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# A Review of Cyclical Indicators For the United States: Preliminary Results

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# A REVIEW OF CYCLICAL INDICATORS FOR THE UNITED STATES: PRELIMINARY RESULTS

by

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This paper represents a very early progress report on a new study of business cycle indicators for the United States. Our host organization, CIRET, is concerned with research on surveys of economic tendencies that cover broad areas of business, investment, and consumer behavior. These inquiries yield mainly qualitative data on plans and expectations of economic decision-making units. Such data are aggregated and also in a sense quantified in form of diffusion indexes (the Ifo Business Test and its components may serve as examples), but they are basically limited to showing only the direction and not the size of changes in the economic variables covered. A major purpose of compiling and analyzing these diffusion measures is to improve prediction of cyclical movements in business activity. This objective is the same as that pursued in the National Bureau studies of quantitative business cycle indicators--the latest of which is the project to be discussed in this paper. Appraisals of the predictive records and potentials of these two time-series data sets (the cyclical indicators and the expectational diffusion indexes) are therefore definitely an appropriate subject for consideration in this conference. (They have already received much attention in a number of CIRET publications.)[1]

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[1] See, in particular, the following recent monographs:
W. Gerstenberger, J. D. Lindlbauer, G. Nerb, W. H. Strigel, Abschwung und Rezession im Spiegel quantitativer und qualitativer Statistik, CIRET-

Before turning to the outline and some particulars of the new project, I shall offer a few comments on the comparative strengths and limitations of indicators, anticipatory data, and some other tools of current business analysis and macroeconomic forecasting.

## 1. Some General Observations on Indicators and Anticipations Data

Economic change has the different but interrelated dimensions of size, frequency, duration, timing, and scope--which receive different emphasis and treatment in time series of (a) levels of economic aggregates and indexes; (b) the corresponding rates of change; and (c) measures of prevailing directional movement. These types of series also reflect differentially the various (but again interrelated) components of economic change--the secular and intermediate trends, cyclical, seasonal, and short irregular movements. In general, uses of the indicators and diffusion indexes focus on the cyclical aspects of economic developments, treat the cyclical fluctuations as largely systematic, and seek to isolate, measure, and ultimately predict the repetitive elements that typified the broad movements of the economy in the past.[2] In this task, cyclical indicators

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Studien, No. 15, August 1969.

W. H. Strigel, "Konjunkturindikatoren aus qualitativen Daten," IFO-Studien, 18 Jahrgang, 1972, Heft 2, S. 185-214 (also published in English as Trade Cycle Indicators Derived from Qualitative Data, CIRET Studien, No. 19).

[2]This approach implies that business cycles are not to be viewed as essentially random fluctuations (say, resulting from a summation of random shocks à la Slutzky). Indeed, the presence in virtually all cycles of certain recurrent patterns and relationships is seen as evidence against that extreme version of the random shock hypothesis. However, methods of cyclical analysis do not imply endorsement of the other polar concept either, namely, that business cycles are purely endogenous movements. All studies of the economy in movement that are not entirely divorced from empirical observations must deal with the effects and interaction of two

and diffusion series are complementary rather than competing inputs into the process of analysis and forecasting.

Diffusion indexes may, of course, be derived from actual (ex post) data as well as from expected (ex ante) data.[3] Diffusion series which correspond to recorded economic aggregates tend to lead the latter at peaks and troughs associated with major changes in business conditions, but their cyclical movements are often obscured by short, irregular fluctuations. In these respects, the diffusion indexes resemble the series of changes in, rather than levels of, the corresponding aggregates.[4] Clearly, then, such indexes can be properly compared with cyclical indicators only when the latter are cast in form of rates of change or first differences. Comparisons with series of levels require that the diffusion

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sets of factors, the exogenous disturbances and the endogenous components of the economic system. See V. Zarnowitz, "The Business Cycle Today: An Introduction," in The Business Cycle Today (ed. by Zarnowitz), NBER, New York, 1972, pp. 1-38, esp. sec. VI.

[3] The indexes simply show the percentage of series in a given set that are expanding in each successive time period. The set may represent a single economic process or a number of related processes and the type and degree of disaggregation may vary greatly (the component series may refer to individual firms or industries or regions, etc.). In the United States, for example, diffusion indexes are available, among others, for new orders (36 industries), profits (about 1,000 corporations), industrial materials prices (13 materials), and sales of retail stores (23 types of stores). See U.S. Department of Commerce, Business Conditions Digest (BCD), monthly, Chart E3. Diffusion indexes are also computed from sets of data for different variables, e.g., groups of the leading, roughly coincident, and lagging indicator series.

[4] The diffusion indexes and the rates of change, even though as a rule positively correlated for the same aggregates, have, of course, quite different meaning and convey largely independent information about two related but distinct aspects of economic change. Their short-term movements can and do show many disparities. See Geoffrey H. Moore, "Diffusion Indexes, Rates of Change, and Forecasting," Chapter 9 in Business Cycle Indicators, Vol. I, Princeton University Press for National Bureau of Economic Research (NBER), New York, 1961.

(net percentage expanding) indexes be first cumulated. The cumulated indexes are, of course, much smoother than the uncumulated ones, but they also lead the corresponding aggregates by much shorter intervals, if they lead them at all.

Leading indicators--highly cyclical series with early timing characteristics--are typically also very sensitive to frequent disturbances of all kinds, so that their month-to-month changes (after elimination of seasonal movements) tend to reflect the short erratic fluctuations much more than their longer cyclical movements. For the cycle-trend components to begin to "dominate" the irregular components, such series must be compared over intervals ranging from 2 to 6 months (or, equivalently, must be smoothed with 2- to 6-month moving averages). Other sources of "noise" in current observations, notably the errors in provisional estimates as indicated by data revisions, may add from 1 to 3 months to the total delay in recognizing the "true" cyclical movements in the series.[5]

In practice, then, such effective leads as can be gained from these data tend to be short; they help to speed up the recognition of major cyclical changes in progress, but do not generally enable the user to anticipate such changes early and reliably. However, without the aid of series with historical lead-time characteristics, recognition appears to be considerably more sluggish still.[6] This means that the data, when

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[5] See Julius Shiskin, "Measuring Current Economic Fluctuations," Annals of Economic and Social Measurement, January 1973, pp. 1-15.

[6] Rendigs Fels and C. Elton Hinshaw, Forecasting and Recognizing Business Cycle Turning Points, NBER, New York, 1968; Geoffrey H. Moore, "Forecasting Short-Term Economic Change," Journal of the American Statistical Association, March 1969, pp. 1-22.

skillfully interpreted, can and do prove valuable to forecasters[7] and also that there is a high premium on any approach that promises to yield earlier indications of the economy's course. It would be indeed advantageous if the leading series themselves could be reasonably well predicted, whether by means of "causal" factors suggested by testable economic theories or by means of "symptomatic" factors representing aggregated microdata on economic anticipations and decisions. Unfortunately, important leading indicators, while good forecasting tools, are poor forecasting targets. This is not really surprising: they are themselves tied to expectations and decisions that are in part "autonomous," and it is ultimately this fact (and proximately their early timing and great sensitivity, i.e., volatility) that makes these series so difficult to predict.

## 2. Related Findings of Recent Studies

Several pieces of evidence support and amplify statements made in the preceding section.

### A. On the direct uses of leading indicators, individually and in combinations

1. New orders received by industries in which production to order is important (in the main durable goods and particularly machinery and equipment) are good predictors of outputs and shipments of the corresponding products.[8] Forecasts of sales in these industries appear to

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[7] On the evidence of the widespread use of leading indicators and anticipations data by economic forecasters in the United States, see Victor Zarnowitz, "New Plans and Results of Research in Economic Forecasting," 51st Annual Report of the National Bureau of Economic Research, NBER, New York, September 1971, pp. 65-69.

[8] On this and the other points made in this paragraph, see Victor Zarnowitz, Orders, Production, and Investment--A Cyclical and Structural Analysis, NBER, New York, 1973, Part I, esp. Chapter 2.

draw strongly upon the information contained in advance orders, and they are generally much more accurate than sales anticipations in industries that produce largely to stock, where such information is not available or very limited. Company forecasts of new orders for nonelectrical machinery, a category of products made largely to order, are on the average quite poor (indeed, on balance less accurate than simple last-level extrapolations for the quarterly series of corresponding aggregate realizations).

2. Estimates of aggregate investment commitments (OC), obtained by adding the value of new orders received by industries producing machinery and equipment to the value of new contracts for industrial and commercial construction, have considerable predictive power with regard to business expenditures for plant and equipment (I).[9] The relation involves distributed lags of I behind OC, which average two to three quarters. It is possible to estimate OC itself fairly well by regressing it on selected variables such as final sales, capital stock, corporate profits, and the long-term interest rate, but only when simultaneous values or short leads of the explanatory factors are used. Moreover, the resulting estimates $\widehat{OC}$ are substantially less effective as predictors of I than the actual investment orders and contracts, OC.

3. Simple mechanical predictions of GNP based on regressions with the composite index of leading indicators compare rather well with the average performance of economic forecasters, according to some experimental calculations designed to match the annual end-of-year forecasts.[10]

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[9] Ibid., Chapters 9 and 10.

[10] Geoffrey H. Moore, "Forecasting Short-Term Economic Change," Journal of the American Statistical Association, March 1969, pp. 1-22 (esp. see

Such predictions, however, are to be viewed merely as additional standards against which to appraise the results of true ex ante forecasting and not at all as optimal applications of the indicators to macroeconomic forecasting. For best results, the indicators must not be used mechanically but rather their evidence must be interpreted with the aid of judgment based on professional training and experience.[11] (The same applies as well to other forecasting approaches including the uses of anticipation surveys and econometric models. Thus there is considerable evidence that ex ante forecasts with econometric models, which involve various types of judgmental adjustments, are on the whole more accurate than forecasts from unadjusted models, even when these are made ex post with correct values of exogenous variables.)[12]

B. On the direct uses of anticipations data

1. In the United States, anticipated and actual business capital outlays are highly correlated on quarterly and annual bases, presumably

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IV); Herman I. Liebling, Discussion of the paper by D. J. Daly, "Forecasting with Statistical Indicators," in Bert G. Hickman, editor, Econometric Models of Cyclical Behavior, NBER, New York, 1972, volume 2, pp. 1195-1204.

[11] Some mechanical uses of the indicators, though instructive, are not really persuasive because they do not allow properly for the characteristics of these series and the original criteria of their selection (notably for the sensitivity and the consequent short-term variability of the leaders as well as the fact that they were chosen for the consistency of their cyclical timing, not for the correlation with such series as real private GNP or the like). As an example, consider the treatment of the indicators in J. W. Elliott, "A Direct Comparison of Short-Term GNP Forecasting Models," Journal of Business, January 1973, pp. 33-60.

[12] Michael K. Evans, Yoel Haitovsky, and George I. Treyz, assisted by Vincent Su, "An Analysis of the Forecasting Properties of U.S. Econometric Models," in Econometric Models of Cyclical Behavior, NBER, New York, 1972, vol. 2, pp. 949-1139. See also V. Zarnowitz, "Forecasting Economic Conditions: The Record and the Prospect," in The Business Cycle Today, pp. 197-99, 218-22, and discussion by Arthur Okun and Otto Eckstein, ibid., pp. 319-22.

reflecting the large amounts of information that managers have concerning their own investment projects already approved and in progress.[13] These investment anticipations are widely used in short-term GNP forecasts of all types and, judging from past results, they should be, particularly the data from the Department of Commerce surveys and for the manufacturing sector. However, the quarterly survey figures often contain sizable errors due to delays and uncertainties of construction and deliveries and they are of little help at turning points, where anticipations frequently lag the actuals by a quarter. Investment commitments (new capital appropriations and orders-contracts) provide longer effective lead-times and better predictions of turns in business capital spending.

2. Business firms, especially corporations of intermediate and large size, increasingly follow formal capital budgeting procedures and in any event tend to put much effort into planning and evaluation of sizable investment projects. Consumer intentions to acquire housing, cars, and major appliances are in principle akin to business intentions to acquire plant and equipment, but in practice they are generally less firmly budgeted and more vague and attitudinal. For this reason, data from surveys of consumer anticipations are regarded by many actual and potential users as having substantially less predictive value than data from surveys of business investment anticipations. However, evidence has been presented lately that, in recent periods for which improved anticipations data are available, both consumer attitudes and purchase

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[13] On the points made in this paragraph, see V. Zarnowitz, Orders, Production, and Investment, as cited, pp. 433-42, 470-75, and "Eine Answertung von kurzfristigen Wirtschaftsvoraussagen in den USA," IFO-Studien, 1966, pp. 30-33; Michael K. Evans, Macroeconomic Activity: Theory, Forecasting, and Control, New York, 1969, Chapter 17.

expectations did have definitely a good net predictive record with regard to consumer outlays for durable goods, particularly automobiles.[14]

3. It is a simple and reasonable proposition that expectations should prove more accurate for variables over which the survey respondents have substantial control than for variables over which they have little or no control. This is probably a major reason why business anticipations of plant and equipment have been much more useful to economic forecasters than business sales and inventory anticipations. Comparisons of the predictive performance of data from the Commerce surveys show clearly the weakness of sales, and to a smaller extent of inventory, anticipations as predictive instruments.[15] Suggestive evidence of related nature comes from Dun and Bradstreet quarterly diffusion indexes of manufacturers', wholesalers', and retailers' anticipations.[16] Thus the

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[14] See F. Thomas Juster and Paul Wachtel, "Anticipatory and Objective Models of Durable Goods Demand," American Economic Review, September 1972, pp. 564-79, with references to earlier work by Juster, Hymans, and others. It should be noted, though, that the strong positive results are limited to a short period 1960-67 for which the expectational data (an "Index of Consumer Sentiment" and buying intentions series, from the University of Michigan Survey Research Center and the Census Bureau) appear to be much better than they were before. For a rather critical summary view of this type of data, see M. K. Evans, op. cit.

