98.4
1970	94.8	87.7	83.4	76.1	72.8	73.4	72.3	70.6	65.2	63.8	61.4	61.0

TABLE A-3 Index of Industrial Production (BCD No. 47)
(as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.2	100.3	100.7	99.7	99.6	99.1	98.4	98.5	99.1	99.4	100.7	100.5
1948	100.7	100.5	99.1	100.0	100.4	100.9	100.7	100.0	98.8	98.0	97.6	96.5
1949	94.8	93.7	91.7	90.6	89.3	88.7	88.2	88.7	87.7	87.4	87.5	88.9
1950	90.1	91.4	92.7	95.1	96.9	99.4	102.0	104.9	103.6	104.0	103.4	104.8
1951	105.0	105.0	105.3	105.3	104.6	103.8	102.0	102.4	101.0	100.5	101.1	101.4
1952	102.0	102.1	101.9	100.6	99.1	97.7	99.5	101.1	102.7	104.5	106.2	106.2
1953	105.9	105.8	106.3	106.4	106.5	105.4	106.3	105.1	102.6	100.7	97.9	95.4
1954	94.4	94.0	93.1	92.8	93.4	93.6	93.0	92.7	93.1	93.3	94.2	95.7
1955	97.7	98.7	100.3	101.8	102.9	103.5	104.1	104.3	105.1	106.0	105.7	105.7
1956	105.2	104.3	103.7	104.9	104.0	103.5	103.8	103.6	104.0	105.2	104.8	105.2
1957	104.6	104.8	104.4	103.1	103.1	103.0	102.8	102.6	100.9	98.7	96.6	94.3
1958	91.7	89.1	87.3	86.4	87.9	90.5	91.9	93.5	93.7	94.1	96.8	97.2
1959	97.7	99.2	100.7	102.7	104.7	104.1	102.3	101.1	98.5	98.9	100.5	103.0
1960	104.8	103.9	103.1	102.1	102.0	101.4	100.7	100.0	98.9	97.9	96.1	94.1
1961	93.8	93.4	94.4	95.3	96.5	97.6	98.0	97.9	97.1	98.3	99.1	99.4
1962	99.3	99.0	99.5	99.5	99.2	98.7	99.1	98.7	98.8	97.9	98.0	97.2
1963	97.0	97.2	97.8	98.0	98.9	98.7	98.8	98.2	97.9	97.7	97.2	97.3
1964	97.7	97.6	97.5	98.4	98.6	98.3	98.7	98.8	98.1	98.2	98.4	99.6
1965	99.8	99.9	100.4	100.0	100.1	100.6	101.0	101.0	100.0	100.5	100.9	102.0
1966	102.7	103.3	103.8	103.4	103.9	104.2	104.2	104.1	103.9	104.3	103.7	103.6
1967	102.4	101.0	100.5	100.3	99.2	99.0	99.1	98.8	98.8	98.8	100.2	101.3
1968	100.5	100.7	100.8	100.3	101.1	101.3	101.3	100.0	100.1	100.0	100.5	100.7
1969	100.5	100.7	101.1	100.9	101.0	101.3	101.4	100.9	100.2	99.4	98.0	97.5
1970	96.7	96.4	96.4	95.5	94.5	94.0	93.9	92.3	91.3	90.3	89.8	89.7

TABLE A-4 Man-hours in Nonagricultural Establishments (BCD No. 48)
(as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.7	100.4	100.2	99.3	99.8	100.0	99.3	99.4	100.2	100.5	100.6	101.1
1948	101.0	100.3	100.7	100.0	100.2	100.8	100.9	100.7	100.5	100.0	100.0	99.5
1949	98.3	97.9	96.9	96.3	95.8	95.0	94.5	94.5	93.7	93.2	93.1	93.5
1950	93.6	94.0	94.7	95.1	96.3	97.3	98.2	99.0	99.7	100.2	100.7	101.6
1951	101.8	101.9	102.2	102.7	102.4	102.4	102.3	101.9	101.5	101.2	101.8	102.1
1952	102.5	102.8	102.2	101.6	101.2	100.8	101.2	101.5	102.0	103.0	103.0	103.8
1953	103.4	103.5	103.7	103.3	102.7	102.5	102.1	101.4	100.5	100.0	99.6	99.0
1954	98.5	98.0	97.5	97.0	96.3	96.3	96.0	95.8	95.7	96.1	97.1	97.3
1955	97.4	97.9	99.0	99.1	99.7	100.4	100.6	100.8	101.4	101.5	101.9	102.3
1956	102.2	102.5	102.7	102.7	102.3	102.5	102.3	102.5	102.5	102.9	103.1	103.3
1957	103.1	102.9	102.6	102.0	101.9	101.6	101.5	101.5	100.8	99.7	99.2	98.9
1958	97.8	96.6	96.1	95.4	95.3	95.4	95.6	96.1	96.9	96.9	97.8	98.0
1959	98.8	98.9	99.6	100.5	100.9	101.1	100.8	99.8	99.5	99.3	100.4	101.2
1960	101.4	101.5	101.1	101.5	101.1	100.9	100.8	100.6	100.0	99.7	99.1	98.6
1961	98.2	98.2	98.0	98.3	98.1	98.4	98.6	98.7	98.1	98.7	98.7	98.9
1962	98.9	99.0	99.4	99.7	99.6	99.6	99.4	99.4	99.0	98.9	99.0	98.7
1963	98.7	98.6	98.6	99.0	98.9	99.0	98.9	98.7	98.8	98.9	98.6	98.5
1964	98.2	98.4	98.5	98.4	98.4	98.4	98.4	98.4	98.2	98.5	98.9	99.5
1965	99.2	99.6	99.7	99.4	99.9	99.5	99.6	99.9	99.7	100.0	100.4	100.8
1966	100.9	101.5	101.7	101.4	101.8	102.0	101.7	101.8	101.4	101.6	101.6	101.4
1967	100.7	100.6	100.5	99.9	100.0	100.1	99.9	100.2	100.1	99.8	100.0	100.1
1968	99.8	100.1	100.0	99.8	100.1	100.3	100.4	100.4	100.1	100.2	100.0	100.1
1969	99.8	100.0	100.7	100.6	100.8	100.6	100.5	100.4	100.2	100.1	99.9	99.8
1970	99.0	99.0	99.1	98.5	97.8	97.1	97.1	96.6	96.2	95.3	95.3	95.2

TABLE A-5 Personal Income (Current $) (BCD No. 52) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	98.4	97.8	97.2	95.3	95.0	96.0	95.6	97.4	98.3	98.1	98.0	98.7
1948	99.8	99.1	100.3	100.3	100.4	101.9	101.8	102.4	102.0	101.9	100.8	99.1
1949	97.0	96.1	96.1	95.2	94.5	93.1	91.9	92.2	93.1	91.0	91.7	93.1
1950	93.8	95.7	95.4	94.8	94.4	94.3	95.6	96.9	97.3	98.0	98.4	100.1
1951	100.1	100.7	101.3	102.0	102.1	102.4	101.8	102.5	102.3	103.0	103.0	103.0
1952	101.7	102.7	102.5	101.7	102.3	102.4	102.6	103.7	104.2	104.0	103.2	103.3
1953	103.0	103.1	103.5	103.1	103.0	102.9	102.1	101.4	100.8	100.9	99.8	98.9
1954	98.3	98.2	97.4	96.6	96.4	96.1	95.8	95.9	96.1	96.2	96.8	96.6
1955	96.7	96.9	97.3	97.9	98.3	98.7	99.0	99.1	99.4	99.5	99.8	100.1
1956	99.9	100.1	100.1	100.6	100.4	100.6	100.9	100.9	101.2	101.3	101.5	101.6
1957	101.1	101.6	101.6	101.3	101.3	101.6	101.6	101.6	100.8	100.4	100.1	99.3
1958	99.0	98.5	98.6	98.0	97.9	98.0	98.6	98.9	99.0	98.8	99.5	99.6
1959	99.5	99.7	100.0	100.4	100.6	100.6	100.3	99.2	99.0	98.9	99.5	100.7
1960	100.6	100.3	100.5	100.4	100.4	100.1	99.9	99.6	99.4	99.2	98.6	98.3
1961	98.0	97.7	98.3	97.9	98.0	98.5	98.3	98.2	98.5	98.6	99.2	99.3
1962	99.4	99.0	99.3	99.4	99.2	99.0	98.8	98.6	98.7	98.4	98.4	98.4
1963	98.3	98.0	97.9	97.6	97.6	97.8	97.5	97.5	97.4	97.6	97.3	97.6
1964	97.7	97.6	97.5	97.6	97.6	97.5	97.5	97.8	97.8	97.3	97.5	98.0
1965	98.0	97.6	97.6	97.6	97.9	98.1	98.2	98.7	99.0	98.9	99.1	99.4
1966	99.1	99.4	99.5	99.3	99.0	99.2	99.1	99.3	99.2	98.9	98.8	99.0
1967	98.8	98.7	98.5	98.1	97.9	98.1	98.1	98.2	97.9	97.6	98.0	98.3
1968	98.2	98.7	99.3	99.0	99.3	99.6	99.7	99.7	99.8	99.9	99.9	99.9
1969	99.7	99.7	100.0	99.9	99.9	99.9	100.1	100.3	100.2	100.0	99.9	99.7
1970	99.5	99.3	99.9	99.7	99.7	98.8	98.8	98.5	98.6	97.7	96.9	96.2

