Forecasting the Depression: Harvard versus Yale

Kathryn M. Dominguez; Ray C. Fair; Matthew D. Shapiro

The American Economic Review, Vol. 78, No. 4 (Sep., 1988), 595-612.

Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28198809%2978%3A4%3C595%3AFTDHVY%3E2.0.CO%3B2-X

The American Economic Review is currently published by American Economic Association.

Forecasting the Depression: Harvard Versus Yale

By KATHRYN M. DOMINGUEZ, RAY C. FAIR, MATTHEW D. SHAPIRO*

Was the Depression forecastable? After the Crash, how long should it have taken contemporary forecasters to realize how severe the downturn was going to be? Data assembled by the Harvard and Yale forecasters — together with modern historical data — are subjected to statistical analysis. Neither contemporary forecasters nor modern times-series analysts could have forecast the large declines in output following the Crash.

James Tobin relates the following story, which was told to him and other members of the Harvard graduate economics club by Professor W. L. Crum. In the 1920s the Harvard Economic Service (HES) issued monthly reports on the current and expected future state of the economy. HES used three indexes, representing speculation, business, and money, to help predict the future. Crum claimed that in the summer of 1929 the statistical assistant at HES became alarmed when she noticed that the indexes indicated that a sharp downturn in economic activity was imminent. Crum did not see in the current business situation any cause for this adverse forecast. Moreover, he feared that a pessimistic forecast by the influential service could itself have an adverse effect on financial markets and economic activity. Therefore, he suppressed the pessimistic findings of the assistant;[1] the published report did not speak of a potential downturn.

The data, in fact, provide only mild support for this account. The account does, however, raise the more general question of whether the Depression was forecastable. Was there anything in the data prior to the October 1929 stock market Crash that indicated the economy was about to enter a protracted slowdown? How should the news of the Crash have revised forecasts of economic growth? To address these questions, we study two sets of data assembled by contemporary business-conditions forecasters. The first consists of the three HES indexes. The second consists of commodity and stock price indexes compiled and analyzed by Irving Fisher. Fisher, who was at Yale from 1891 until his death in 1947, was a competitor of HES. He also released periodic reports on the state of the economy, and he was a critic of the HES indexes.

We also use modern historical data on industrial production, producer prices, stock prices, time-loan rates, and the money stock in our statistical analysis. The use of these data allows us to address the broader question of the forecastability of the Depression without recourse to the services' idiosyncratic data. We can also ask whether the Depression-era data contain information not embodied in the modern data.

The procedures, data, and pronouncements of the Harvard and Yale forecasting services are discussed in Section I, where the accuracy of Crum's account is also investigated. Both services failed to anticipate the Depression and remained optimistic about economic performance following the Crash. In the following section, we examine the data using time-series analysis. The analysis suggests that the services' optimism was not unwarranted.

*Dominguez: John F. Kennedy School of Government, Harvard University, Cambridge, MA 02138. Fair and Shapiro: Cowles Foundation for Research in Economics, Yale University, New Haven, CT 06520, and National Bureau of Economic Research. We are grateful for helpful comments from James Tobin, Paul A. Samuelson, and anonymous referees.

[1]And consequently he lost the opportunity to gain a reputation for Delphic wisdom.

I. The Harvard and Yale Forecasting Services

The Harvard and Yale economic forecasting services were probably the two preeminent economic analysis and forecasting services available to businesses and members of the general public in the 1920s. Despite their similarities—their association with prominent academic institutions—they were quite different in purpose and organization. The Harvard service, which had a full-time professional staff, was designed as a business whose object was to provide corporations with economic analysis for short- and long-range planning. By contrast, Fisher provided a service that was designed originally as an educational tool for the public. Later, Fisher developed a full-scale advisory business,[2] but initially his pronouncements were published weekly in a syndicated newspaper column on economic affairs that appeared nationwide.

This section summarizes the activities of the two forecasting services. The Appendix gives a more detailed chronology of their pronouncements.

A. *Harvard Economic Service*

The HES forecasts, which were offered to businesses by annual subscription,[3] were centered on the Service's Index of General Business Conditions, which was created by HES's first editor, Warren Persons. Its three curves were meant to represent "speculation" (the *A*-curve), "business" (the *B*-curve), and "money" (the *C*-curve). The Harvard forecasts were then based on the relations determined to exist among the three curves during any given phase of the business cycle and on the magnitude of the movement from peak to trough of each curve (Persons, 1922).

Although the specific series that made up the three curves changed over the thirteen years that HES published the indexes, the basic index methodology remained the same. Curve *A*, representing speculation, included a series of New York bank clearings and industrial stock prices; curve *B*, representing business, included outside bank debits and commodity prices;[4] curve *C*, representing money, was based upon commercial paper rates.