[15] See V. Zarnowitz, Orders, Production, and Investment, as cited, pp. 58-68 and 360-69, with references to work by M. C. Lovell and others; also, M. K. Evans, op. cit., pp. 480-86. Of course, the results of these surveys, though poor from the viewpoint of forecasting performance, can be valuable as material and tools for research on how business expectations are formed, revised, and used. For example, reasonable associations have been observed between errors in sales expectations and errors in investment anticipations (see Arthur M. Okun, "The Value of Anticipations Data in Forecasting National Product" in The Quality and Economic Significance of Anticipations Data, Universities-National Bureau Conference 10, Princeton for NBER, 1960, pp. 439-42 and references therein).

[16] These are indexes of the familiar percent-rising type, plotted for four-quarter spans in the terminal quarter; they are shown in this form in each monthly issue of BCD, Chart C2 (see note 3 above), along with the corresponding actual diffusion indexes. The following observations in the text are based on an analysis of these graphs.

deviations between these series and the corresponding actual indexes are much smaller for the number of employees than for new orders, net sales, net profits, and the level of inventories in manufacturing and trade. Moreover, the errors for employment are much less systematic than the errors for the other variables (for sales and profits, the series are very similar and the anticipated indexes consistently exceed the actual indexes; for inventories, the opposite bias prevails). Finally, for selling prices, the indexes show appreciably smaller discrepancies between the anticipations and the realizations in manufacturing than in wholesale and retail trade.

C. On indirect evidence from aggregative forecasts and related inferences

1. Series that tend to coincide or lag at business cycle turns may have more recognizable prior signals than series that move early, and may therefore be on the whole easier to predict. It is consistent with this expectation, for example, that forecasts of business investment in plant and equipment generally have smaller relative errors than forecasts of inventory investment.[17] The former relate to a rather late stage of a process which is, as a rule, time-consuming, and they are helped by indications from the earlier stages (new capital appropriations and commitments). Of course, the relative timing is not the sole relevant factor. Inventory investment not only requires much less time than business fixed investment, it also is much more volatile. But in general these and other related findings[18] agree with the notion that series in the broadly

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[17] Victor Zarnowitz, An Appraisal of Short-Term Economic Forecasts, NBER, New York, 1967, pp. 36-40 and 80-82.

[18] Investment in residential structures, which shows some long leads in the recent U.S. business cycles, also tends to be predicted with

defined class of "leading indicators" help predict the more sluggish series, while being themselves more difficult to predict.[19]

2. Small-scale econometric models relying heavily on selected leading indicators and anticipations data have accumulated relatively good predictive records, as illustrated by the Friend-Taubman model in which housing starts, plant and equipment anticipations, and business sales anticipations serve as exogenous variables to estimate expenditures on residential construction and business fixed and inventory investment.[20] However, some model-builders report mixed (and in large part negative) results from the use of such data.[21] Since the anticipatory variables themselves are viewed as incapable of being accurately predicted (i.e., of being replaced with no significant loss by some endogenous explanatory variables), any short-term forecasting gains from their inclusion must

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relatively large errors. Here additional difficulties for the forecasters are presumably created by the presence in the wide fluctuations of outlays on housing of particular countercyclical elements (due to financial factors on the supply side: mortgage credit was scarce in advanced expansions, relatively abundant in late contractions and recoveries). See Zarnowitz, ibid., and in The Business Cycle Today, as cited, pp. 209-12.

[19] As already noted, there is also a good deal of more direct evidence to support this idea.

[20] Irwin Friend and Paul Taubman, "A Short-Term Forecasting Model," Review of Economics and Statistics, August 1964, pp. 229-36; Herman O. Stekler, "Forecasting with an Econometric Model: Comment," American Economic Review, December 1966, pp. 1242-43; J. W. Elliott, "A Direct Comparison of Short-Run GNP Forecasting Models," Journal of Business, January 1973, pp. 33-60.

[21] Michael K. Evans, Macroeconomic Activity: Theory, Forecasting, and Control, Harper & Row, New York, 1969, Chap. 17. On the other hand, Lawrence R. Klein (with whom Evans collaborated on the Wharton econometric model) acknowledged that data on business investment intentions and consumer attitudes often did improve the Wharton forecasts; see L. R. Klein, An Essay on the Theory of Economic Prediction, Helsinki, 1968, pp. 86-89.

be weighed against the concomitant limitations on the model's ability to serve the purposes of longer-term forecasting and simulations.

3. Anticipations and forecasts often include relatively large components of extrapolation in ways that imply both heavy weighting of the most recent values and failure to utilize much of the predictive content of the longer history of the series concerned. This helps explain such common features of expectational data as (a) the tendency to underestimate actual changes (mainly increases), which becomes stronger as the predictive span increases; (b) the high proportion of "missed" turning points, particularly peaks.[22] The trailing of expectations behind realizations at turning points is a widely observed phenomenon (the Commerce quarterly investment anticipations and the Dun and Bradstreet diffusion indexes of businessmen's expectations may serve as examples). It is characteristic of even the more sophisticated autoregressive

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[22]To be sure, expectations have other than extrapolative ingredients as well, which contribute to their relative accuracy and other characteristics. On balance, many macroforecasts and aggregates of microexpectations show smaller average errors than the corresponding predictions from at least the simpler extrapolative benchmark models, so apparently the "autonomous" forecast components have some net predictive powers. Underestimation, while very frequent, is by no means ubiquitous; it prevails for series dominated by growth trends, but declines are just as often missed or overestimated and forecasts of highly variable series show smaller proportions of underpredicted changes. Also, in some business tendency surveys such as the Dun and Bradstreet anticipated diffusion indexes, there is evidence of regressiveness (trend reversion) as well as underestimation. See V. Zarnowitz, An Appraisal of Short-Term Economic Forecasts, NBER, New York, 1967; Jacob Mincer and Victor Zarnowitz, "The Evaluation of Economic Forecasts" in Mincer, ed., Economic Forecasts and Expectations, NBER, New York, 1969; and Universities-National Bureau Committee for Economic Research, The Quality and Economic Significance of Anticipations Data, Princeton University Press for NBER, 1960 (notably the contributions by A. G. Hart and J. Bossons and F. Modigliani, pp. 205-62).

extrapolations and of forecasts with econometric models that make wide use of autoregressive terms (lagged values of dependent variables as in Koyck distributed-lag relations, etc.). Judicious use of economic relationships among the leading, roughly coincident, and lagging indicators can help counterbalance such tendencies and improve turning-point forecasts.

## 3. The Scope of the New Project: Data and Problems

The findings reviewed in section 2 suggest strongly that economists have good reasons for using cyclical indicators and data from anticipations surveys as joint inputs into the process of analyzing and forecasting business conditions. Most users also combine this information with models of the economy built around the framework of the national income and product accounts; these are either econometric models or, more often, less formalized sets of relationships.[23] These practices are clearly indicated by the expressed preferences of the forecasters, and they find general support in the analysis of relative accuracy of both the non-econometric and the econometric model forecasts (ex ante and ex post).[24]

It follows that the tool box of a good practitioner in this area should include a rather comprehensive and varied collection of time series, namely

(a) the main aggregates and components in the GNP accounts;

(b) the cyclical indicators;

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[23] It is not quite accurate to distinguish the latter as "judgmental," as it is sometimes done, for judgment as to the use of outside information and interpretation (possibly modification) of the results typically plays a large role in working with the econometric as well as the "informal" models.

[24] See references in footnotes 7 and 12 above.

(c) measures of changes in business and consumer expectations;

(d) analytical measures such as those of diffusion, rates of change, etc.

All these types of data, and some additional ones, are found in the monthly report of the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), entitled Business Conditions Digest (formerly Business Cycle Developments, in short BCD). Section A includes all major series from the expenditure and income sides of the GNP accounts, for the personal, business, government, and rest-of-the-world sectors, in nominal and real terms. Section B presents about 80 cyclical indicators, classified by economic process[25] and by timing (leading, roughly coincident, lagging), as well as ten composite indexes based on groups of series produced by this dual classification. Section C shows several aggregate series and a number of diffusion indexes derived from surveys of anticipations and intentions of businessmen and households. Section D contains series relating to foreign trade, the balance of payments, federal government activities, changes in prices, wages, productivity, and the size and composition of the labor force--series that are important for the overall view of the economy but do not qualify as indicators of expansions and contractions in aggregate economic activity because their behavior during business cycles is not sufficiently regular or consistent. Section E consists of various analytical measures: actual and potential GNP, ratios (e.g., of output to capacity, inventories

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[25] Seven "major processes" are distinguished as follows: employment and unemployment; production, income, consumption, and trade; fixed capital investment; inventories and inventory investment; prices, costs, and profits; money and credit. These are further subdivided into "minor processes" which tend to differ considerably with regard to cyclical timing.

to sales, personal saving to disposable income), diffusion indexes based on selected leading and coincident indicators, and rates of percentage changes in a few key aggregates and indexes. Finally, section F provides some international comparisons for consumer prices, industrial production, and stock price indexes.

In sum, BCD assembles approximately 600 monthly and quarterly time series. At present, most of the charts begin in 1952.[26] Except for section F, the charts contain shading which indicates periods of recession in general business activity, according to the NBER cyclical chronology for the U.S. All data for the current and the last 2-3 years are also regularly presented in tabular form. There is an introductory part explaining the adopted methods of presentation. Appendixes provide descriptions of series, historical data, seasonal adjustment factors, cyclical behavior patterns, specific peak and trough dates, and average variability measures for the principal indicators.

It would seem that the general content and format of BCD are very well suited to the needs of those who are engaged in analyzing and forecasting the course of the U.S. economy, and the good sales record of the publication is consistent with this claim. However, this merely confirms that business economists and other professionals in this field recognize the need to be au courant on the changing expectations, signals, and developments that find their expression in the large collection of series

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[26] The main cyclical indicators which appear on the NBER "short list" (12 leading, 8 roughly coincident, and 6 lagging series) are shown back to 1948, and so are the composite indexes which represent various subsets of this collection of indicators (BCD, charts B6 and B7). The anticipations data in section C are charted from 1957 on.

systematically and conveniently presented in BCD; the details of what should go into this collection and of how the data are to be processed and displayed are open to many questions and must be frequently reevaluated. At times, moreover, cumulative changes in the economic system and in related modes of thought and action are likely to call for a more basic review of these materials and techniques. Such a comprehensive review initiated late in 1972, is now in progress at the Bureau of Economic Analysis (the government agency publishing BCD) and at the NBER.[27]

The first selection of cyclical indicators, limited to revivals, was made at the NBER by Wesley C. Mitchell and Arthur F. Burns in 1937, and the resulting list was then extended to recessions and successively revised by G. H. Moore in 1950 and 1960 and by Moore and J. Shiskin in 1966.[28] Since that last review, several important developments have occurred in the United States and abroad which make it advisable and promising to undertake another comprehensive evaluation of this system of economic data. The period witnessed strong and persistent inflationary tendencies and major policy efforts to counter them; a "credit crunch" in 1966 and a brief but pervasive business slowdown in 1967; a mild recession in 1970, with some particular features attributable to the force of continuing inflation; the subsequent recovery and institution of

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[27] The initiative in getting the project under way belongs to George Jaszi, Director, BEA, and Julius Shiskin, Chief Statistician, Office of Management and Budget. Charlotte Boschan is in charge of the work at the NBER in New York and Feliks Tamm, editor of BCD, is in charge of the work at the BEA in Washington. The project is under my general direction.

[28] W. C. Mitchell and A. F. Burns, Statistical Indicators of Cyclical Revivals, NBER Bulletin 69, New York, 1938; G. H. Moore, Statistical Indicators of Cyclical Revivals and Recessions, NBER Occasional Paper 31, New York, 1950; G. H. Moore, ed., Business Cycle Indicators, 2 vols., NBER, New York, 1961; G. H. Moore and J. Shiskin, Indicators of Business Expansions and Contractions, NBER Occasional Paper 103, New York, 1967.

general price and wage controls; great changes in international monetary and political relations and military activities affecting the U.S. economy and, most recently (after the abandonment of the post-World War II system of fixed exchange rates, two devaluations and a downward "float" of the dollar), another round of a boom and inflation and renewed price controls. Such developments test anew the ability of indicators and anticipations data to help in the diagnosis and prognosis of economic conditions.