TABLE A-6 Personal Income (Constant $) (BCD No. 52D)
(as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	105.1	104.0	101.7	100.1	100.0	100.8	100.0	101.9	102.0	100.0	99.3	98.8
1948	99.0	98.4	100.5	99.4	98.9	100.1	99.2	99.7	99.9	100.2	100.0	98.8
1949	97.2	96.8	97.0	96.1	95.8	94.7	94.4	94.8	95.7	94.1	94.8	95.5
1950	97.8	99.9	100.2	99.3	98.7	98.5	99.3	100.4	100.4	100.8	100.8	101.3
1951	99.9	98.9	99.5	100.2	100.3	100.8	100.5	101.5	100.8	101.2	100.6	100.2
1952	99.1	100.4	100.5	99.4	100.2	100.3	100.4	101.2	101.2	101.9	101.1	101.4
1953	101.4	101.7	102.2	101.8	101.8	101.5	101.0	100.1	99.6	99.6	99.0	98.3
1954	97.5	97.5	97.0	96.4	96.2	96.0	95.9	96.3	96.8	97.2	97.9	97.9
1955	98.0	98.1	98.6	99.5	100.2	100.4	100.9	101.3	101.5	101.7	102.0	102.4
1956	102.4	102.7	102.6	102.6	102.5	102.5	102.5	102.6	102.8	102.7	102.6	102.4
1957	102.1	102.2	102.1	101.5	101.4	101.6	101.3	101.1	100.4	100.2	99.6	98.8
1958	98.1	97.6	97.2	96.6	96.7	96.8	97.2	97.8	98.2	98.2	98.9	99.1
1959	99.0	99.3	99.9	100.4	100.5	100.4	100.2	99.1	98.8	99.1	99.2	100.5
1960	100.6	100.2	100.0	100.1	100.2	99.9	100.0	99.6	99.4	99.1	98.4	98.3
1961	97.9	97.6	98.3	98.1	98.3	98.7	99.1	98.5	98.8	98.9	99.5	99.7
1962	99.7	99.2	99.5	99.5	99.4	99.3	99.3	99.0	98.7	98.6	98.7	98.9
1963	98.8	98.4	98.3	98.2	98.3	98.3	97.9	97.9	98.0	97.8	98.0	98.1
1964	98.2	98.3	98.3	98.4	98.6	98.5	98.6	98.9	99.0	98.6	98.7	99.3
1965	99.5	99.2	99.4	99.3	99.6	99.6	99.9	100.1	100.4	100.9	101.1	101.1
1966	101.0	101.0	101.0	100.7	100.7	100.8	100.8	100.7	100.6	100.7	100.7	100.7
1967	100.9	100.6	100.7	100.4	100.2	100.5	100.4	100.4	100.3	100.0	100.4	100.6
1968	100.6	100.8	101.2	100.9	101.1	101.4	101.3	101.3	101.4	101.1	101.1	101.0
1969	100.6	100.5	100.4	100.0	99.8	99.7	99.7	99.7	99.4	99.2	98.8	98.7
1970	98.0	98.1	98.1	97.4	96.7	96.5	96.2	96.0	95.5	94.5	94.3	94.0

TABLE A-7 Wages and Salaries in Mining, Manufacturing, and Construction (Current $) (BCD No. 53) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	95.2	95.2	95.6	95.3	95.9	96.1	95.1	95.7	97.2	97.9	98.6	100.2
1948	101.8	100.8	101.5	100.5	100.6	101.5	102.4	103.4	102.3	101.7	101.4	99.7
1949	97.9	96.5	93.8	91.9	90.7	88.5	88.2	86.9	85.7	85.0	84.1	85.2
1950	86.1	87.0	87.7	89.3	91.0	92.0	94.0	96.4	96.1	98.9	99.7	100.4
1951	100.9	101.9	103.1	104.5	103.8	104.0	103.5	102.8	102.8	101.9	102.5	103.8
1952	103.9	104.2	104.3	102.5	102.8	101.1	101.9	103.6	104.9	107.2	108.0	108.9
1953	108.3	108.6	109.0	108.5	108.1	106.9	106.8	105.5	103.2	103.0	100.9	99.4
1954	97.5	97.3	96.3	95.2	95.1	94.3	93.2	92.9	92.1	93.4	95.0	95.1
1955	95.4	96.1	97.3	97.9	99.2	99.3	99.9	99.4	100.0	100.7	101.9	101.9
1956	101.9	101.8	102.2	102.2	102.6	103.0	103.2	103.7	104.7	105.0	105.3	106.5
1957	105.2	105.8	105.3	104.5	103.6	103.9	103.4	103.3	102.0	100.9	100.1	98.5
1958	97.0	94.6	94.2	92.6	92.2	93.1	93.8	95.0	95.8	96.7	98.2	98.4
1959	99.1	99.7	100.9	102.0	102.9	103.1	102.2	100.7	99.0	99.8	101.1	102.3
1960	103.3	103.4	102.7	102.6	102.7	101.8	101.2	100.1	99.0	97.9	97.2	96.4
1961	95.7	95.1	95.1	95.6	96.1	97.4	97.3	97.4	97.6	97.8	98.9	98.9
1962	97.7	98.3	98.9	99.9	99.2	98.8	99.1	98.7	98.9	98.0	98.2	97.7
1963	97.5	97.0	97.1	96.7	97.5	97.6	97.5	97.0	97.4	97.4	97.2	97.5
1964	96.2	97.3	97.2	97.6	97.3	97.1	97.5	98.0	98.2	97.7	97.5	98.4
1965	97.7	98.2	98.2	98.1	98.0	98.1	97.9	98.1	98.0	98.7	99.2	99.6
1966	99.4	100.3	100.6	101.1	100.9	101.4	101.0	101.4	101.0	101.2	101.0	100.6
1967	99.3	98.8	98.2	97.9	97.2	97.5	97.7	98.3	97.6	97.9	98.5	98.8
1968	98.2	98.7	99.3	99.6	100.1	100.1	100.0	99.7	100.3	100.6	100.8	101.2
1969	100.8	100.4	101.5	101.3	101.2	101.7	101.7	101.8	101.6	101.4	100.8	101.1
1970	99.8	99.1	99.4	98.1	96.8	96.3	96.2	95.6	94.8	93.8	93.4	92.9

TABLE A-8 Wages and Salaries in Mining, Manufacturing, and Construction (Constant $) (BCD No. 53D) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	102.1	101.7	100.5	100.4	101.3	101.2	99.7	99.7	99.6	100.1	100.2	100.6
1948	101.2	100.6	99.7	98.6	99.5	100.0	100.1	101.0	100.5	100.3	100.8	99.7
1949	98.5	97.5	94.9	93.0	92.2	90.2	90.8	89.6	88.4	88.3	88.6	88.9
1950	90.3	91.0	91.9	93.8	95.4	96.4	97.9	100.1	99.5	101.8	102.4	101.8
1951	100.9	100.2	101.5	102.8	102.0	102.5	102.3	101.9	101.4	100.1	100.2	101.1
1952	101.4	101.9	102.5	100.3	100.8	99.1	100.3	101.1	102.5	105.2	105.9	107.0
1953	106.8	107.2	107.7	107.2	106.8	105.4	105.6	104.3	102.0	101.7	100.1	98.8
1954	96.7	96.6	95.9	95.0	94.8	94.2	93.3	93.2	92.8	94.2	96.1	96.3
1955	96.7	97.2	98.6	99.4	101.0	101.3	101.9	101.5	101.9	102.9	104.1	104.1
1956	104.4	104.3	104.7	104.6	104.7	104.9	105.3	105.3	106.2	106.9	106.4	107.3
1957	106.2	106.3	105.7	104.6	103.6	103.8	103.1	102.8	101.5	100.7	99.4	97.9
1958	95.9	93.6	92.6	91.0	90.8	91.8	92.6	93.9	94.9	96.1	97.4	97.8
1959	98.5	99.2	100.7	101.9	102.7	102.8	102.0	99.2	98.7	99.8	100.8	102.0
1960	102.2	103.3	102.7	102.2	102.5	101.6	101.3	100.1	99.1	98.6	97.0	96.6
1961	95.5	94.9	95.1	95.8	96.4	97.6	97.4	97.5	97.7	98.0	99.2	99.3
1962	98.8	98.4	99.1	99.9	99.4	99.2	99.6	99.0	98.9	98.2	98.5	98.3
1963	97.9	97.3	97.4	97.3	98.1	98.2	97.9	97.4	97.9	98.1	97.8	98.0
1964	97.6	98.0	98.0	98.4	98.3	98.2	98.6	99.1	98.7	98.8	98.7	99.7
1965	99.0	99.7	99.7	99.5	99.4	99.3	99.4	99.9	99.9	100.7	101.1	101.4
1966	101.3	101.9	102.2	102.5	102.3	103.1	102.7	102.7	102.4	102.6	102.5	102.4
1967	101.1	100.8	100.4	100.2	99.5	99.8	100.0	100.5	99.8	100.3	100.9	101.0
1968	100.2	101.4	101.2	101.4	101.2	101.9	101.5	101.2	101.8	101.8	101.8	102.3
1969	101.7	101.1	101.9	101.3	101.1	101.4	101.1	101.2	100.8	100.5	99.6	99.6
1970	97.9	97.0	97.2	95.6	94.1	93.7	93.5	92.9	91.9	90.5	89.5	89.0

TABLE A-9 Index of Wholesale Prices, Industrial Commodities, 1957–59 = 100 (BCD No. 55) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	92.7	93.0	94.1	94.4	94.1	94.0	94.5	95.6	96.4	97.2	98.2	99.4
1948	100.8	100.1	100.8	100.2	100.1	100.4	101.0	102.1	102.3	102.2	102.3	101.9
1949	101.3	100.2	99.4	98.0	96.6	95.8	95.3	95.4	95.2	95.0	94.8	94.8
1950	94.8	94.9	94.7	94.5	95.0	95.3	96.6	98.3	100.2	101.8	103.8	105.0
1951	106.8	107.5	107.3	107.0	106.5	105.9	105.3	104.7	104.2	103.8	103.6	103.6
1952	103.2	103.0	102.5	101.9	101.4	100.9	100.6	100.8	100.8	100.4	100.0	99.9
1953	99.8	99.5	99.6	99.1	99.2	99.3	98.9	99.6	99.3	98.9	98.7	98.6
1954	98.4	98.6	97.9	98.0	97.9	97.6	97.6	97.5	97.4	97.4	97.6	97.5
1955	97.7	98.0	97.7	97.7	97.4	97.4	98.0	98.7	99.4	99.6	99.8	99.9
1956	100.3	100.2	100.5	100.7	100.7	100.4	100.5	100.8	101.2	101.4	101.8	102.1
1957	102.3	102.4	102.1	102.0	101.7	101.6	101.8	101.9	101.7	101.5	101.3	101.4
1958	101.2	100.8	100.6	100.3	100.1	100.0	100.0	100.3	100.3	100.3	100.5	100.8
1959	100.9	101.0	101.3	101.3	101.3	101.0	101.2	101.1	101.1	101.0	101.1	101.1
1960	101.0	101.0	100.9	100.9	100.7	100.7	100.6	100.6	100.5	100.5	100.4	100.2
1961	100.2	100.3	100.3	100.1	99.9	99.8	99.8	99.7	99.6	99.6	99.8	99.8
1962	99.7	99.6	99.6	99.7	99.7	99.6	99.6	99.6	99.7	99.4	99.4	99.3
1963	99.3	99.2	99.2	99.0	99.0	99.3	99.2	99.2	99.1	99.2	99.1	99.2
1964	99.3	99.1	99.0	99.0	98.9	98.7	98.8	98.7	98.7	99.0	98.9	99.0
1965	98.9	98.8	98.8	98.9	99.0	99.1	99.0	99.2	99.2	99.0	99.2	99.1
1966	99.2	99.3	99.4	99.5	99.7	99.9	100.1	99.9	99.9	99.7	99.6	99.4
1967	99.4	99.4	99.3	99.0	98.9	98.8	98.7	98.8	98.8	98.8	98.9	99.1
1968	99.1	99.2	99.3	99.3	99.0	99.1	99.2	99.1	99.2	99.4	99.3	99.4
1969	99.5	99.6	99.8	99.9	100.1	100.2	100.3	100.5	100.7	100.8	101.0	101.2
1970	101.4	101.5	101.6	101.7	101.9	102.1	102.2	102.2	102.3	102.4	102.5	102.7

TABLE A-10 Manufacturing and Trade Sales (Current $) (BCD No. 56) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1948	100.3	99.2	99.5	100.5	99.4	100.9	101.8	101.8	101.2	100.3	99.0	98.8
1949	96.7	95.3	94.2	92.9	90.7	90.6	88.6	89.7	87.6	86.9	87.5	86.2
1950	87.6	89.3	90.0	91.0	93.7	97.8	100.7	102.8	102.8	104.6	105.2	106.3
1951	107.2	109.1	107.2	105.0	105.4	104.0	103.3	102.4	101.8	102.6	102.1	100.7
1952	101.5	101.9	100.6	101.1	101.7	101.4	101.5	100.1	102.7	105.3	104.0	104.8
1953	104.8	105.6	106.3	105.6	104.9	103.3	104.8	101.9	100.7	99.7	96.7	96.1
1954	95.2	95.8	94.9	95.6	93.7	94.3	93.7	92.6	92.4	94.5	95.0	97.0
1955	98.2	99.0	100.6	101.5	101.5	101.5	101.7	101.3	103.2	102.7	103.2	103.2
1956	102.3	101.6	101.9	102.4	102.3	102.6	102.1	101.3	102.5	103.6	104.0	104.9
1957	105.1	105.5	104.3	103.9	101.9	102.4	102.1	101.0	100.8	99.9	98.6	96.3
1958	95.8	94.0	92.9	92.7	93.2	94.5	95.1	96.1	96.3	97.1	98.6	99.1
1959	99.9	101.4	102.2	103.9	105.1	104.7	103.9	100.2	99.8	99.3	100.6	101.6
1960	101.9	102.9	101.9	102.6	100.9	100.4	99.7	98.5	99.0	98.3	96.8	96.8
1961	94.8	94.8	96.0	94.9	95.7	96.7	95.4	97.3	97.4	98.2	98.6	98.7
1962	98.7	98.2	99.1	98.8	98.3	97.3	97.4	97.8	97.8	97.9	96.8	96.6
1963	96.6	97.8	97.4	97.8	97.3	97.7	98.9	97.3	97.4	98.1	96.6	98.0
1964	98.5	97.7	96.9	97.9	98.4	97.6	98.4	97.6	98.7	98.3	97.1	99.6
1965	99.4	98.8	100.4	100.3	99.7	99.5	100.7	100.5	100.9	100.2	101.5	101.7
1966	102.7	102.3	103.8	102.5	101.4	102.6	101.0	101.7	101.9	101.2	100.0	99.8
1967	99.2	97.8	97.9	97.4	97.1	97.8	96.7	97.7	97.5	97.4	97.0	98.5
1968	98.7	98.7	99.2	98.8	99.6	100.4	100.9	100.6	100.2	100.4	100.5	99.0
1969	99.6	100.2	100.1	100.4	100.5	100.7	99.8	100.8	101.0	100.9	99.4	98.4
1970	97.8	98.4	97.2	96.4	97.5	97.6	97.8	97.1	96.5	95.7	94.4	94.5

TABLE A-11 Manufacturing and Trade Sales (Current $) (BCD No. 56D) (as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1948	101.4	101.2	101.5	101.8	100.4	101.2	101.5	100.6	99.9	99.9	99.2	99.6
1949	98.3	98.1	97.4	96.9	95.2	95.6	93.9	95.0	93.2	92.7	93.6	92.5
1950	94.2	96.0	96.9	97.9	100.1	103.8	105.0	105.7	104.2	104.7	104.0	103.7
1951	103.0	103.5	101.4	99.4	99.9	99.1	98.6	98.4	98.0	98.7	98.2	96.8
1952	98.0	98.8	97.9	98.8	99.4	99.2	99.5	99.7	100.6	103.7	103.0	104.4
1953	104.5	105.6	106.4	106.0	105.0	103.5	104.4	101.8	100.5	100.0	97.5	96.9
1954	95.7	96.6	95.8	96.3	94.5	95.6	94.9	93.8	94.0	96.2	97.1	99.2
1955	100.3	101.1	103.0	103.9	104.1	104.0	104.0	103.3	104.8	104.4	105.1	105.2
1956	104.2	103.3	103.5	103.5	103.0	103.3	102.5	101.7	102.4	103.3	103.5	104.4
1957	104.3	104.5	103.4	102.7	101.0	101.3	100.6	99.8	99.5	98.9	97.4	95.2
1958	94.4	92.8	91.4	91.2	91.8	93.2	93.8	95.0	95.3	96.2	97.6	98.2
1959	99.0	100.6	101.4	103.0	104.2	103.9	101.8	99.8	99.2	98.9	100.2	101.3
1960	101.5	102.7	101.4	102.0	100.6	100.0	99.4	98.4	98.9	98.0	96.5	96.5
1961	94.5	94.5	95.7	94.8	96.0	97.2	97.2	97.6	97.6	98.5	99.0	98.9
1962	98.7	98.3	99.3	99.0	98.6	97.7	97.6	98.2	97.6	98.1	97.3	97.2
1963	97.2	98.6	98.5	99.0	98.3	98.4	99.4	98.0	98.4	99.0	97.4	98.9
1964	99.2	98.7	99.6	99.1	99.9	99.1	99.7	99.1	100.2	99.8	98.5	101.2
1965	100.8	100.4	102.1	101.8	101.0	100.4	101.7	101.6	101.9	101.4	102.5	102.4
1966	103.3	102.6	104.1	102.8	101.6	102.8	101.1	101.6	102.0	101.5	100.6	100.7
1967	100.1	99.0	99.3	99.1	98.8	99.3	98.2	99.4	99.2	99.1	99.0	100.3
1968	100.3	100.1	100.5	100.1	101.0	101.7	100.9	101.7	101.5	101.7	101.7	100.2
1969	100.4	100.9	100.4	100.7	100.6	100.6	99.5	100.6	100.8	100.3	98.7	97.4
1970	96.5	97.0	95.8	94.8	95.9	96.0	96.0	95.5	94.8	92.6	92.2	91.2