At the same time, work on improvements and extensions of time series representing all types of economic processes continued at a high rate. Thus, there is need to appraise the indicator qualities of new and revised data as well as to reassess those of many "old" series taking into account their behavior since 1966. The broad objectives here are (1) to review BCD and other pertinent materials so as to complement and update the record and the cyclical analysis and scoring for a large collection of the series concerned; (2) to recommend, on a documented basis, such changes in form and substance of BCD as appear best calculated to enhance the informational value of that report.

The data base for the study is quite broad, consisting of approximately 250 time series, about 150 of which are currently in in BCD.[29] Recent developments in macroeconomic research, especially on business cycles and programmed approaches to their study, forecasting, and econometric models, offer some new ideas and techniques for the task of

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[29] These include nearly all items in section B and selected items from sections A, C, D, and E (about the contents of these parts of BCD, see text above).

evaluating these data.[30] In particular, the Bry-Boschan computer programs for cyclical analysis are being used extensively in our project, with very satisfactory results.

Several serious problems must be confronted by this analysis. Those considered but not resolved in the preceding studies include:

(a) Systematic differences in timing at peaks and troughs. Earlier research has established that they exist for many series that show good indicator characteristics.[31] However, these distinctions are ignored in the present classification of indicators (based on measures of timing at all turns), mainly to simplify the presentation of the data and to avoid additional difficulties in evaluating the evidence.

(b) Differences in length of the leads or lags that are characteristic of the various indicators. These too are often pronounced and significant (mainly for the leaders).[32] But the indicators are now grouped into three

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[30] Some of the recent publications that are important in this context are: Gerhard Bry and Charlotte Boschan, Cyclical Analysis of Time Series: Selected Procedures and Computer Programs, NBER, New York, 1971; Victor Zarnowitz, ed., The Business Cycle Today, as cited, especially the contributions by Ilse Mintz, Solomon Fabricant, and G. H. Moore; Frank E. Morris, "The Leading Indicators Revisited," Business Economics, September, 1970, pp. 14-19; Julius Shiskin, "Economic Policy Indicators and Cyclical Turning Points," ibid., pp. 20-28; and the items referred to in footnotes 5 and 10 above.

[31] Thus, of the 72 series classified by timing in the 1966 review by Moore and Shiskin, 38 have been found to fall in the same timing class at peaks and troughs and 34 in different classes. See Indicators of Business Expansions and Contractions (as cited in fn. 28), pp. 34 and 94-101. These classifications are based, for each individual series, on the median lead or lag plus a probability test applied to the number of leads, rough coincidences, or lags relative to the number of business cycle turns covered.

[32] Edgar R. Fiedler, "Long-Lead and Short-Lead Indexes of Business Indicators," Proceedings of the Business and Economic Statistics Section, American Statistical Association, 1962.

timing categories only: leading, lagging, and roughly coincident.[33] In addition to reopening these questions, some new ones must be asked:

(c) How should the series representing government activities and policies be treated? Some fiscal and defense indicators are now grouped separately in BCD (section D3), while the monetary policy indicators in the form of change-in-money-supply series are included in the section for leading indicators, money and credit (B6). But this does not do justice to the importance of the economic policy indicators and their relations with each other and with the private sector indicators.[34] It must be recognized that some activities of the federal government in the U.S. result in time series that do have cyclical regularities and that they both influence the private sector and contain endogenous elements in the sense of being responsive to earlier developments in the economy.[35]

(d) Should more attention be paid to the distinction between the real and the nominal indicators?[36] In 1969-70, inflation persisted

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[33] A series is roughly coincident if it exhibits a significant number of timing observations that lie within the range of lags (+) or leads (-) of 3 months or less (i.e., in the range of $\pm$ 3 months). Thus, this category overlaps the other two, since a series may simultaneously qualify as roughly coincident and as leading (or lagging) by short intervals. However, dual classifications are avoided in the final designations of the indicators according to timing (which occasionally differ from those obtained by application of the rules noted in fn. 31; see Moore and Shiskin, op. cit., pp. 34-45).

[34] See the papers by Morris and Shiskin cited in footnote 30 above.

[35] For some recent discussions of these matters, see The Business Cycle Today (ref. in fn. 2), particularly V. Zarnowitz, "The Business Cycle Today: An Introduction," and "Econometric Model Simulations and the Cyclical Characteristics of the U.S. Economy," and Yoel Haitovsky and Neil Wallace, "A Study of Discretionary and Nondiscretionary Monetary and Fiscal Policies in the Context of Stochastic Macroeconometric Models."

[36] The real indicators are series in physical units, quantity indexes, and aggregates in constant dollars (deflated). The other indicators are nominal series--aggregates in current dollars--and price indexes and interest rates.

amidst a decline in production and a rise in unemployment more strongly than was previously recorded. In the United States, this episode is definitely identifiable as a recession, i.e., cyclical contraction according to real aggregates, but it would seem to be only a retardation in terms of the nominal aggregates. This suggested to some observers that it may be instructive to reconsider the criteria of severity of recessions in terms of the relative significance of real vs. pecuniary measures of economic activity.[37] This raises some major theoretical issues which need not be fully resolved in this study; but we decided to give the real indicators much greater weight than they received in the previous reviews.[38]

(e) Some indicators are expressed in absolute or relative changes rather than levels (e.g., changes in inventories and in money supply), and the form in which the series are cast tends to affect decisively their cyclical timing and sometimes also their cyclical conformity. Comprehensive price indexes, for example, have never conformed very well to business cycles and in recent years have conformed poorly if at all; but the broad fluctuations in their rates of change show a rather close correspondence with economic fluctuations since 1947 when both recessions

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[37] On this subject opinions differ, as illustrated in Ilse Mintz, "Dating American Growth Cycles," Solomon Fabricant, "The 'Recession' of 1969-70," and comments by Moore and Mintz (pp. 176-82) in The Business Cycle Today.

[38] Of course, it is the fluctuations in the real measures that are primarily important in the context of the problem of cyclical unemployment. Furthermore, for the latter to become severe it is not necessary that the demand for output and employment decline absolutely, only that they grow appreciably slower than the labor force and productive capacity over some sufficiently long stretches of time.

and slowdowns are recognized.[39] This matter deserves further study as does the more general problem of the form in which some indicators are used and the degree and type of smoothing applied to them.

(f) Related to (d) and (e) is the important distinction between the "classical" business cycles--sequences of generalized expansions and contractions--and the "growth cycles," an object of much recent attention. Economic fluctuations have definitely become milder in the post-World War II period, in the U.S. and, even more, in other highly developed market economies (Western Europe, Japan), where slowdowns in the rate of growth of total spending and income have largely replaced sustained declines in the levels of these aggregates.[40] However, many features of the historical cycles in which such declines were incorporated apparently reappear in those recent cycles that show up only in the rates of growth or in the levels of trend-adjusted series. Thus, downturns in the leading indicators generally predict either a decline--recession--or a marked retardation in aggregate economic activity, and upturns in these sensitive series predict either a recovery or a pronounced acceleration.[41] This suggests that the system of economic intelligence represented by the data and analytical measures covered in BCD would continue to prove

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[39] See G. H. Moore, "The Cyclical Behavior of Prices," in The Business Cycle Today, pp. 137-66.

[40] These developments are variously attributed to changes in (a) the structure and institutions of the economy; (b) economic knowledge and its policy applications; and (c) public attitudes and expectations. Some of these changes, however, seem to have at the same time strengthened the forces of inflation, which makes them partly destabilizing.

[41] See Ilse Mintz, "Dating American Growth Cycles," in The Business Cycle Today, pp. 75 and 82.

useful in a world in which the probability of growth cycles greatly exceeded that of business cycles (of the kind recorded by NBER). But surely that system, having been devised to observe the latter type of economic fluctuations, is not as well adapted to observe the former. What is required, in the broadest sense, is that the methods of cyclical analysis and forecasting be reexamined and elaborated with a view to making them more adequate for dealing with the recently prevalent patterns of instability, namely the major fluctuations in the rates of economic growth and inflation.

Some of these problems are rather difficult, especially the last one concerning the growth cycles. These movements can be measured as deviations from trends, alternating phases of high and low growth rates called "step cycles," or rates of change (which usually must be smoothed with moving averages).[42] Trend estimates can hardly be avoided here, yet they are often notoriously arbitrary and of uncertain value, particularly in this context where they must be brought up-to-date. Until recently, no reference chronology for the U.S. growth cycles existed, although it was increasingly needed. The pioneering work by Ilse Mintz, initiated just a few years ago, goes far towards filling this need, but some of her results are based on limited evidence from an analysis that is still in part experimental. They need further testing and much

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[42] Ilse Mintz used the first two of these methods in Dating Postwar Business Cycles: Methods and Their Applications to Western Germany, 1950-67, NBER, New York, 1969, and in "Dating American Growth Cycles," The Business Cycle Today, as cited. G. H. Moore used smoothed rates of change in "The Cyclical Behavior of Prices" (see ref. in footnote 39).

additional work will be required to date the growth cycle phases with adequate precision on a current basis.[43]

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[43] It should also be noted that a growth-cycle reference chronology of the type developed by Mintz cannot be simply combined with the business-cycle reference chronology of the type developed by NBER and used in BCD: the former is based on major fluctuations in series of deviations from trend or of properly measured rates of change, while the latter is based on major fluctuations in the levels of the series concerned. Useful chronologies that integrate the two dichotomies (expansion-contraction, speedup-showdown) can perhaps be devised by dividing the cycles into stages which might resemble somewhat the stages used in the NBER reference cycle analysis (Arthur F. Burns and Wesley C. Mitchell, Measuring Business Cycles, NBER, New York, 1947, Chapters 2 and 5). But the division would probably have to be much more flexible, with variable-length stages not all of which will necessarily be found in each cycle. A closely related problem is that of combining such a chronology with a system of dating the major changes in the rate (and perhaps type) of price-level inflation; see G. H. Moore, "The Cyclical Behavior of Prices," as cited in footnote 39, and John R. Meyer, "On Classifying the 'New Realities' of the Business Cycle," to appear in the 1973 Annual Report of the National Bureau.

## 4. Some Preliminary Results

At the time of this writing (June, 1973), the Bry-Boschan computer program for dating cyclical turning points has been applied to more than 200 time series and the results have been reviewed by the senior staff of the project. The collection includes the following broad groups:[44]

| | | |
|---|---|---|
| Cyclical indicators (individual and composites) | 86 | series |
| Data from anticipations surveys and other indicators | 33 | " |
| National income and product accounts | 21 | " |
| Analytical measures (ratios, rates of change) | 26 | " |
| Diffusion indexes (actual and anticipated) | 17 | " |
| New indicators | 28 | " |

The program[45] is a stepwise approach designed to identify first the major cyclical swings in the series, then the neighborhoods of their maxima and minima, and finally the monthly dates of the specific peaks and troughs. It uses seasonally adjusted data and searches for the turns sequentially in: a 12-month moving average; a weighted 15-month moving average (Spencer curve); a 3- to 6-month moving average (according to the number of months

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[44] The first five categories below refer, respectively, to the BCD sections B; C and D; A; E; and C2 and E3 (see text above for a brief description of the major parts of BCD). The new indicators (not presently included in BCD) relate to aspects or components of employment, unemployment, and labor turnover and productivity; of GNP; of industrial production; and of manufacturers' new orders and shipments. A complete list of the 211 series is available upon request.

[45] For detail, see Bry and Boschan, Cyclical Analysis (as cited in footnote 30), Chapter 2.

required for the cyclical factor to dominate the irregular); and the series proper.[46] The basic output of this computer program starts with tabulations of the unsmoothed data and the various moving averages and ends with several tentative lists and one "final" list of the selected turning points.

Given this information, large computer charts were then produced, one for each series, showing the seasonally adjusted data marked to locate their cyclical peaks and troughs and the corresponding moving averages. Each chart was inspected so as to determine the correctness of the mechanically selected turns. Wherever judgment dictated deviations from the latter, the charts were appropriately revised to show only the finally approved turning dates. Although the process resulted in many changes, by far most of the computer-chosen turning points were accepted and we consider the program as having performed quite well.

A few of these charts may serve to illustrate the cyclical behavior of selected individual indicators (Chart 1) and composite indexes (Chart 2).[47] Consider some of the comprehensive "coinciders." The quarterly GNP aggregates have, of course, nearly coincident timing, but note that their specific peaks and troughs deviate occasionally from the dates of business cycle peaks and troughs (shown at the top of each chart to mark the beginning and end of each of the shaded areas representing the NBER-designated recessions). One should recall that the NBER "reference" dates of business

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[46] With proper modifications, the program is also available for quarterly series.