TABLE A-12 Business Expenditure on New Plant and Equipment (Current $) (BCD No. 61) (as percentage of seventy-five-month moving average; quarterly data, interpolated)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	93.8	94.8	95.7	96.7	98.3	99.4	100.4	100.9	101.2	101.3	101.8	103.0
1948	104.4	105.3	105.3	104.5	103.5	102.7	101.8	101.8	103.1	104.8	105.1	103.7
1949	100.6	97.6	95.1	92.8	90.9	89.0	87.4	85.3	83.2	80.9	79.6	79.4
1950	80.2	80.8	80.8	80.7	81.9	84.4	88.0	91.3	94.1	96.2	98.2	100.1
1951	101.8	103.2	104.3	105.3	106.3	107.4	108.3	108.7	108.1	107.1	107.3	108.8
1952	111.2	112.5	112.0	110.1	107.9	105.8	104.0	102.5	101.6	101.1	101.2	102.2
1953	103.6	104.5	105.0	104.8	104.4	103.7	102.8	101.9	101.0	100.0	99.0	97.8
1954	96.7	95.6	94.5	93.6	92.5	91.4	90.1	89.0	87.9	86.9	86.3	86.0
1955	86.0	86.4	87.1	88.2	89.9	92.3	95.1	97.6	99.7	101.5	102.9	104.1
1956	105.2	106.5	108.0	109.8	111.1	111.9	112.2	112.5	112.5	112.6	113.2	114.2
1957	115.6	116.4	116.8	116.7	116.4	116.1	115.6	114.6	112.8	110.6	108.0	105.4
1958	102.5	99.8	97.1	94.5	92.3	90.4	89.0	88.1	87.8	88.0	88.4	88.9
1959	89.5	90.2	90.9	91.8	92.8	94.3	95.9	97.2	97.9	98.3	98.8	99.6
1960	100.6	101.6	102.4	103.1	103.1	102.6	101.6	100.9	100.6	100.6	100.0	98.7
1961	96.8	95.5	95.1	95.5	95.7	95.5	95.1	95.2	95.7	96.6	97.0	96.8
1962	96.1	95.6	95.3	95.3	95.3	95.5	95.7	95.5	94.8	93.6	92.3	90.9
1963	89.5	88.8	88.7	89.2	90.1	91.3	92.5	93.2	93.3	92.9	93.0	93.9
1964	95.2	96.1	96.2	95.8	95.3	94.9	94.7	94.6	94.9	95.4	95.9	96.2
1965	96.5	97.2	98.2	99.4	100.3	100.7	100.7	101.0	101.8	102.8	103.7	104.4
1966	105.0	105.6	106.5	107.4	107.8	107.7	107.2	107.0	107.3	107.7	107.6	106.5
1967	104.9	103.6	102.9	102.6	102.2	101.5	100.5	99.7	98.9	98.2	97.8	97.6
1968	97.4	96.9	96.0	94.9	94.2	94.0	94.3	94.4	94.1	93.5	93.6	94.3
1969	95.5	96.4	96.8	96.9	97.2	97.8	98.6	98.9	98.4	97.3	96.3	95.5
1970	94.9	94.5	94.5	94.6	94.8	94.9	94.9	94.6	94.1	93.3	92.3	91.0

TABLE A-13 Business Expenditure on New Plant and Equipment (Current $) (BCD No. 61D)
(as percentage of seventy-five-month moving average; quarterly data, interpolated)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	90.8	90.4	89.9	89.5	91.7	93.5	94.9	95.9	96.6	97.0	97.8	99.1
1948	100.6	101.6	101.9	101.6	101.6	102.1	103.0	103.6	103.7	103.4	102.5	101.2
1949	99.5	97.5	95.4	93.1	90.8	88.5	86.3	83.9	81.5	79.2	77.7	77.3
1950	77.6	77.9	77.8	77.7	78.7	81.3	85.0	88.7	92.0	95.0	97.3	99.1
1951	100.4	102.0	103.9	106.0	107.8	108.9	109.6	109.6	109.2	108.5	108.9	110.4
1952	112.8	113.9	113.5	111.7	109.8	107.8	106.0	104.4	103.2	102.4	102.2	102.8
1953	104.0	104.8	105.1	105.1	104.7	104.0	103.0	101.9	100.7	99.4	98.1	96.8
1954	95.5	94.2	92.9	91.6	90.3	88.8	87.2	85.9	84.7	83.8	83.2	82.8
1955	82.8	83.0	83.4	84.2	85.7	88.0	90.9	93.7	96.0	97.9	99.7	101.5
1956	103.1	104.7	106.2	107.7	109.1	110.3	111.3	112.1	112.7	113.0	113.8	115.2
1957	117.0	118.2	118.7	118.7	118.5	118.3	117.9	117.1	115.6	113.6	111.3	108.9
1958	106.2	102.9	99.1	95.0	92.0	90.3	89.7	89.4	89.3	89.3	89.6	90.3
1959	91.2	92.1	92.8	93.4	94.3	95.6	97.3	98.6	99.3	99.6	100.1	100.7
1960	101.5	102.3	103.0	103.6	103.7	103.1	102.1	101.3	101.0	101.0	100.2	98.6
1961	96.3	94.9	94.6	95.1	95.5	95.6	95.4	95.5	96.1	97.1	97.4	97.1
1962	96.2	95.5	95.1	95.1	95.1	95.2	95.3	94.9	94.1	92.8	91.5	90.1
1963	88.9	88.2	88.1	88.6	89.5	90.5	91.7	92.3	92.1	91.5	91.5	92.3
1964	93.7	94.5	94.6	94.2	93.7	93.4	93.1	93.1	93.3	93.7	94.1	94.4
1965	94.8	95.5	96.5	97.6	98.4	98.7	98.6	98.9	99.7	100.9	101.8	102.4
1966	102.7	103.2	104.1	105.2	105.9	105.8	105.4	105.2	105.5	106.0	105.8	104.9
1967	103.4	102.1	101.2	100.7	100.2	99.5	98.7	97.9	97.2	96.6	96.3	96.1
1968	96.1	95.6	94.7	93.5	92.7	92.6	92.9	92.9	92.5	91.9	92.0	93.2
1969	95.0	96.0	95.7	94.8	94.8	96.2	98.4	99.6	99.3	98.0	96.8	96.1
1970	95.9	95.9	95.9	96.0	96.3	96.8	97.3	97.2	96.3	94.6	92.3	89.3

TABLE A-14 Treasury Bond Yields (BCD No. 115)
(as percentage of seventy-five-month moving average)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	97.4	97.2	96.1	95.9	95.8	96.9	98.0	97.3	97.1	98.2	101.9	103.0
1948	105.4	105.2	104.5	104.3	103.3	104.3	103.7	103.9	103.7	103.5	102.8	102.6
1949	101.6	100.1	99.5	99.3	99.1	98.9	94.1	92.7	91.7	91.5	90.5	89.9
1950	90.1	91.6	92.4	93.2	93.2	93.6	93.6	92.8	93.7	94.1	93.9	94.1
1951	93.9	94.3	97.0	100.5	103.2	103.9	103.1	100.7	101.9	102.2	104.1	105.5
1952	106.9	105.5	104.9	102.4	99.4	100.7	100.4	103.6	103.6	104.4	102.9	104.1
1953	105.6	106.4	108.2	110.8	112.7	113.1	111.5	111.0	109.1	106.0	103.7	100.6
1954	96.6	93.7	90.1	87.9	89.6	89.5	86.3	86.2	87.2	87.5	88.2	88.6
1955	91.4	94.6	94.4	95.6	95.0	95.1	97.7	98.5	97.0	94.9	95.1	95.3
1956	93.8	92.4	94.5	93.6	94.7	93.0	94.8	99.7	100.5	99.7	102.3	104.8
1957	102.4	98.2	98.8	100.0	101.9	106.7	106.7	107.1	107.3	103.5	103.6	99.6
1958	97.4	93.8	92.5	88.5	88.7	90.0	94.1	100.4	104.2	104.0	102.0	104.2
1959	106.8	106.6	106.2	108.3	109.8	109.6	109.8	109.1	113.0	108.8	108.8	112.5
1960	111.9	110.7	106.8	109.1	105.2	103.4	100.0	98.1	99.2	100.8	101.2	99.7
1961	99.8	97.5	96.4	96.6	94.6	98.1	98.2	100.4	100.7	99.5	99.4	101.2
1962	101.6	101.7	99.6	96.5	96.2	96.7	99.6	98.6	97.5	96.2	95.7	95.6
1963	95.9	98.0	96.7	97.5	97.3	97.9	97.9	97.2	98.1	98.6	99.3	99.8
1964	99.9	99.5	100.2	100.4	99.1	98.1	97.7	97.6	97.7	97.3	96.0	96.1
1965	95.7	95.8	97.5	94.8	94.2	93.9	93.8	94.4	95.4	95.6	96.5	98.0
1966	97.4	100.7	100.6	98.2	100.4	98.7	100.7	99.4	100.2	97.6	97.7	95.2
1967	89.5	90.3	89.4	89.9	94.2	95.5	94.9	96.0	96.1	99.5	99.5	101.5
1968	97.5	96.5	100.2	97.5	99.1	95.3	92.2	90.7	91.0	93.1	94.6	99.3
1969	100.1	101.5	104.1	99.9	103.7	102.2	101.8	100.4	104.7	106.5	106.6	110.7
1970	104.6	103.3	105.9	103.4	109.2	109.3	106.3	104.2	101.7	100.5	94.5	93.9

TABLE A-15 Gross National Product in Current $ (BCD No. 200)
(as percentage of seventy-five-month moving average; quarterly data, interpolated)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	94.3	94.2	94.2	94.2	94.3	94.7	95.1	95.7	96.2	96.8	97.4	97.6
1948	97.8	98.0	98.4	98.9	99.4	100.0	100.3	100.6	100.5	100.2	99.6	98.5
1949	97.1	95.8	94.6	93.6	93.0	92.7	92.6	92.4	92.0	91.5	91.4	91.5
1950	92.1	92.5	92.7	92.9	93.7	95.0	96.8	98.3	99.1	99.4	100.1	101.0
1951	102.3	103.1	103.7	103.9	104.0	104.3	104.7	104.9	104.9	104.8	104.6	104.5
1952	104.3	104.0	103.3	102.5	101.9	101.7	101.7	102.1	102.7	103.5	104.0	104.2
1953	104.1	104.0	103.8	103.5	103.2	102.6	101.9	101.1	100.0	98.9	98.0	97.4
1954	97.1	96.8	96.3	95.7	95.3	95.1	95.2	95.3	95.5	95.8	96.4	97.2
1955	98.2	98.9	99.4	99.6	99.8	100.2	100.5	100.8	101.1	101.3	101.3	101.0
1956	100.6	100.3	100.4	100.6	100.7	100.7	100.5	100.5	100.8	101.2	101.5	101.8
1957	102.0	102.0	101.7	101.4	101.2	101.3	101.6	101.6	101.1	100.1	99.1	98.0
1958	97.0	96.3	95.9	95.8	96.0	96.5	97.2	97.9	98.5	99.1	99.6	99.9
1959	100.1	100.4	100.6	100.8	100.7	100.5	100.2	99.9	99.9	99.9	100.1	100.2
1960	100.5	100.6	100.7	100.8	100.6	100.3	99.7	99.2	98.8	98.3	97.8	97.2
1961	96.7	96.4	96.6	97.0	97.4	97.5	97.4	97.5	97.8	98.3	98.7	98.9
1962	99.0	99.0	99.2	99.3	99.3	99.3	99.1	99.1	99.0	99.0	98.9	98.7
1963	98.4	98.1	97.9	97.8	97.7	97.7	97.7	97.8	97.9	97.9	97.9	98.0
1964	98.1	98.1	98.1	98.1	98.0	98.0	98.0	98.0	97.9	97.8	97.8	97.9
1965	98.0	98.1	98.2	98.1	98.2	98.3	98.4	98.6	98.8	99.1	99.4	99.8
1966	100.1	100.4	100.4	100.4	100.3	100.2	100.1	100.1	99.9	99.8	99.6	99.4
1967	99.1	98.8	98.5	98.3	98.3	98.3	98.5	98.6	98.6	98.6	98.7	98.8
1968	98.9	99.2	99.5	99.9	100.2	100.3	100.3	100.3	100.3	100.3	100.2	100.2
1969	100.3	100.3	100.2	100.1	100.1	100.2	100.4	100.4	100.2	99.9	99.5	99.1
1970	98.8	98.5	98.2	98.0	97.9	97.8	97.8	97.6	97.3	96.9	96.3	95.7

TABLE A-16 Gross National Product in 1958 Dollars (BCD No. 205)
(as percentage of seventy-five-month moving average; quarterly data, interpolated)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	98.6	98.8	99.1	99.3	98.6	98.0	97.8	97.7	98.0	98.3	98.4	98.3
1948	98.1	98.0	98.2	98.7	98.9	99.0	98.8	98.6	98.8	99.0	98.7	98.1
1949	97.1	96.3	95.6	95.1	94.7	94.4	94.2	94.0	94.0	94.1	94.4	94.8
1950	95.3	95.8	96.4	97.1	97.9	99.0	100.1	101.0	101.4	101.6	101.8	101.8
1951	101.9	102.0	102.2	102.5	102.8	103.3	103.8	104.0	103.8	103.2	102.8	102.7
1952	102.8	102.6	102.2	101.4	100.8	100.5	100.4	100.7	101.2	101.9	102.5	102.7
1953	102.9	102.9	103.0	103.1	102.9	102.5	101.9	101.2	100.6	99.9	99.2	98.4
1954	97.6	96.9	96.4	96.0	96.0	96.1	96.4	96.7	97.1	97.4	98.0	98.8
1955	99.7	100.6	101.1	101.4	101.7	102.1	102.4	102.8	103.0	103.3	103.2	102.8
1956	102.1	101.7	101.7	101.8	101.8	101.5	101.0	100.8	101.0	101.4	101.7	101.8
1957	101.9	101.7	101.3	100.9	100.8	100.7	100.8	100.6	100.1	99.3	98.3	97.2
1958	96.0	95.2	94.8	94.9	95.2	95.7	96.5	97.2	97.8	98.5	98.9	99.3
1959	99.5	99.8	100.0	100.2	100.3	100.1	99.8	99.6	99.6	99.8	100.0	100.2
1960	100.4	100.5	100.6	100.6	100.5	100.1	99.7	99.1	98.6	98.1	97.5	96.9
1961	96.4	96.2	96.4	96.9	97.3	97.6	97.7	97.8	98.2	98.6	98.8	99.0
1962	99.0	99.2	99.4	99.6	99.7	99.8	99.7	99.6	99.6	99.5	99.4	99.1
1963	98.9	98.7	98.4	98.3	98.3	98.4	98.6	98.7	98.7	98.7	98.7	98.8
1964	99.0	99.1	99.1	99.1	99.1	99.1	99.1	99.0	98.9	98.8	98.8	98.9
1965	99.1	99.3	99.3	99.4	99.5	99.6	99.9	100.3	100.6	101.0	101.3	101.7
1966	102.0	102.2	102.2	102.0	101.8	101.7	101.6	101.5	101.4	101.3	101.1	100.9
1967	100.6	100.4	100.2	100.2	100.2	100.3	100.4	100.5	100.4	100.3	100.3	100.3
1968	100.5	100.7	101.0	101.3	101.5	101.6	101.5	101.5	101.3	101.2	101.1	101.0
1969	100.9	100.7	100.6	100.4	100.3	100.2	100.1	99.9	99.7	99.2	98.7	98.1
1970	97.4	96.9	96.5	96.3	96.1	96.0	95.8	95.5	95.1	94.5	93.8	92.9

TABLE A-17 Composite Index, Undeflated Deviation Cycles, 12 Series

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.0	100.2	100.7	99.5	99.7	100.1	99.8	101.5	103.7	105.2	107.2	108.9
1948	110.9	109.2	110.2	110.0	110.4	112.1	112.9	113.3	113.0	112.5	111.2	108.5
1949	103.8	100.5	97.3	94.4	91.8	89.4	87.4	87.0	85.9	84.4	84.1	85.1
1950	86.2	88.0	88.9	90.2	92.6	95.5	100.0	104.8	107.2	110.1	112.6	116.2
1951	118.5	121.0	122.2	123.8	123.9	123.7	123.1	122.5	121.1	120.5	121.1	121.8
1952	121.9	122.5	121.3	118.5	116.6	115.0	114.9	116.7	118.7	121.0	121.6	123.1
1953	122.4	123.4	124.1	123.1	122.7	121.3	119.7	117.2	113.8	111.0	107.4	104.3
1954	101.6	100.3	97.9	96.6	95.7	95.2	94.3	93.9	93.9	94.8	96.7	97.9
1955	99.7	101.6	103.6	104.9	106.5	108.0	109.9	110.9	112.8	113.6	114.7	115.1
1956	114.9	114.8	115.2	116.5	116.3	116.2	115.9	117.0	118.2	119.6	120.2	121.7
1957	121.3	121.8	120.8	119.7	118.6	119.0	118.8	118.3	115.9	112.7	109.7	106.4
1958	103.1	99.1	97.3	95.2	95.1	96.0	97.4	99.5	101.0	101.9	104.3	105.3
1959	106.9	108.1	109.8	112.2	113.6	113.7	112.7	110.6	109.6	109.5	111.2	114.0
1960	114.9	115.5	114.5	114.8	113.9	112.4	110.9	109.4	108.0	106.9	105.1	103.1
1961	101.6	100.5	101.0	101.3	101.8	103.0	102.8	103.6	103.6	104.6	105.9	106.4
1962	106.2	106.2	106.7	107.0	106.9	106.4	106.7	106.2	106.0	105.1	104.5	103.7
1963	103.0	102.9	102.5	102.5	102.7	103.3	103.6	103.2	103.3	103.4	102.8	103.5
1964	103.5	103.9	103.7	103.9	103.8	103.2	103.7	103.6	103.5	103.4	103.6	104.8
1965	104.7	105.0	105.7	105.4	106.0	106.2	106.8	107.5	107.9	108.5	109.9	111.1
1966	111.6	113.1	113.9	113.4	113.6	114.1	113.8	113.7	113.4	113.0	112.5	111.5
1967	109.6	108.6	107.8	107.0	106.6	106.8	106.6	107.1	106.5	106.2	107.1	108.2
1968	107.6	108.1	108.9	108.8	109.2	109.3	109.2	108.9	108.8	109.1	109.3	109.9
1969	109.8	110.4	111.2	110.6	111.0	111.2	111.1	111.1	110.7	110.2	109.2	108.6
1970	106.5	105.7	105.6	104.1	103.6	102.7	102.2	100.9	99.5	97.7	96.0	94.9