[47] All these series refer to the so-called short list of NBER indicators (see footnote 26 above). The numbers of the series are those used in BCD for identification purposes only; they do not reflect the relationships between the series or the order in which the series are presented. The charts are shown after reduction to regular page size.

cycle turns are monthly and based on the evidence of other series as well as GNP. Moreover, in the 1970 recession nominal GNP continued to rise, though at reduced rates, while real GNP declined mildly. Industrial production shows fluctuations that resemble broadly those in real GNP but have larger percentage amplitudes and somewhat earlier timing at peaks. This reflects the greater sensitivity and much smaller coverage of this monthly index, which covers manufacturing, mining, and public utilities.[48] The rate of unemployment, for which an inverted scale is used to convert the countercyclical movements of this series into procyclical movements, is classed as a coincident indicator in BCD. As the chart shows clearly, however, unemployment tends to lag at troughs and lead at peaks. This is so because employment usually rises slowly in both the initial and the late stages of a business expansion, whereas the labor force continues to grow at a fairly steady rate.[49]

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[48] These industries have grown less than the U.S. economy as a whole in recent times as the proportion accounted for by service industries of all types has increased. Presumably this worked to reduce instability. Cyclical declines in manufacturing apparently no longer drag down the rest of the economy as promptly as they used to.

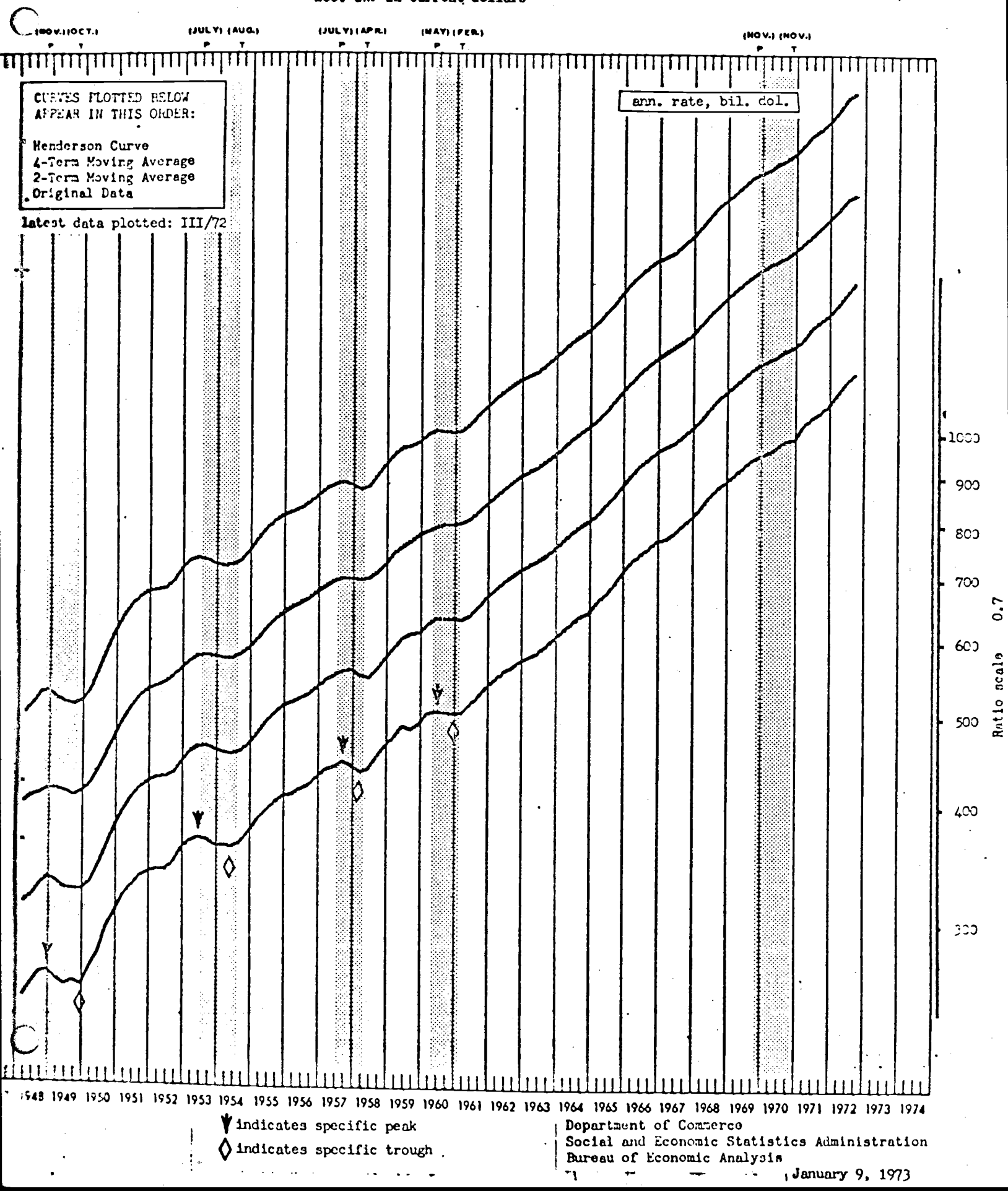
[49] The relatively slow increase in employment during the recovery phase (which starts from low rates of capacity utilization) reflects the typically large rise in both the productivity of labor (output per man-hour) and the average workweek. The retardation in employment growth late in expansion is due largely to the spread of cost increases and shortages in segments of the labor market. Unemployment and related aggregate measures of unused capacity such as the "GNP gap" (potential, i.e., full employment, GNP minus actual GNP) thus provide some of the most important examples of systematic differences in timing at peaks and troughs.

Chart 1

# Selected Indicators of Income, Production, Unemployment, and Credit, 1948-72



## 200. GNP in current dollars

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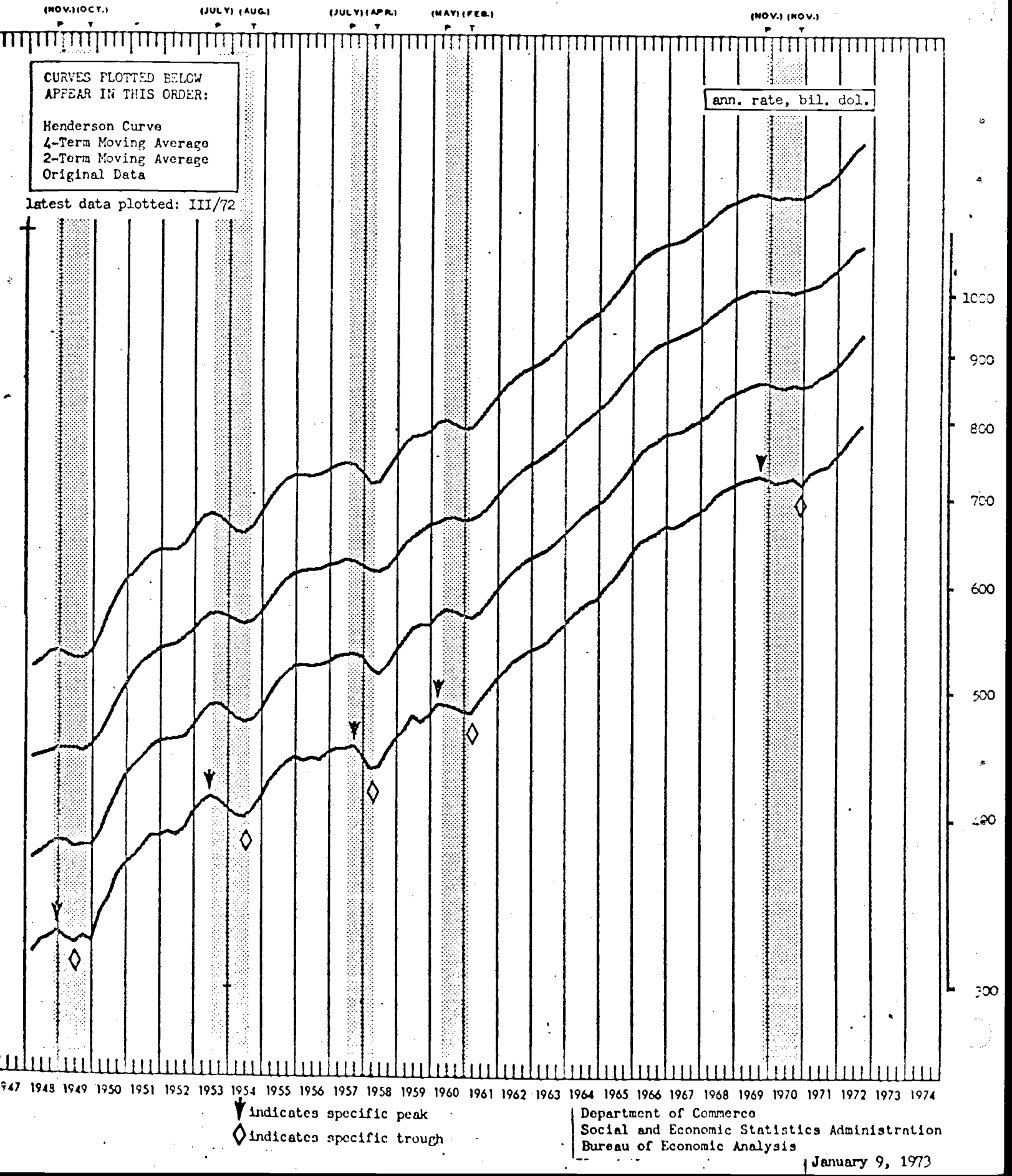
Bureau of Economic Analysis

January 9, 1973

205. GNP in 1958 dollars

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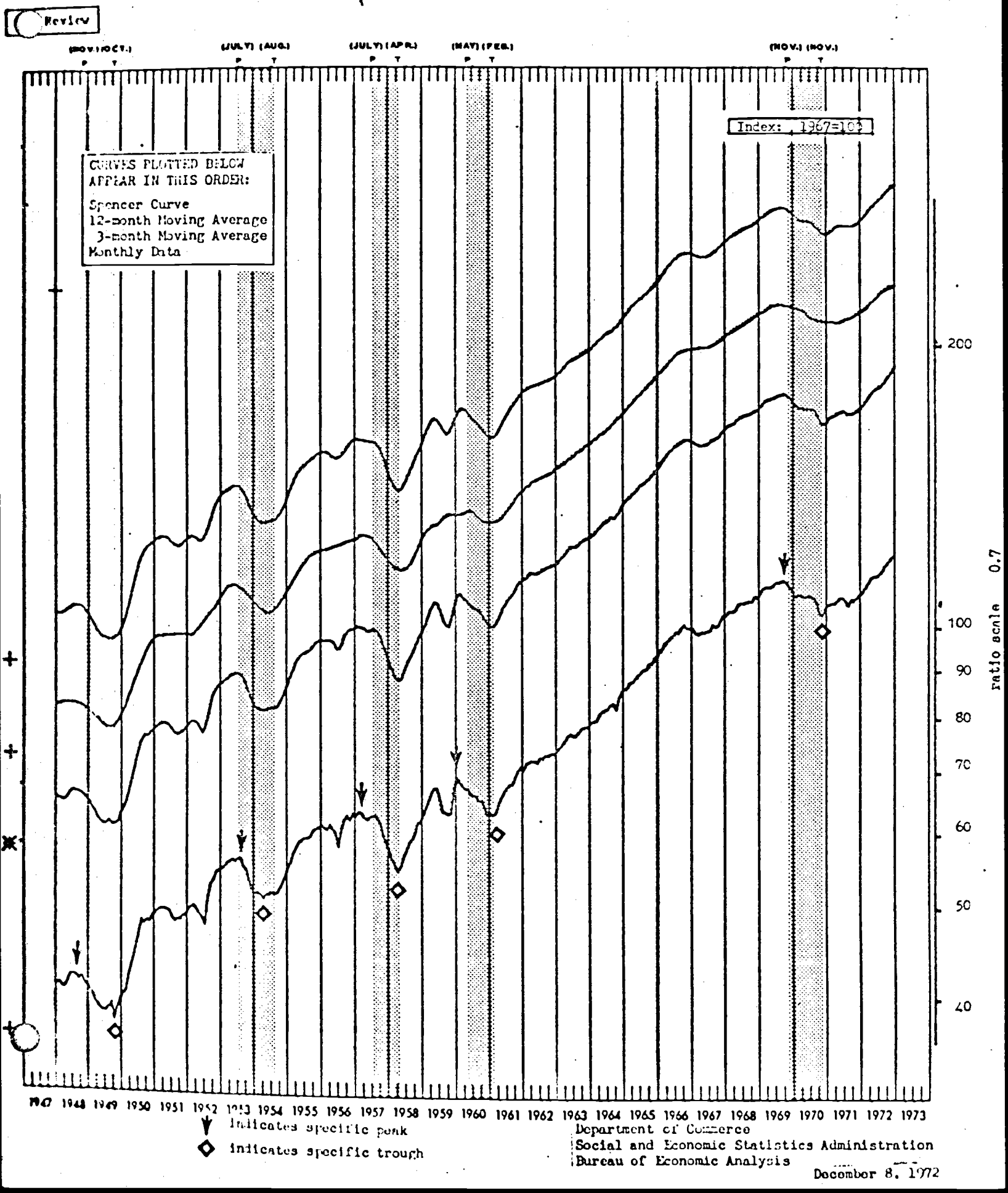
Bureau of Economic Analysis

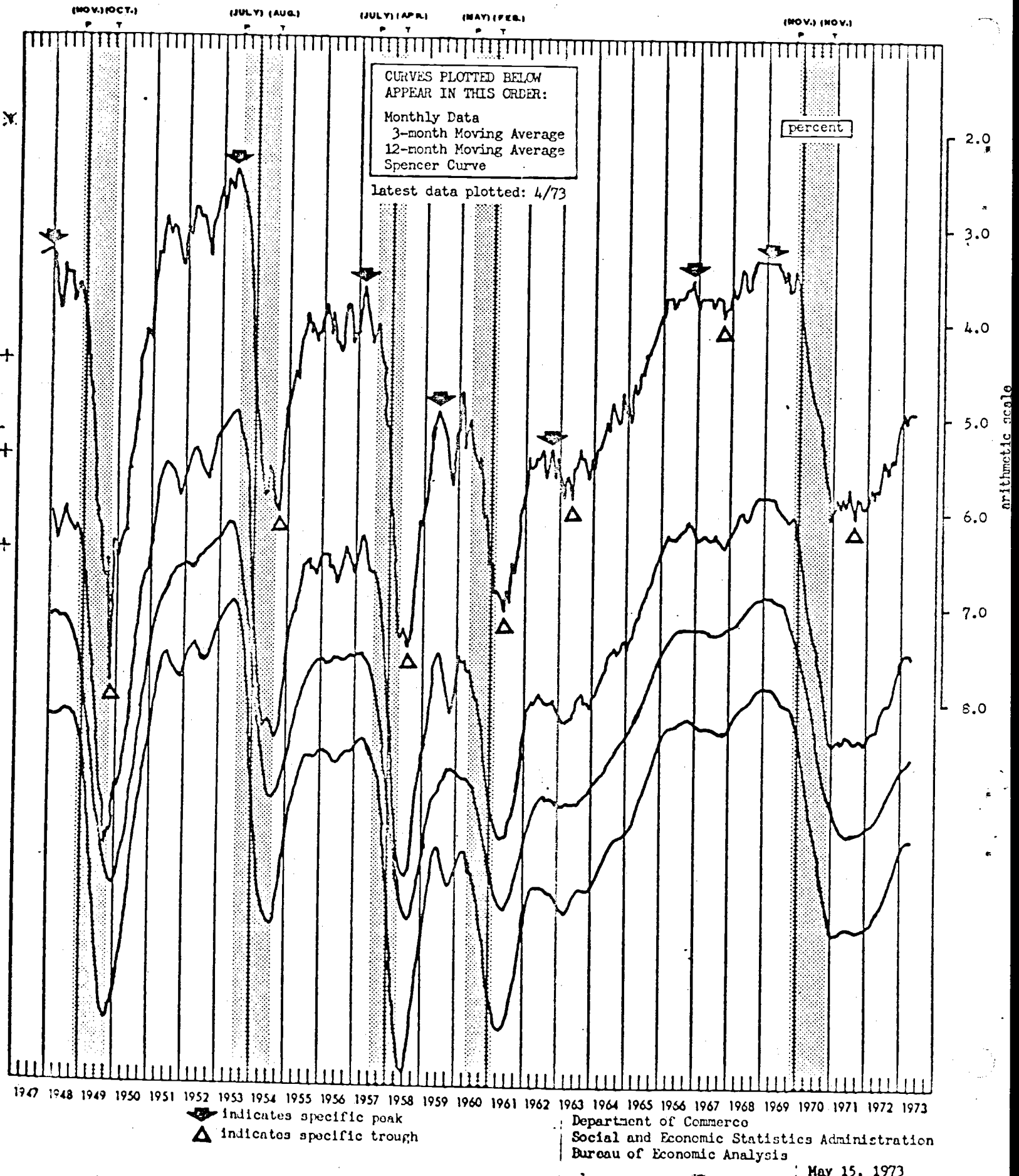
January 9, 1973

47. Industrial production



CD Review

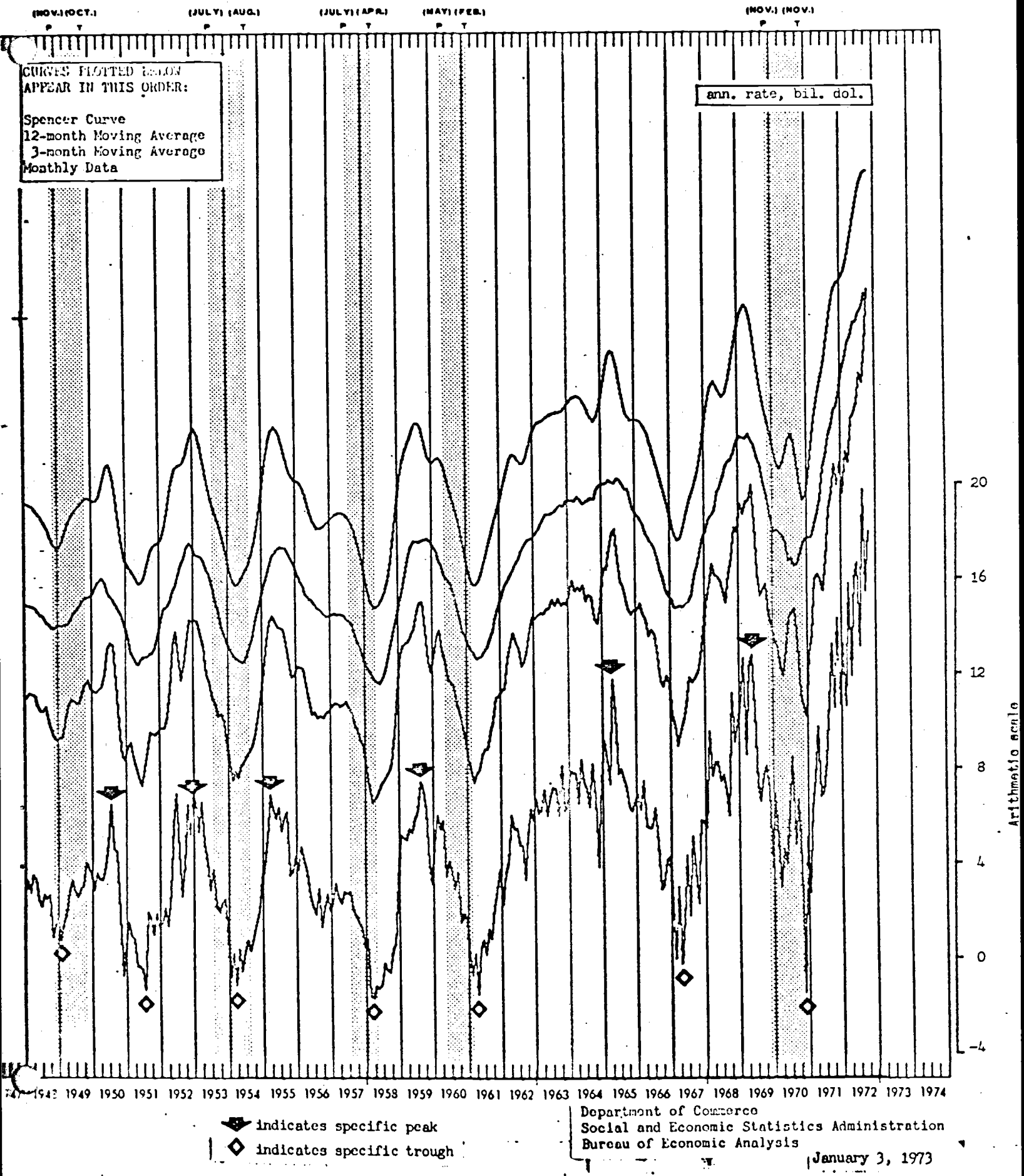
## 43. Unemployment rate, total




Department of Commerce
Social and Economic Statistics Administration
Bureau of Economic Analysis

May 15, 1973

113. Change in consumer installment debt



The change in consumer installment debt is subject to sizable erratic variations--a frequent characteristic of monthly first difference series--but these short movements do not obscure the longer cyclical fluctuations with their large amplitudes and long leads at peaks (short leads or coincidences at troughs). In addition to the declines associated with business recessions (shaded areas), the change in consumer installment debt shows about equally large "extra" declines in 1950-51 and 1965-66. Such movements, which signalize the much less visible retardations in the growth of the comprehensive coincident aggregates in 1951-52 and 1966 (see, e.g., the GNP charts), appear in many sensitive leading indicators.

The composite indexes shown in Chart 2 combine indicators that have similar timing but differ greatly in other respects (economic process, coverage, frequency of observation, smoothness, etc.). The indexes are constructed by standardizing the per-month percentage changes in each series so that all are expressed in comparable units.[50] Also, the index of leading indicators has been "reverse trend adjusted" to increase its long-run trend so as to make it parallel to that of the index of coincident indicators. This tends to shorten (lengthen) the leads of the former index at business cycle peaks (troughs); it also reduces the timing variability for the leading index and facilitates comparisons between the three indexes presented in this chart.[51]

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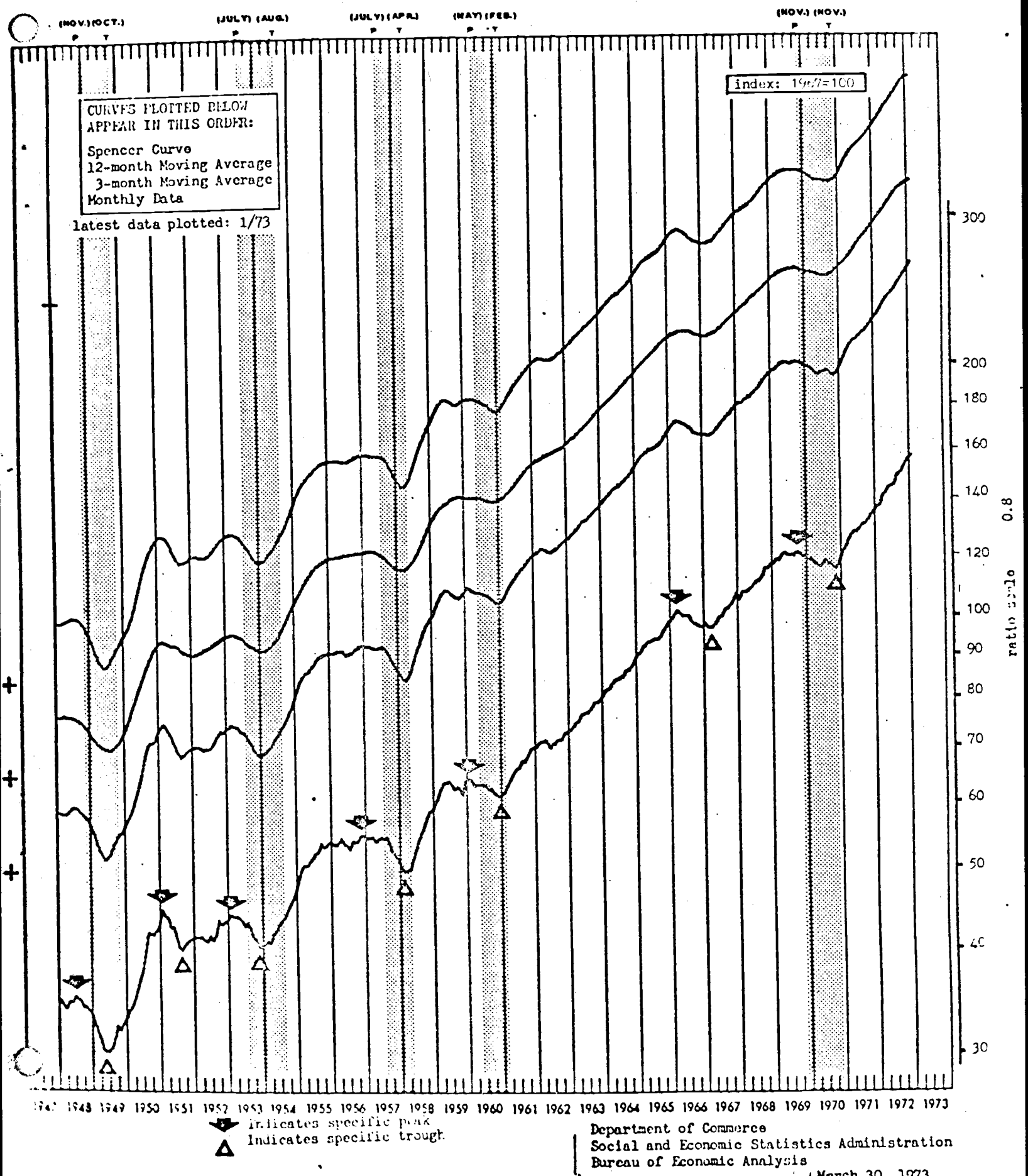
[50] That is, the average month-to-month change, without regard to direction, is 1 for each component series and the index as a whole. For more detail, see Julius Shiskin, Signals of Recession and Recovery, NBER Occasional Paper 77, New York, 1961, Appendix A.

[51] J. Shiskin, "Reverse Trend Adjustment of Leading Indicators," Review of Economics and Statistics, February, 1967.