TABLE A-18 Composite Index, Undeflated Step Cycles, 12 Series

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1947	100.0	103.1	103.7	101.1	102.4	102.9	102.2	105.5	106.2	105.2	105.6	105.2
1948	105.2	100.8	104.3	102.8	103.2	104.9	103.5	103.2	102.6	102.2	100.6	97.6
1949	94.0	95.5	95.8	96.3	97.0	97.5	98.5	100.9	99.5	98.9	101.6	104.8
1950	105.6	106.5	105.5	106.3	108.9	110.8	113.8	113.3	108.2	107.8	107.2	108.3
1951	106.9	106.1	104.5	104.4	102.7	102.8	102.2	101.6	100.2	100.6	102.5	103.2
1952	103.0	103.0	100.1	97.9	99.1	99.9	102.5	105.2	106.2	106.8	104.8	105.2
1953	103.1	104.0	104.0	101.8	102.0	100.5	100.0	99.0	97.4	97.9	96.8	97.3
1954	97.6	99.5	97.7	99.3	100.2	101.1	100.7	101.3	102.2	103.5	105.5	104.7
1955	105.7	105.7	105.2	104.2	104.5	104.8	105.7	104.4	105.3	103.7	103.4	102.2
1956	101.0	101.6	102.7	104.0	102.0	101.6	100.9	102.7	103.5	104.0	103.4	104.2
1957	102.1	102.7	100.8	100.1	100.7	102.4	102.1	101.2	98.2	96.6	96.3	95.7
1958	95.1	94.4	97.8	97.8	101.6	103.4	104.5	105.5	104.9	104.0	106.2	103.9
1959	104.5	103.9	104.7	105.3	103.9	102.0	100.6	99.5	100.5	102.1	104.4	105.5
1960	103.5	102.8	101.0	102.1	100.5	99.4	99.1	99.0	99.3	99.5	98.6	98.0
1961	98.8	100.1	103.1	103.8	103.9	104.4	102.4	103.7	103.1	104.9	104.9	103.4
1962	102.1	102.5	103.3	103.3	102.5	101.9	102.7	101.8	102.1	101.1	101.4	100.9
1963	101.0	101.9	102.1	102.8	103.4	104.1	103.8	102.9	103.2	102.9	102.3	104.3
1964	103.6	103.9	102.9	103.2	102.7	102.2	103.6	102.9	102.8	103.0	103.5	104.9
1965	103.2	103.9	104.3	103.1	104.2	103.7	104.1	104.5	104.2	104.7	105.6	105.4
1966	104.4	105.5	104.4	102.9	103.5	103.8	102.7	102.9	102.7	102.7	102.3	101.3
1967	99.8	101.1	101.5	101.6	102.3	103.0	102.6	103.3	101.9	102.0	103.8	104.5
1968	102.4	104.0	104.2	103.1	103.6	103.4	103.1	102.6	102.8	103.1	103.2	103.9
1969	103.2	104.0	104.0	102.2	103.6	103.5	103.3	102.9	102.0	101.5	100.7	101.4
1970	99.6	101.2	102.4	100.8	101.8	101.6	102.3	100.7	100.4	99.5	99.4	99.8

NOTES AND REFERENCES

1. Ilse Mintz, *Dating Postwar Business Cycles: Methods and Their Application to Western Germany, 1950–67* (New York: NBER, 1969).
2. Ilse Mintz, "Dating American Growth Cycles," in *The Business Cycle Today*, Victor Zarnowitz, ed., Fiftieth Anniversary Colloquium I (New York: NBER, 1972), pp. 39–88.
3. Measures of business cycles as major deviations from long-term trends played a prominent role in pre-1930 literature but later fell into disuse. See Wesley C. Mitchell, *Business Cycles: The Problem and Its Setting* (New York: NBER, 1927), Chapter 3; and Arthur F. Burns and Wesley C. Mitchell, *Measuring Business Cycles* (New York: NBER, 1946), Chapter 7. The step cycles were introduced by Milton Friedman and Anna Schwartz; see their "Money and Business Cycles," *Review of Economics and Statistics*, Vol. 45, No. 1, part 2 (February, 1963).
4. See the section under the same title, below. For the discussion of the earlier version of this report, see Zarnowitz, *The Business Cycle Today*, pp. 167–82.
5. See Arthur F. Burns, *The Business Cycle in a Changing World* (New York: NBER, 1969), pp. 50, 102.
6. "The American people have of late been more conscious of the business cycle, more sensitive to every wrinkle of economic curves, more alert to the possible need for contracyclical action on the part of government, than ever before in our history" (Burns, *Business Cycle*, p. 101).

   "Only in relatively few cases (the United States, Canada, Switzerland and Belgium) can we register significant absolute declines in one or more years. However, we must refer these instability experiences to the much greater postwar ambitions with regard to full employment, as well as to the new ambitions of rapid and stable growth, that have become accepted more or less explicitly by all countries after the war. From this point of view a retardation of growth from a normal rate of 5 per cent to 1 per cent is regarded as quite a serious affair . . . ." (Erik Lundberg, *Instability and Economic Growth* [New Haven: Yale University Press, 1968], p. 87).
7. "As a general proposition it seems to me that when ancient definitions cease to reflect current reality it is a good thing to shift gears and get it over as quickly as possible" (Henry Wallich in Zarnowitz, *The Business Cycle Today*, p. 170.) See also Otto Eckstein, the same source, p. 168.
8. For references to others who stress the similarity of relative and absolute decline, see Mintz, *Dating Postwar Business Cycles*; pp. 3, 4.
9. "The lessened amplitude of economic fluctuations in recent years suggests that business cycles should be redefined as deviations from growth trends, as in some other countries, notably Japan. For this reason, changes in the business cycle framework developed by the NBER now appear to be necessary." Julius Shiskin, "Judging the Leading Indicators," *The Washington Post*, April 4, 1972.
10. This definition is: "Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own" (Burns and Mitchell, *Measuring Business Cycles*, p. 3).
11. See Burns and Mitchell, *Measuring Business Cycles*, p. 41; and Wesley C. Mitchell, *What Happens During Business Cycles* (New York: NBER, 1951), p. 14.

12. An earlier method of analyzing mild economic fluctuations should be mentioned here. In her work on cycles in consumption, Ruth Mack identified minor waves occurring within business expansions or contractions of the interwar period. Subcycles, as she called them, are shorter (their minimum duration is five months) and flatter (their minimum phase amplitude is zero) than regular business cycles. The subcycle concept proved a useful tool for the analysis of the interwar period. It was not designed, of course, for situations in which the predominance of negative rates of change is a rare exception. (See Ruth Mack, *Consumption and Business Fluctuations* [New York: NBER, 1956].)
13. For a thorough investigation of trend-adjusted U.S. business cycles, 1866–1914, see Edwin Frickey, *Economic Fluctuations in the United States* (Cambridge, Mass.: Harvard University Press, 1942).
14. I owe the idea and the name of step cycles to Milton Friedman and Anna J. Schwartz. The concept will be explained in detail in the section on deviation and step cycles in individual indicators.
15. Gerhard Bry and Charlotte Boschan, *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs* (New York: NBER, 1971).
16. Extensive comparisons between results with the two methods as applied to economic indicators can be found in Bry and Boschan, *Cyclical Analysis of Time Series*, pp. 29–57.
17. This and the following quotation are from Eckstein, in Zarnowitz, *The Business Cycle Today*, pp. 169 and 170.
18. For the definitive investigation of GNP revisions and their effects on GNP turning points, see Rosanne Cole, *Errors in Provisional Estimates of Gross National Product* (New York: NBER, 1969), especially pp. 73–81.

    For an excellent study of the effects of dating reference cycles by GNP cycles, see two articles by Victor Zarnowitz, "On the Dating of Business Cycles," *Journal of Business of the University of Chicago*, April 1963, and "Cloos on Reference Dates and Leading Indicators: A Comment," ibid., October 1963.

    For a striking example of repeated back-and-forth shifts of a trough through GNP revisions, see Rendigs Fels and C. Elton Hinshaw, *Forecasting and Recognizing Business Cycle Turning Points* (New York: NBER, 1968), p. 29. For general arguments against reliance upon a single measure, see Mitchell, *What Happens During Business Cycles*, p. 11, and Geoffrey H. Moore, "What is a Recession?" *American Statistician*, October 1967.