SCD Review

## 810. Twelve leading indicators, reverse trend adjusted (series 1, 5, 6, 10, 12, 16, 17, 19, 23, 29, 31, 113)

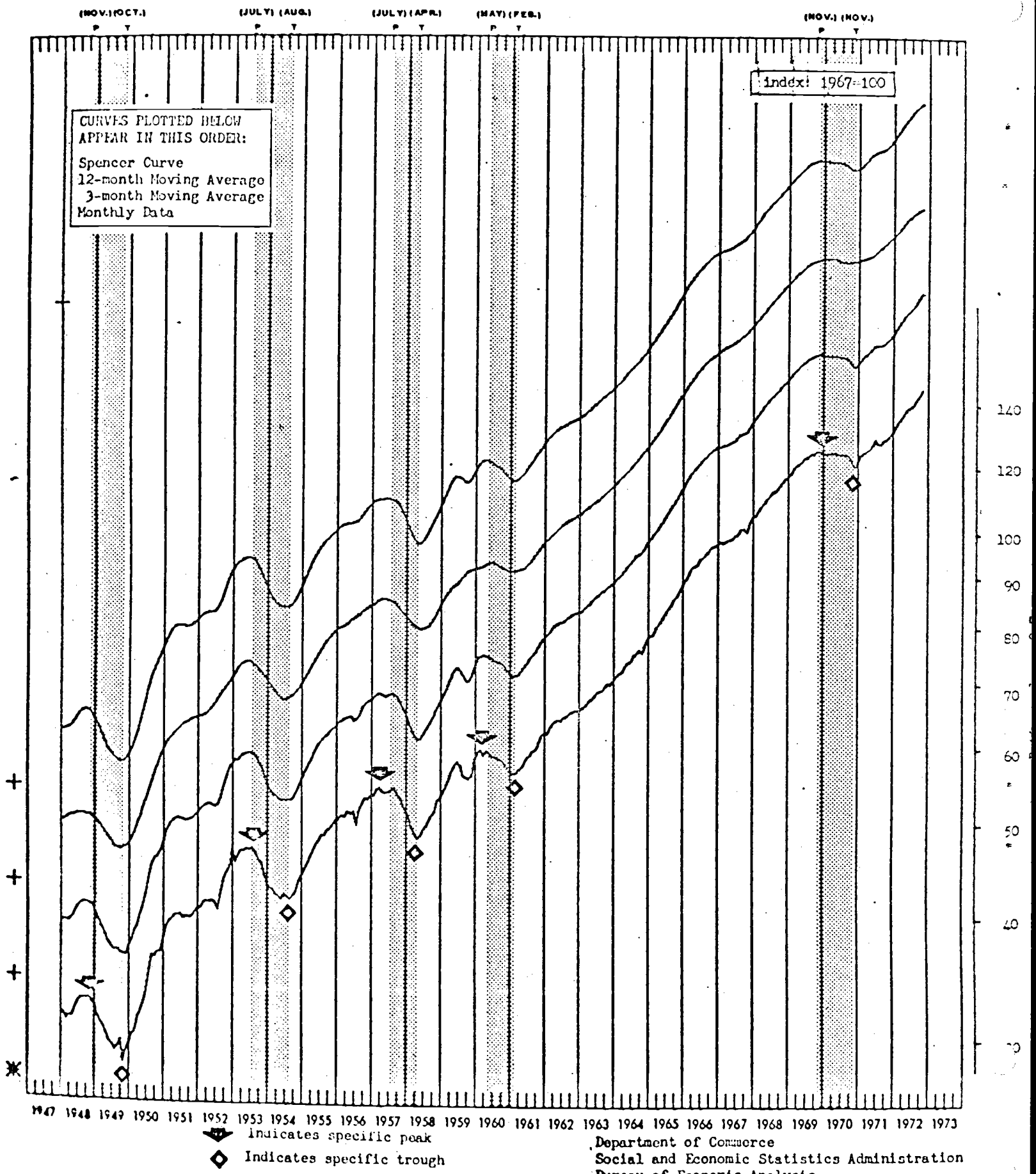



Department of Commerce
Social and Economic Statistics Administration
Bureau of Economic Analysis

March 30, 1973

BCD Review

820. Five coincident indicators, estimated aggregate economic activity — original index
(series 41, 43, 47, 52, 56)

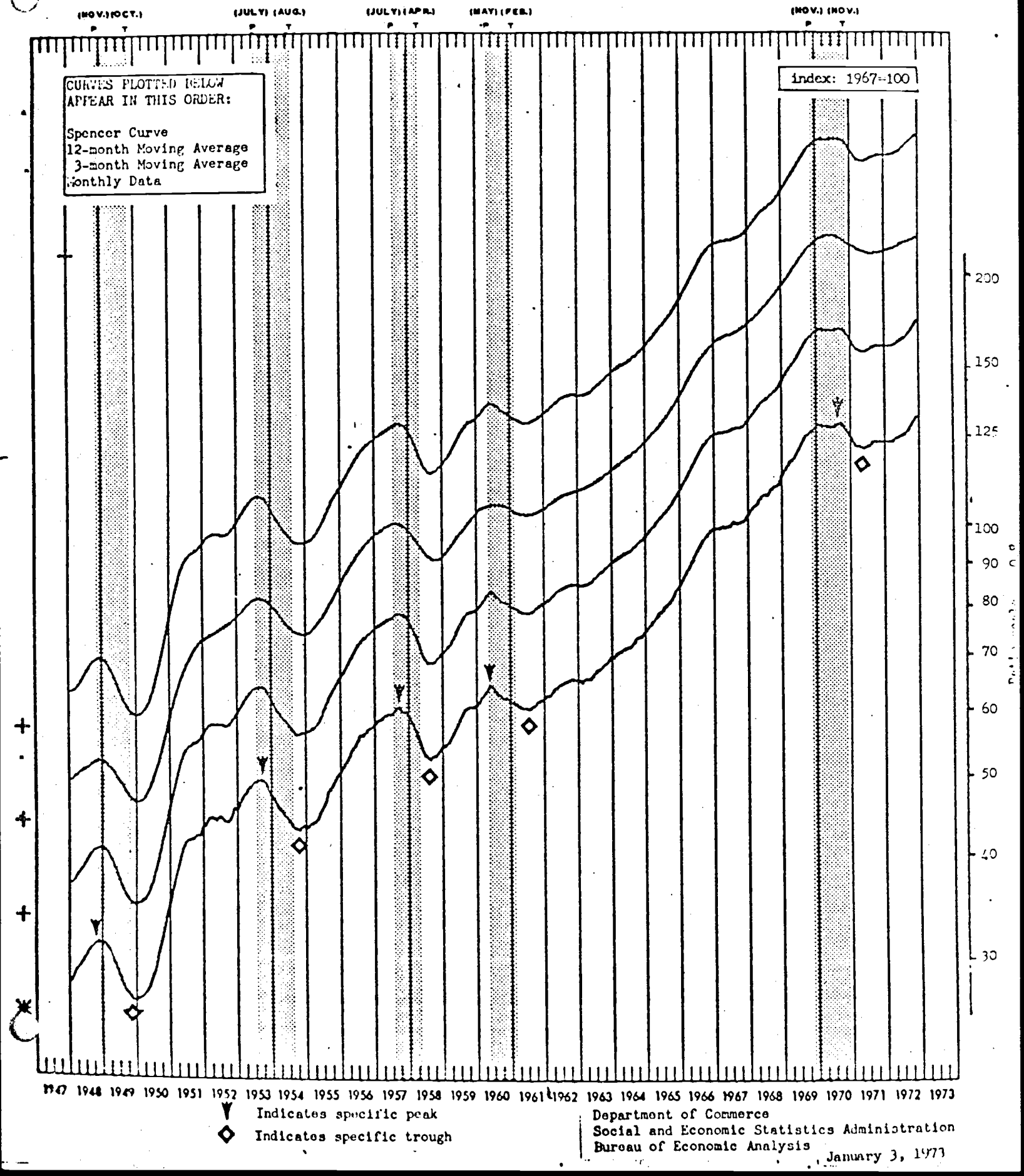



Department of Commerce
Social and Economic Statistics Administration
Bureau of Economic Analysis

December 14, 1972

BCD Review

830. Six lagging indicators.
(series 44, 61, 62, 67, 71, 72)




Department of Commerce
Social and Economic Statistics Administration
Bureau of Economic Analysis

January 3, 1973

The composite index of leading indicators[52] has led at every peak and (though lately by very short intervals) at every trough in the U.S. business cycles of the post-World War II period. The only other cyclical contractions in this series occurred in 1951 and 1966, matching the retardations in economic growth that somewhat later showed up in GNP and other coincident aggregates. The leading index has shown no major downturns and upturns at any other time,[53] and in this sense has given no false signals, i.e., unconfirmed anticipations of a serious weakening or strengthening of the economy. This statistical construct, then, is remarkably sensitive to business recessions and recoveries, as well as to pervasive slowdowns and speedups; yet it is also relatively smooth and capable of being rather efficiently updated.

The composite index of coincident indicators[54] had exact coincidences or short leads at business cycle peaks and exact coincidences only at troughs. It lagged behind the leading index on each of these occasions, although often by very short intervals. No major declines are recorded in this index at any times other than the NBER-designated recessions.[55]

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[52]The twelve series included in this index are listed in Table 1, lines 1-12.

[53]The much shorter and smaller declines in mid-1952, mid-1956, and the second half of 1959 are all connected with the main strikes of this era (centering on the steel industry). Such strikes (the last of which occurred late in 1970) sometimes make the recognition of cyclical turns in the economy's course particularly difficult.

[54]The five series included in this index are listed in Table 1, lines 13, 14, 15, 17, and 19.

[55]The effects of the major strikes mentioned in footnote 53 are visible in this index, too, but in a very attenuated form.

The composite index of lagging indicators[56] coincided at two and lagged at three of the peaks, while lagging at each of the troughs in aggregate economic activity. Thus, at turning points, this index tends to move for a time in a direction opposite to the leading and then to the coincident index, which can help verifying the occurrence of a recession or recovery. Like the coinciders and unlike the leaders, the lagging series tend merely to undergo slowdowns, not absolute declines, during periods of retarded growth, and this is clearly reflected in the corresponding composite indexes.

Since most of the indicators were selected and classified many years ago, and the underlying data undergo various revisions and sometimes conceptual changes, the recent behavior of these series provides a fair test of their usefulness. The charts, especially those for the composite indexes, suggest that the indicators continued to perform reasonably well during the expansion preceding the 1970 recession and also during the last contraction and the following recovery and upswing. That is, the series that had been expected to lead did so, and the series that had been expected to lag did so too, relative to the movements of the group of the "roughly coincident" indicators representing the main aspects of aggregate economic activity (employment, production, and income).

However, such graphical analyses permit only broad and rather impressionistic inferences. The evaluation of indicators will require a numerical and detailed record of how the many time series in question have performed.

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[56] The six series included in this index are listed in Table 1, lines 21-26.

Table 1 takes a step in this direction. It presents measures of central tendency and dispersion of cyclical timing for all indicators on the NBER short list and all composite indexes currently in use.[57] The individual series are cross-classified according to the overall timing categories presently adopted in BCD and according to the distinction between the real and nominal indicators that was drawn up for this study.[58] New summary timing measures and classifications are provided for the observations at business cycle peaks and troughs separately.

In the 1966 evaluation by Moore and Shiskin, an indicator was classed as leading if its median timing at all business cycle turns covered was two months or more and if the probability that the observed proportion of leads could be attributed to chance was sufficiently low.[59] The twelve series listed in the first section of Table 1 all pass this double test when the observations at peaks and troughs are combined for each indicator. The overall mean leads vary from 7.2 to 12.4 months for

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[57] See footnote 26 above. [58] See footnote 36 above.

[59] The probability test was first devised by Moore in his 1950 study (as cited in footnote 28). It is based on the assumptions that the probability that a series will produce a timing comparison of a given type at a reference turn is one-half and that the results in successive cycles are independent. These assumptions can be questioned but they permit application of the binomial and this simple method appears to be adequate as a rough screening device. The maximum acceptance level corresponds as nearly as possible to the probability $P = 0.250$ (e.g., the probability is 0.223 that four or more leads will occur when a leading indicator covers six turns). The longer the series (the more turns it covers), the lower the probability for a given proportion of successes (say, leads for a leading indicator). Thus, the maximum acceptable percentage of failuresis directly related to the length of the series. An exact coincidence is counted as a half-lead and a half-lag; so that for leads the successes are represented by leads and half the number of exact coincidences (the other 50 percent of the observations are, of course, failures; while for lags the reverse applies). See also Moore and Shiskin (as cited in footnote 28), pp. 18-19 and 91.

TABLE 1

TIMING OF SELECTED INDICATORS AND COMPOSITE INDEXES AT BUSINESS CYCLE PEAKS AND TROUGHS, SUMMARY MEASURES AND CLASSIFICATIONS, 1948-70

| Line No. | BCD No. | BCD Timing Classification and Title of Series | Leads (-) or Lags (+), in Months | | | Timing Classification[a] | Leads (-) or Lags (+), in Months | | | Timing Classification[a] | Leads (-) or Lags (+) in Months | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Median (1) | Mean (2) | Stand. Dev. (3) | (4) | Median (5) | Mean (6) | Stand. Dev. (7) | (8) | Mean (9) | Stand. Dev. (10) |
| | | | Business Cycle Peaks | | | | Business Cycle Troughs | | | | All Turns | |
| I. | Leading Indicators | | | | | | A. Real Series[b] | | | | | |
| 1 | 1 | Avg. work week, prod. wkrs., mfg. | -13 | -12.2 | 5.12 | L | -2 | -2.8 | 2.04 | L | -7.5 | 6.10 |
| 2 | 5 | Avg. wkly. initial claims, unemp. ins. | -13 | -16.6 | 7.20 | L | 0 | -1.2 | 2.48 | C[c] | -8.9 | 9.40 |
| 3 | 12 | Index of net business formation | -11 1/2 | -14.2 | 6.38 | L | -1 | -1.6 | 2.15 | C[c] | -7.2 | 7.76 |
| 4 | 17 | Ratio, price to unit labor costs, mfg. | -21 | -21.8 | 12.32 | L | -2 | -3.0 | 3.10 | L | -12.4 | 13.00 |
| 5 | 29 | New bldg. permits (priv. hous. units) | -13 | -15.4 | 7.66 | L | -9 | -6.8 | 3.97 | L | -11.1 | 7.46 |
| | | | | | | | B. Nominal and Price Series[d] | | | | | |
| 6 | 6 | New orders, durable goods industries | -9 | -10.0 | 5.59 | L | -3 | -2.8 | 1.60 | L | -6.4 | 5.46 |
| 7 | 10 | Contracts and orders, plant and equip. | -12 | -14.5 | 6.98 | L | -1 | -2.0 | 3.22 | U[e] | -7.6 | 8.13 |
| 8 | 16 | Corporate profits after taxes (Q)[f] | -12 | -10.4 | 6.12 | L | -2 | -3.2 | 3.43 | L | -6.8 | 6.13 |
| 9 | 19 | Stock prices, 500 common stocks, index | -10 | - 8.8 | 2.79 | L | -4 | -5.6 | 2.73 | L | -7.2 | 3.19 |
| 10 | 23 | Industrial materials price index | -10 | -12.2 | 10.98 | L | -2 | -0.8 | 4.83 | L | -6.5 | 10.22 |
| 11 | 31 | Change in mfg. & trade inventories (book value) | - 9 | -12.6 | 8.45 | L | -2 | -1.0 | 7.21 | L | -6.8 | 9.76 |
| 12 | 113 | Changes in consumer installment debt | - 9 | -12.4 | 8.06 | L | -1 | -2.6 | 3.93 | L | -7.5 | 8.02 |
| II. | Roughly Coincident Indicators | | | | | | A. Real Services[b] | | | | | |
| 13 | 41 | Employees on nonagricultural payrolls | - 2 | - 1.2 | 2.79 | L | 0 | +0.2 | 0.40 | C | -0.5 | 2.11 |
| 14 | 43 | Unemployment rate, total (inverted) | - 6 | - 6.6 | 3.93 | L | +3 | +3.2 | 3.12 | Lg[g] | -1.7 | 6.05 |
| 15 | 47 | Index of industrial production | - 4 | - 2.8 | 2.14 | L | 0 | -0.8 | 1.60 | C | -1.8 | 2.14 |
| 16 | 205 | GNP in 1958 dollars (Q) | - 2 | - 1.4 | 1.62 | L[h] | -2 | -2.0 | 1.90 | L[h] | -1.7 | 1.79 |
| | | | | | | | B. Nominal and Price Series[d] | | | | | |
| 17 | 52 | Personal income | + 1 | + 1.0 | 1.63 | U | -3 | -3.0 | 0.82 | U | -1.0 | 2.38 |
| 18 | 54 | Sales of retail stores | 0 | - 0.7 | 2.05 | U | -2 | -2.2 | 3.27 | U | -1.5 | 2.83 |
| 19 | 56 | Manufacturing and trade sales | - 3 | - 2.6 | 1.86 | L | 0 | -0.4 | 0.49 | C[c] | -1.5 | 1.75 |
| 20 | 200 | GNP in current dollars (Q) | 0 | - 0.2 | 1.09 | C | -2 1/2 | -1.8 | 1.64 | C | -1.0 | 1.58 |

TABLE 1

(Continued)

| Line No. | BCD No. | BCD Timing Classification and Title of Series | Leads (-) or Lags (+), in Months: Median (1) | Mean (2) | Stand. Dev. (3) | Timing Classification[a] (4) | Leads (-) or Lags (+), in Months: Median (5) | Mean (6) | Stand. Dev. (7) | Timing Classification[a] (8) | Leads (-) or Lags (+) in Months: Mean (9) | Stand. Dev. (10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Business Cycle Peaks | | | | Business Cycle Troughs | | | | All Turns | |
| III. | Lagging Indicators | | | | | | A. Real Series[b] | | | | | |
| 21 | 44 | Unemployment rate, 15 weeks and over | +2 | -0.2 | 4.02 | Lg[g] | +4 | +5.4 | 5.00 | Lg | +2.6 | 5.33 |
| | | | | | | | B. Nominal and Price Series[d] | | | | | |
| 22 | 61 | Business expend. for new plant and equip. (Q) | 0 | -0.2 | 1.09 | C | +2 | +2.0 | 1.58 | Lg | +0.9 | 1.76 |
| 23 | 62 | Labor costs per unit of output, mfg. | +9 | +6.7 | 3.90 | Lg | +10 | +10.5 | 1.87 | Lg | +8.6 | 3.39 |
| 24 | 67 | Bank rates on short-term business loans (Q) | +4 | +2.2 | 4.21 | Lg | +6 | +14.8 | 17.24 | Lg | +8.5 | 14.04 |
| 25 | 71 | Mfg. and trade inventories, book value | + 2 1/2 | +2.5 | 0.50 | Lg[g] | +2 1/2 | +2.7 | 0.83 | Lg | +2.6 | 0.70 |
| 26 | 72 | Comm. and indus. loans outstanding, Large comm. banks | + 1 1/2 | +2.5 | 4.72 | U | +3 | +4.0 | 2.45 | Lg | +3.2 | 3.83 |
| IV. | Composite Indexes | | | | | | | | | | | |
| 27 | 810 | 12 leading indicators,[i] reverse trend adjusted | - 5 | -5.0 | 2.00 | L | -2 | -3.8 | 2.93 | L | -4.4 | 2.58 |
| 28 | 811 | 12 leading indicators,[i] prior to trend adjustment | - 9 1/2 | -11.7 | 6.34 | L | -2 | -2.2 | 2.04 | L | -6.4 | 6.53 |
| 29 | 813 | 4 marginal employment adjustments[j] | - 10 1/2 | -12.0 | 4.95 | L | -2 | -2.6 | 1.62 | L | -6.8 | 5.85 |
| 30 | 814 | 4 capital investment commitments[k] | -12 | -13.2 | 5.63 | L | -2 | -2.4 | 1.50 | L[h] | -7.2 | 6.66 |
| 31 | 815 | 4 inventory investment and purchasing[l] | -16 | -15.7 | 10.47 | L | -2 | 0.2 | 6.14 | L | -6.9 | 11.51 |
| 32 | 816 | 3 profitability[m] | - 6 | -10.2 | 6.40 | L | -3 | -3.4 | 3.14 | L | -6.8 | 6.08 |
| 33 | 817 | 4 sensitive financial flows[n] | -11 | -12.0 | 6.99 | L | -4 | -4.2 | 3.37 | L | -8.1 | 6.73 |
| 34 | 820 | 5 coincident indicators[o] | - 1 | - 1.4 | 1.86 | Cc | 0 | 0 | 0 | C | -0.7 | 1.49 |
| 35 | 825 | 5 coincident indicators, deflated[p] | - 1 | - 1.8 | 1.47 | Cc | 0 | -0.6 | 1.20 | C | -1.2 | 1.47 |
| 36 | 830 | 6 lagging indicators[r] | + 2 | + 2.6 | 3.32 | Lgg | +4 | +3.8 | 1.60 | Lg | +3.2 | 2.68 |

[a] L = leading; C = roughly coincident; Lg = lagging; U = unclassified by timing. Based on two criteria: (1) median timing (a lead of 2 months or more for L; a lag of 2 months or more for Lg; -1, 0, or +1 month for C) and (2) probability that the observed proportion of leads or rough coincidences or lags could occur by chance (maximum acceptance level P = 0.250). See text and footnotes 59 and 60.

[b] Series in physical units, quantity indexes, and aggregates in constant prices (deflated).

TABLE 1

(Concluded)

[c] On the probability test alone, the classification would be C/L (both C and L accepted; see footnote 60), but the median criterion indicates C.

[d] Aggregates in current dollars (nominal series) and price indexes and interest rates (price series).

[e] On the probability test alone, the classification would be L, but the median lead (-1) is not long enough (see note a).

[f] Q denotes quarterly series. All series not so marked are monthly.

[g] On the probability test alone, the classification would be C/Lg.

[h] On the probability test alone, the classification would be C/L.

[i] The series in section I of this table (lines 1-12).

[j] BCD series 1 and 5 (lines 1 and 2) and BCD series 2 (accession rate, mfg.) and 3 (layoff rate, mfg.).

[k] BCD series 12, 29, 6, and 10 (lines 3, 5, 6, and 7).

[l] BCD series 23 and 31 (lines 10 and 11) and BCD series 25 (change in unfilled orders, durable goods industries) and 37 (purchased materials, percent of companies reporting higher inventories).

[m] BCD series 17, 16, and 19 (lines 4, 8 and 9).

[n] BCD series 113 (line 12) and BCD series 33 (change in mortgage debt), 85 (change in money supply, M1), and 112 (change in bank loans to businesses).

[o] BCD series 41, 43, 47, 52 and 56 (lines 13, 14, 15, 17 and 19).

[p] BCD series 41, 43, and 47 (lines 13, 14 and 15) and BCD series 52D (personal income, deflated) and 56D (manufacturing and trade sales, deflated).

[r] The series in section III of this table (lines 21-26).

the real series in this group and cluster narrowly between 6.4 and 7.6 months for the nominal and price series (col. 9). The median leads are in most cases smaller than the mean leads but the differences are not large. The timing comparisons show a great deal of dispersion (col. 10), but leads prevail heavily over lags. At business cycle peaks, the timing characteristics of these series are entirely unambiguous (cols. 1-4). Here the average leads are 9-12 months or even longer and each of the twelve series qualifies as "leading (L) under the probability test. At troughs (cols. 5-8) the leads are much shorter than at peaks, with most of the averages falling in the 1-4 months range. One of the series is accepted for rough coincidences rather than leads and two others are rather difficult to classify under the adopted rules.[60] However, these seem to be marginal cases. I conclude that the selection of these 12 series as leading indicators, made in earlier NBER studies on the strength of the then available historical evidence, is generally confirmed by the new measures here presented, for both peaks and troughs and also for both the real and the nominal data subsets.

The findings for the roughly coincident indicators in Section II of Table 1 leave much more room for doubt. The overall timing averages fall in a narrow range close to 0, but they are all short <u>leads</u> (varying

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[60] See Table 1, col. 8, lines 2, 3, and 7, and footnotes c and e. The probability test for the significance of rough coincidences treats all leads and lags that are longer than three months as failures. Success in this test does not preclude a series from also passing the test as a leader (if short leads prevail strongly in the record) or as a lagger (if short lags prevail). However, such double classifications (C/L and C/Lg) are eliminated when the median timing rule is added to the probability test rule, since the former makes a clear distinction between the three timing categories in terms of the observed median leads or lags (see Table 1, footnote a).

from 0.5 to 1.8 months, col. 9). At peaks, the real series have longer leads, with medians of 2-6 months, and they qualify as leaders rather than coinciders.[61] Of the nominal series, two (personal income and retail sales) fail to pass the probability tests, one (manufacturing and trade sales) passes but as a leader, and only one (GNP) qualifies as a coincider. At troughs, the unemployment rate is better described as a short lagger than a coincider, and the median timing of GNP is again a short lead (see footnote 61); also, personal income and retail sales fail the tests here as well as at peaks and must be designated "U" (unclassified by timing).

The indicators grouped as lagging in the NBER short list (section III of the table) have sufficiently long average lags at all turns, except for business expenditures on plant and equipment, which qualifies as coincider at peaks (line 22). Also, the series on commercial and industrial bank loans fails the test at peaks (line 26). All six indicators in this group are accepted for lags (Lg) at troughs.

The composite indexes conform well to the expected timing patterns, as shown in the last section of Table 1. The index of 12 leading indicators has variable but on the average long leads at peaks, short leads at troughs; the reverse trend adjustment reduces these discrepancies.[62] The indexes for the five leading indicator subgroups (lines 29-33) display similar concentrations of long leads at peaks, short leads at troughs.[63] The indexes of

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[61] Real GNP would be accepted for both rough coincidences and leads, but the median timing (-2) indicates the classification L (see Table 1, line 16).