    For a contrary view, see George W. Cloos, "How Good are the National Bureau's Reference Dates?" *Journal of Business*, January 1963.
19. Cf. Paul Samuelson in Zarnowitz, *The Business Cycle Today*, p. 175: "It's the level of unemployment and how well we do with respect to our potential that is the most important thing."
20. For an example of the application of this concept to the analysis of instability in twelve countries, see Lundberg, *Instability*. Lundberg comments (p. 102): "Obviously the suggested method involves a considerable degree of arbitrariness and subjective judgment." See also *How Full is Full Employment?* by Geoffrey H. Moore, American Enterprise Institute for Public Policy Research, Domestic Affairs Study No. 14, July 1973.
21. "The 'Recession' of 1969–1970," in Zarnowitz, *The Business Cycle Today*, pp. 117 ff.
22. Ibid., pp. 119, 179.
23. The mean distance between deflated and undeflated growth-cycle turns, 1948–69, was 0.6 months. The corresponding distance between undeflated and deflated classical-cycle turns, 1948–61, is 1.5 months (derived from Table 3, and Table 8, last column).

24. For example, by the Italian Istituto Nazionale per lo Studio della Congiuntura (ISCO), Rome, Italy, and by the Japanese Economic Planning Agency, Tokyo, Japan.
25. Geoffrey H. Moore in Zarnowitz, *The Business Cycle Today*, p. 177.
26. Ibid.
27. Objections that can be raised against the step-cycle method will be discussed after its full description in Section 6.

    The good agreement between the results with the two methods can be indicated briefly by the following facts: out of 226 turns in deviation cycles of 16 indicators, 218 match step-cycle turns. Nearly half of these paired turns occur in the same months and 72 per cent occur within 3 months of each other (Table 6, Section 6).
28. Henry Wallich in Zarnowitz, *The Business Cycle Today*, p. 172.
29. Ibid., p. 171.
30. This section deals with turning points in classical cycles and in deviation cycles. The programed determination of step-cycle turns is described in Section 6.
31. Burns and Mitchell, *Measuring Business Cycles*, Chapter 4.
32. Cf. Bry and Boschan, *Cyclical Analysis of Time Series*, Foreword.
33. Ibid., p. 55.
34. Ibid.
35. By comparison, the NBER rules used in the handpicking of turns are: A full business cycle must have a minimum duration of more than a year. (The shortest business cycle observed historically in the United States lasted seventeen months.) In specific series, cycles as short as fifteen months are recognized. No minimum length for a business-cycle phase has been laid down in traditional cycle dating, but in practice no phase shorter than six months has been recognized.

    It should, perhaps, be pointed out that the median and the mode of the distributions of indicator turns are among the many factors considered in traditional turning-point determination. In the programed approach, turns in the diffusion index correspond to the medians of indicator turns. The mode of these turns is not used—among other reasons because of the very large number of indicator analyses that this procedure would entail.
36. "Indeed, one of the greatest hazards in forecasting is that a statistical series which is generally highly reliable may suddenly and without warning prove quite unreliable" (Alec Cairncross, "Economic Forecasting," *Economic Journal*, December 1969, p. 803).
37. The "short list" is a "list of 25 series, drawn from the full 1966 list of 88 series. All series on the short list have high scores and involve little duplication." A short list of indicators "is a step toward a summary, from which one may wish to go farther" (Geoffrey H. Moore and Julius Shiskin, *Indicators of Business Expansions and Contractions* (New York: NBER, 1967), pp. 4, 32.
38. See ibid. and Geoffrey H. Moore, ed., *Business Cycle Indicators* (New York: NBER, 1961). Four deflated indicators were prepared at the NBER by Solomon Fabricant in 1971 (see "The 'Recession' of 1969–1970," Table 1). These series have not undergone the analysis mentioned in the text and are not included in the Shiskin-Moore lists.
39. Rough coincidences include exact coincidences and leads and lags of three months or less.
40. See, e.g., Norman Trueblood, "The Dating of Postwar Business Cycles," *Proceedings of the Business and Economics Statistics Section of the American Statistical Association*, 1961, p. 17.
41. Moore and Shiskin, *Indicators*, p. 33.
42. This method of interpolation was developed by Charlotte Boschan and programed by Susan Crayne at the NBER.
43. See Table 1, columns 18 and 19; and Table 2, lines 18 and 19.

44. *Business Conditions Digest* (formerly *Business Cycle Developments*), published monthly by the Bureau of Economic Analysis, U.S. Department of Commerce.
45. The modification consists in replacing the extreme values of the series with the corresponding values of a smoothed version (a Henderson curve) of it. The method is described in Julius Shiskin, Allan H. Young, and John C. Musgrave, *The X-11 Variant of the Census Method II Seasonal Adjustment Program* (Washington, D.C.: Bureau of the Census, Technical Paper No. 15, February 1967).
46. Bry and Boschan, *Cyclical Analysis of Time Series*.
47. The Spencer curve is a complex fifteen-month graduation formula, a weighted moving average with the highest weights in the center and negative weights at either end. This ensures that the curve follows the data closely. It has approximately the flexibility of a five-month moving average but is much smoother.
48. To be more precise, the span varies between four and six months, depending on the term of the moving average.
49. See Bry and Boschan, *Cyclical Analysis of Time Series*, p. 18.
50. Some of the diffusion indexes in Table 2 below are not "historical" indexes but "current" ones. The method of construction is the same in both. However, in the current index, an indicator in a given month is defined as in upswing or downswing according to its change over a fixed span of months, instead of by its cyclical phase.
51. Julius Shiskin, *Signals of Recession and Recovery* (New York: NBER, 1961). Later versions of this type of index are published in Geoffrey H. Moore and Julius Shiskin, *Indicators of Business Expansions and Contractions*, and in the same authors' *Composite Indexes of Leading, Coinciding and Lagging Indicators, 1948–67*, Supplement to NBER Report 1, January 1968.
52. See footnote 37.
53. Measures for the Shiskin-Moore index are from *Business Conditions Digest*, June 1970, p. 101. For explanation of the measures and further examples, see Shiskin, *Signals of Recession and Recovery, pp. 48–49*.
54. The purpose of the indexes on lines 19 and 20 differs from that of the others and, therefore, so do the criteria for selecting the lists. This will be discussed in Section 5.
55. The difference between lines 10 and 15 is that the former is based on nonmodified, and the latter on modified, series.
56. The turns in 1969–70 are not included in Table 2 because the testing of the indicator lists was done before these latest turns could be determined. The turns are entered, however, on Table 3 and subsequent tables.
57. Solomon Fabricant, "Recent Economic Changes and the Agenda of Business-Cycle Research," National Bureau Report Supplement, New York, 1971, pp. 4, 5.
58. Since the so-called undeflated cycles are in fact based on both physical volume (or deflated) and pecuniary series, the differences also depend on the mix. In the Shiskin-Moore index, for example, 3 of the 5 series are in physical units (nonfarm employment, unemployment rate, industrial production) while 2 are in current dollars (personal income, manufacturing and trade sales). Recently a deflated counterpart to this index has been constructed, by deflating the 2 current dollar series. This permits a comparsion based on the same set of indicators, neither of which includes prices or interest rates. The deflated and undeflated indexes reach turning points in the same month in Oct. 1948 (P), Oct. 1949 (T), July 1953 (P), Apr. 1958 (T), Feb. 1960 (P), Feb. 1961 (T) and Nov. 1970 (T). The deflated index reached earlier turns in 3 instances: May vs. Aug. 1954 (T), Mar. vs. Aug. 1957 (P), and Oct. vs. Dec. 1969 (P).
59. Fabricant, "Recent Economic Changes," p. 12.
60. Ibid., pp. 11, 13. On the general treatment of strikes in NBER cycle dating, see Zarnowitz, "Dating of Business Cycles," p. 187.

61. "Recent Economic Changes" and "The 'Recession' of 1969–70."
62. A check shows, however, that with the 12-undeflated-indicator list, it makes no difference whether we adjust the components of the composite index or the index itself. The index constructed from series unadjusted for trend (i.e., the classical composite index) was adjusted for its trend and the turns in the index's deviation from its trend were determined. All 15 turns in these deviations occur in the same months as do the turns in the composite index constructed from trend-adjusted indicators. For indicator lists other than the 12-indicator list, we found discrepancies of one or two months at one or two dates.
63. As described in Section 5, the 9-indicator list for deflated cycles includes 5 indicators also included in the 12-indicator list for undeflated cycles. The 9-indicator list further includes 4 constant dollar series which are not included in the 12-indicator list. The 12-indicator list and the 9-indicator lists together thus use a total of 16 indicators.
64. The unemployment rate shows a rising trend until 1961, but a falling trend in the years 1961–69. For some other indicators, trends are debatable for at least part of the period. However, all series have been expressed as deviations from the moving average for the sake of uniformity.
65. Because of their tentative nature, no charts are presented for the 4 deflated series which are used in the 9-indicator list but are not used in the 12-indicator list. These 4 series also are not shown in *Business Conditions Digest*.
66. The Spencer curve is a smooth, flexible moving average of the seasonally adjusted series, which represents the cyclical component.
67. Milton Friedman and Anna Schwartz, "Money and Business Cycles."
68. Note that Geoffrey H. Moore finds that many rate of change curves, except for their choppiness, look like curves of other series (Zarnowitz, *The Business Cycle Today*, p. 178).
69. See Mitchell, *What Happens During Business Cycles*, p. 299. For similar results regarding the rate of change of the money supply, see Phillip Cagan, *Determinants and Effects of Changes in the Stock of Money, 1875–1960* (New York: NBER, 1965), p. 271.
70. One reason is that independent errors of measurement in the original series introduce a negative serial correlation into rates of change.
71. The method used is essentially a computerized version of the Friedman and Schwartz method. Friedman and Schwartz decided by inspection, in most instances, and relied on calculation without use of computers in difficult cases.
72. n_1,n_2: the number of months in steps 1 and 2.
    $\bar{X}$: mean rate of change for period of $n_1 + n_2$ months.
    $\bar{X}_1$, $\bar{X}_2$: mean rates of change of steps 1 and 2.
    $n_1 (\bar{X}_1 - \bar{X})^2 + n_2 (\bar{X}_2 - \bar{X})^2$: maximized value.