[62] Compare lines 27 and 28 in Table 1 and see text and footnote 51 on page 32 above. These indexes cover the leading series from the NBER short list only.

[63] These indexes are not reverse trend adjusted. Taken together, they include the 12 leading indicators from the NBER short list and 7 other series (see notes to Table 1).

coincident indicators, particularly the deflated one, have slight tendencies toward short leads at peaks, but there is no doubt about their basic timing characteristics.[64] Finally, lags dominate the timing record of the composite index of lagging indicators, but more decidely so at troughs than at peaks.[65]

Table 2 presents a different type of summary for a larger collection of time series,[66] namely the group timing averages at each successive peak and trough of U.S. business cycles since 1948. These measures confirm that the real indicators tend to have longer leads at peaks than the nominal indicators, which reflects inflation in the advanced stages of economic expansions. The series classified as leading and lagging in BCD show the expected timing (mean leads and lags, respectively) at each of the turns covered (cols. 1-3 and 7-8). The series classified as roughly coincident in BCD do occupy the middle ground between the leaders and the laggers, but they show a preponderance of leads, particularly the real indicators at peaks (cols. 4-6). The leads are on the whole considerably longer at peaks than at troughs, and the lags are conversely shorter at peaks than at troughs (lines 6 and 12).

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[64] The coincident index includes 5 of the 8 series classed as roughly coincident in the NBER short list (omitting the quarterly indicators and one monthly series on account of overlapping coverage; see Table 1, footnote o). The deflated index uses constant-dollar rather than current-dollar series for personal income and manufacturing and trade sales (footnote p).

[65] This index includes the six lagging indicators from the NBER short list. It may be added that its lags were considerably longer at the last two business cycle turns (relating to the 1969-70 recession) than generally on earlier occasions (see Chart 2).

[66] These are 54 cyclical indicators from section B of BCD, including 21 series from the NBER short list (see also Table 2, footnote e).

TABLE 2

SUMMARY OF CYCLICAL TIMING FOR 54 INDICATORS, 1948-70

| | Leading Indicators[a] | | | Roughly Coincident Indicators[a] | | | Lagging Indicators[a] | | |
|---|---|---|---|---|---|---|---|---|---|
| | Real Series (15)[b] | Nominal and Price Series (12)[c] | All Series (27) | Real Series (9)[b] | Nominal and Price Series (12)[c] | All Series (21) | Nominal and Price Series (5)[c] | All Series (6)[d] | All Indicators[e] |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Ref. Peaks | Mean Lead (-) or Lag (+), In Months | | | | | | | | |
| 1. Nov. 1948 | -17.5 | -9.4 | -14.1 | -4.2 | -4.0 | -4.1 | +2.2 | +2.2 | -8.3 |
| 2. July 1953 | - 7.3 | -9.6 | - 8.4 | -2.2 | -0.5 | -1.3 | +5.4 | +5.0 | -4.0 |
| 3. July 1957 | -20.6 | -17.9 | -19.4 | -6.8 | -1.3 | -3.9 | +4.0 | +3.7 | -10.9 |
| 4. May 1960 | -11.1 | -10.2 | -10.7 | -4.7 | -3.4 | -4.1 | +5.8 | +4.8 | -6.5 |
| 5. Nov. 1969 | -15.1 | -7.8 | -11.8 | -3.3 | +0.7 | -1.0 | n.o. | -8.0 | -8.2 |
| 6. All peaks | -14.4 | -11.1 | -12.9 | -4.3 | -1.8 | -3.0 | +4.5 | +3.5 | -7.6 |
| Ref. Troughs | | | | | | | | | |
| 7. Oct. 1949 | - 5.7 | -5.1 | - 5.5 | -1.1 | +0.9 | 0 | +3.8 | +3.2 | -2.5 |
| 8. Aug. 1954 | - 6.4 | -7.0 | - 6.7 | -1.4 | -1.2 | -1.3 | +3.0 | +2.8 | -3.4 |
| 9. Apr. 1958 | - 1.1 | -2.5 | - 1.7 | +0.3 | +0.8 | +0.6 | +6.8 | +6.3 | +0.04 |
| 10. Feb. 1961 | - 1.7 | -2.8 | - 2.1 | +0.8 | +4.4 | +2.3 | +12.4 | +11.2 | +1.0 |
| 11. Nov. 1970 | - 0.3 | -0.9 | - 0.6 | +0.7 | +7.0 | +2.7 | n.o. | +4.0 | +0.7 |
| 12. All troughs | - 2.8 | -3.5 | - 3.1 | -0.1 | +1.7 | +0.8 | +6.6 | +5.9 | -0.8 |
| 13. All turns | - 8.5 | -7.3 | - 7.9 | -2.2 | -0.05 | -1.1 | +5.6 | +4.7 | -4.1 |

[a]Classified as such in BCD.

[b]Series in physical units, quantity indexes, and aggregates in constant prices (deflated).

[c]Aggregates in current dollars (nominal series) and price indexes and interest rates (price series).

[d]Includes the five series covered in column 7 and one real series not shown separately.

[e]Includes all 54 series covered in the table. Twenty-six of these series are identifed in Table 1, lines 1, 2, 3, 5, 6, 8-22, 25, and as components of the composite indexes for the leading indicator subgroups, in footnotes f through j in Table 1.

n. o.
No observations.

Closer reading of Table 2 suggests that the behavior of the indicators generally may vary in systematic ways at the different business cycle recessions and revivals. For example, the leads at peaks were on the average relatively short in 1953 and long in 1957; the leads at troughs were relatively long in 1954 and short in 1970; the lags were much longer in 1961 than at any other revival; etc. This is consistent with more detailed evidence on the corresponding specific turning points and is associated with the fact that strong positive correlations are common among indicators within the same timing category. But the particular cyclical episodes covered would have to be closely examined to explain the observed differences between them.

## 5. Further Considerations

What do we learn from these results? As ever so often, in answering this question some others must be raised:

1. What revisions, if any, are to be made in the dates of the business cycle peaks and troughs?

One might read Tables 1 and 2 as saying that at least some of the recent peaks in the NBER reference chronology are dated too late, because too many average leads, which are not always small enough, are recorded at these turns for the "roughly coincident" indicators. A review of the reference dates is indeed needed and is now in progress. It requires more and different measures than I was able to present in this paper. There is no way to derive an acceptable chronology mechanically from one or a few selected series; rather, the procedure must involve a combination of judgment and working rules of cyclical analysis.[67] Since both the structure of the economy and the relevant statistical information are changing, reappraisals of the evidence are necessary in matters of selecting the proper indicators of "aggregate economic activity" and their turning points, the methods and weights to be used in combining these indicators, etc.[68] It is convenient to have monthly reference dates, but of course, these can only be workable approximations and should not be taken to be highly precise (claims of close

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[67] The reasons are discussed in V. Zarnowitz, "On the Dating of Business Cycles," Journal of Business, April 1963, pp. 179-99.

[68] The decisions must often consider a wide range of problems, e.g., the adequacy of seasonal adjustments, the effects of strikes and other "random events," the consequences of using some quarterly series in addition to the monthly ones, and so on.

accuracy in this context would necessarily be spurious).[69] Where turning points in the major indicators of macroeconomic activity are closely clustered, the approximations are better than where these turns are widely scattered. In the latter cases of relatively flat turning zones, the NBER practice is to place the reference date toward the close of the transition period, unless economic or statistical considerations indicate otherwise.[70] Some of the propensity to lead in the timing of the roughly coincident indicators is attributable to this rule of late dating.

We are reviewing the NBER business cycle chronology for the United States since 1948 by a close analysis of a set of 19 important indicators relating to aggregate employment, income, expenditures, and sales. Historically these series tended to have the overall properties of roughly coincident indicators. As many as 12 of them are real aggregates or indexes. Distributions of specific cycle turns, diffusion indexes and their cumulative versions, and composite (amplitude-adjusted) indexes--all these methods of distilling the relevant evidence are applied to this selection of series as a whole and to its real and nominal subsets. This work is not yet completed but the drift of the results is already emerging. Briefly, the shifts in the present reference dates that may be indicated are small and mainly limited to a few peaks. Some of them are well supported by the

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[69] It is therefore fortunate that "the consequences of errors and shifts in reference dates for the analysis of timing relations among interdependent economic processes are not very troublesome. A common reference point [date] offers a convenient short-cut device for measuring these relations, but the latter are independent of it" (Zarnowitz, "On the Dating of Business Cycles," as cited, pp. 184-185). This is so because obviously the sequence of turning points in specific series is not affected by the selection of a reference date.

[70] There are some arguments against this rule, but those for it are believed to have been stronger in the past (see ibid., p. 194).

evidence, others are still doubtful.[71]

2. How should we interpret and use the differences between (a) the timing patterns at peaks and troughs; (b) the cyclical changes in real and in nominal and price series?

There are important systematic elements in each of these distinctions. They would not be significantly affected by any changes that might realistically be made in the U.S. business cycle chronology. There is need to place more emphasis in cyclical analysis on this double dichotomy and less on overall measures that cut across these divisions and conceal the systematic differences involved.

There are several reasons for the well-observed peak-trough timing differences. In late stages of expansion, production in many industries is supported at high and even rising levels by the backlog of unfilled orders accumulated earlier during the business upswing; hence, output and shipments can continue increasing for some time after the downturn in demand (i.e., in currently received orders). In contrast, at the end of a contraction, orders backlogs are depleted and capacity reserves plentiful, so that when current orders turn up so does output with little delay.[72] In general, forces of growth help to prolong the expansion in aggregate economic activity in its late, faltering phase even though declines had already occurred in many partial indicators (economic processes and sectors); but the same forces

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[71] Examples of the former are: a change of the November 1948 peak to October 1948 and a change of the May 1960 peak to April 1960 (perhaps also the shift of the July 1957 peak date to August 1957). The two somewhat larger and more uncertain changes would be: a shift of the July 1953 peak to May 1953 and of the August 1954 trough to May 1954.

[72] Substantial evidence that the leads of new orders and contracts are longer at peaks than at troughs is assembled in Zarnowitz, Orders, Production, and Investment (as cited in footnote 8), Chapters 4 and 11.

also help to shorten the contraction and hasten the transition to recovery.

The real indicators are being given a large total weight in our study, particularly in determining the time-reference framework of the analysis. There are special reasons for this emphasis in the present era of sustained inflation, but these variables always deserved and attracted much attention in business cycle studies, including those of the National Bureau. However, nominal and price series must continue to be included in these studies as well. Separate chronologies and other summary measures for the sets of real and nominal indicators should be useful and will be prepared in the course of this research project, but there is no good reason to base the concept and the analysis of business cycles on the real indicators only.

3. How is the current list of the main cyclical indicators to be assessed in the light of this review?

The leading indicators on the NBER short list performed in recent years (including the 1967 slowdown, the 1968-70 sequence of inflationary boom and recession, and the recovery and expansion since 1971) about as well as in the past.[73] Of the roughly coincident indicators, one or two seem to be doing poorly. In particular, personal income did not decline during either the last (1970) or the previous (1960) recession. The series, wages and salaries in manufacturing, construction, and mining, would appear to be a better choice for the short list, despite its narrower coverage, since its record as a coin-

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[73] The only significant deviation seems to be that the investment in (change in value of) manufacturing and trade inventories has been unusually sluggish in the 1971 recovery; its upturn lagged behind the cycle trough in November 1970 by a full year. This is an interesting episode, which however may well be rather singular. It does not, of course, detract from the importance of this series as a representation of one of the major cyclical variables, and the overall record of this indicator is still good (Table 1, line 11).

cident indicator is very good.[74] Finally, the selection of the main lagging indicators retains its validity on grounds of both the economic theory of cyclical processes and the usefulness of statistical applications, but it is important to bear in mind that as many as three of the six series in this group failed to show cyclical declines throughout this period.[75]

To sum up, most of the series now identified as the principal indicators continue to meet the required standards, but in some cases substitutions of different series within the same economic-process and timing categories may well prove desirable. Since the ongoing review extends to many other indicators (including, but not limited to, those presently published in BCD), there will be many more additions and deletions to be considered.

Much further work is needed in several areas to which I already referred, notably on the concept, dating, and indicators of growth cycles, on the relations between the "objective" indicators and the "subjective" anticipations data, and on the economic policy indicators. These are promising as well as important subjects to which we hope to make some contributions, but their exploration in depth will obviously require far more research than can be undertaken within the scope of this project.

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[74] The drastic reduction in the fluctuations of personal income reflects the increased weight of relatively stable or even countercyclical types of income (including the effects of fiscal and other "automatic stabilizers"). However, inflation is also a factor: real (deflated) personal income did decline during each of the five U.S. recessions of the post-World War II period. Similarly, sales of retail stores, measured in current dollars, show no cyclical decline that can be matched with the 1970 recession, but the corresponding series in constant dollars does show such a decline.

[75] These series are: business expenditures for new plant and equipment, book value of manufacturing and trade inventories, and the index of labor cost per unit of output in manufacturing.