    The breaking point which maximizes the variances between the steps, of course, also minimizes the variance within the steps.
73. To illustrate: assume, first, that a downturn to downturn cycle from February 1957 to February 1960 has been confirmed, and that April 1962 has been tentatively selected as the date of the next downturn. The computer program then finds the date of the upturn between February 1960 and April 1962. For this purpose, it divides the tentative cycle at each intervening month into two phases; the first, one of low growth; and the second, one of high growth. For each of these partitions, the variance is computed. Assume that it is found that partition in February 1961 yields the largest variance between the two steps. (Partitions at points less than five months from the tentative turns are excluded by requiring a 5-month minimum phase duration.)

    Next, the computer-determined upturn in February 1961 is used together with the next tentative upturn in April 1963 in order to check whether the downturn in April

1962 (used previously for the selection of the upturn of February 1961) is the correct partition between February 1961 and April 1963. If the downturn in April 1962 is confirmed, we proceed to the checking of the following turn. If the downturn in April 1962 is rejected, however, and replaced by, say, June 1962, the analysis which used April 1962 as the cycle turn must be repeated with the new date, June 1962. This means that the period from February 1960 to June 1962 will be partitioned in the manner described above, which may either confirm the previously found upturn in February 1961 or result in a different date, say, March 1961. In the latter case, the February 1961 to April 1963 analysis has to be replaced by one for the period March 1961 to April 1963, and so on.

If a cycle from February 1960 to about April 1962 cannot be validated, the hypothesis that such a cycle occurred is rejected and replaced by a new one. For instance, a longer tentative cycle, February 1960 to June 1966 may be tested. The variances and partitions produced by the computer program in the unsuccessful attempt to confirm the first tentative cycle, February 1960 to April 1962, provide useful clues for the selection of the alternative tentative cycle.

The first turns at either end of a series obviously cannot be confirmed in this fashion. All that can be done in order to identify the best possible turns at the ends is to experiment with several alternative dates. For each such date, the maximum variance between the two following, or the two preceding steps, is computed. The alternative turn that yields the highest maximum variance is the one chosen.

74. The matching of turns in two series is based on a set of rules described in Burns and Mitchell, *Measuring Business Cycles*, p. 118.

75. The differences in the rankings of a few indicators are due mostly to differences in the number of cycles recognized by the two approaches. Average cycle amplitudes tend to be larger, the fewer cycles found in a given time period. Therefore, if a series has more deviation cycles than step cycles, the rank of its deviation-cycle amplitude will be lower than the rank of its step-cycle amplitude.

76. The indexes are constructed in the same fashion as those for classical cycles, described in Section 4, except as follows:

The *composite indexes for deviation cycles* use the trend-adjusted indicators, whereas the indexes for classical cycles use non-trend-adjusted ones. The composite indexes for deviation cycles equalize the month-to-month differences in the standing of the indicators, whereas the indexes for classical cycles equalize month-to-month percentage changes. The latter are not used for deviation cycles because the trend-adjusted series are expressed as percentage ratios to the trend.

In addition to the main composite indexes for deflated and undeflated deviation cycles described in the preceding paragraph, we constructed shortcut composite indexes for deviation cycles. Instead of adjusting each indicator for its trend and then combining them into composite indexes, we took the composite indexes for classical cycles and adjusted them for their trends as represented by the 75-month moving averages. It is noteworthy that all turns in the shortcut composite indexes coincide with those in the main indexes, for undeflated as well as for deflated cycles.

The main *composite indexes for step cycles* are derived by using the month-to-month percentage changes of the indicators in the same fashion as the original series are used in the classical composite indexes. The amplitude adjustment is applied to month-to-month differences between rates of change, instead of month-to-month percentage changes. Step-cycle turning points are obtained by partitioning the composite index by the same method by which individual indicators are partitioned.

Also, a shortcut composite index has been constructed for step cycles, analogous to the shortcut index for deviation cycles. A series of month-to-month percentage changes is derived from the composite index for classical cycles. This series is partitioned into step cycles. However, in contrast to the experience with deviation cycles, only 9 out of the 15 turns are identical in the main and shortcut indexes for step cycles, whether the deflated or the undeflated list is used. The discrepancies in the indexes for undeflated step cycles are only one month or two; but for deflated step cycles, there are three rather long intervals between the turn shown by the main index and the corresponding turn in the shortcut index. The discrepancies reflect the greater instability of step cycles, as compared to deviation cycles, and show that a shortcut index for the former has to be used with great caution.

77. This assumes that the June 1970 peak in classical undeflated cycles is valid.
78. The reference is to the ranks of amplitudes, because the amplitudes themselves are not comparable, as explained in Section 6.
79. The NBER has always selected a single month as turning point even when the evidence did not point clearly to a single month. Otherwise it would be necessary to work with alternative turns or with turning zones, which would greatly reduce the usefulness of the chronology.
80. The cyclical component is defined by the Spencer curve (see footnote 66); the irregular component is obtained by dividing the Spencer curve into the seasonal adjusted series. Both components are measured by their month-to-month percentage changes. The ratios of the irregular to the cyclical components of the composite indexes are 0.44 and 0.52 for undeflated and deflated deviation-cycle indexes; and 1.88 and 2.30 for undeflated and deflated step-cycle indexes.
81. In my study of German growth cycles, chronologies based on deviation cycles and on step cycles were quite similar, so that it made little difference which one was selected. I preferred the diffusion index for deviation cycles for its somewhat greater smoothness and amplitude. Composite indexes were not used for German growth cycles, but they could readily be constructed to provide a chronology strictly comparable with that selected here for the United States.
82. The average duration of German growth cycles, 1951–67, was much longer, namely four and a half to five years (see Mintz, *Dating Postwar Business Cycles*, p. 25). It is interesting to note that classical German business cycles before World War II also were considerably longer than their U.S. counterparts (see Burns and Mitchell, *Measuring Business Cycles*, p. 371).
83. The comments which follow are based on undeflated deviation cycles. With minor qualifications, they also hold for step cycles.
84. Amplitudes of downturn-to-downturn cycles vary more than amplitudes of upturn-to-upturn cycles. This may be taken to be due to the positive correlation of rises and preceding falls, and the absence of such correlation between rises and subsequent falls. However, this kind of difference in variability is not found in step-cycle amplitudes. The result for deviation cycles may, therefore, be due merely to chance.
85. To repeat: the eight indexes are the four diffusion indexes for undeflated and deflated deviation and step cycles and the corresponding four composite indexes.
86. When amplitudes are based on step cycles instead of on deviation cycles, the findings differ in a few points. The rise of 1961–62 belongs to the relatively large ones, whereas the 1963–66 rise was even smaller than the last one. Also, based on step cycles, the decline of 1952–53 was among the largest falls.
87. The term "level" refers to the average rate of change during a phase. I owe the observation on variability to Geoffrey H. Moore.
88. The reference is to the BCD series "twelve leaders prior to trend adjustment," i.e. to the leading-indicator index in its original form. The reverse-trend adjustment devised by Julius Shiskin (*Review of Economics and Statistics*, February 1968) in order to make the

leaders more comparable to the rising curve of the coincident indicators is not appropriate for relating leaders and growth cycles, since the rising trends have been removed from the latter. It should be noted that the leaders and the growth cycles have no series in common, therefore their agreement cannot be explained by an overlap of coverage.

89. This is based on step cycles in the rate of change of money as analyzed by Anna Schwartz.
90. The finding holds for both undeflated and deflated indicator lists. The comparisons include those in which the growth-cycle turn is skipped by an indicator.
91. Moore and Shiskin, *Indicators,* pp. 38–41, 68.
92. Mintz, *Dating Postwar Business Cycles,* p. 40.
93. The sources for exact coincidences are the same as for rough coincidences.
94. Three of the indicators skip the entire Group II cycles in 1951–52 and in 1962–63, but turn closer to the reference turns in 1951 and 1963 than to the Group I reference turns in 1953 and 1961. In these instances, the 1951 and 1963 turns are counted as corresponding to Group I reference turns.
95. Within Group I and Group II there are also large differences in deviations. Thus, the median deviation is zero in 1961 at the upturn in undeflated and deflated deviation and step cycles. This date marks also the clearest and sharpest of the classical-cycle troughs. The largest deviations occur at the repeatedly mentioned upturn in 1963.
96. A similar contrast was found between German growth-cycle upturns and downturns (see Mintz, *Dating Postwar Business Cycles,* p. 28). On the contrary, turns of the 12 indicators in U.S. classical business cycles were slightly more concentrated at reference peaks than at reference troughs, 1948–61, measured by the median deviations of indicator turns from reference turns.
97. Returning to the previously discussed measure of the contrast between upturns and downturns, we find that the median diviations of indicator turns from growth-cycle turns would not be affected by exclusion of 1948 and 1969.