The construction of the three indicators was as follows. First, the underlying component(s) in the index were adjusted for seasonality. Then, for each underlying component, a "similar" series *not* in the index was isolated, which was thought to represent a secular trend relative to the cyclical component in question. (For example, for the "money" series, the baseline was the average yield of ten prime railroad bonds of distant maturities.) Percentage deviations between each component of the index and the "baseline" series were taken and then normalized by the appropriate standard deviation. The resulting groups of adjusted components were then averaged to form the relevant index curve.

The resulting indexes are illustrated in Figures 1 and 2 for, respectively, the years 1904–13 and 1919–31.[5] The Harvard data

[2] In 1930, Fisher began to market the *Financial Analysis Service*, published by the Index Number Institute (a company founded by Fisher), which included analysis and economic forecasts based upon the Fisher indices. This publication was succeeded by a similar service named *Trade and Money Index* in late 1931. This service was in turn succeeded by *Market Indicators*, which ceased publication in 1934.

[3] A subscription to the service cost $100 per year ($805 in 1987 dollars) and consisted of the *Weekly Letter*, which contained the Index of General Business Conditions and an accompanying analysis and forecast, the *Quarterly Review of Economic Statistics*, and special statistical supplements.

[4] Curve *B* as first constructed by Persons in 1919 was a composite of economic series that reflected business conditions, including both production of materials and goods (most notably, pig-iron production) and transactions in commodities and services. The curve was revised in 1923 to include only bank debits and a ten-commodity price index. The position of the baseline (Bradstreet's index) used in constructing curve *B* "was determined by shifting the curve upward so that the crossing points with the ten-commodity index would correspond to the dates of crossing given for pig iron production, the index of trade, and outside debits." [Persons, 1923, p. 187]

[5] As can be seen, there appears to be strong predictive power in the earlier period. A close inspection of HES's brochure suggests, however, that the remarkable fit was in fact achieved by an "exhaustive study of business statistics, for the primary purpose of developing a reliable index of general business conditions" [Harvard University Committee on Economic Research, 1923b, p. 8] and that this exhaustive study was performed using data from the years 1904–13.

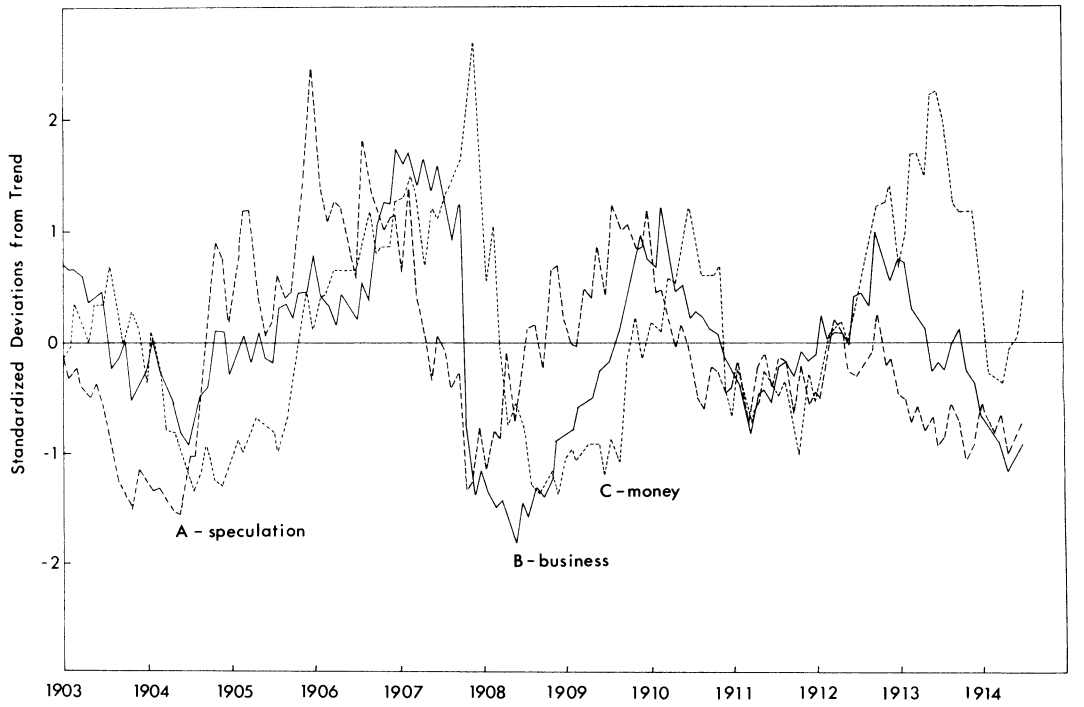

FIGURE 1. HES TEST-PERIOD INDEXES, 1903–14

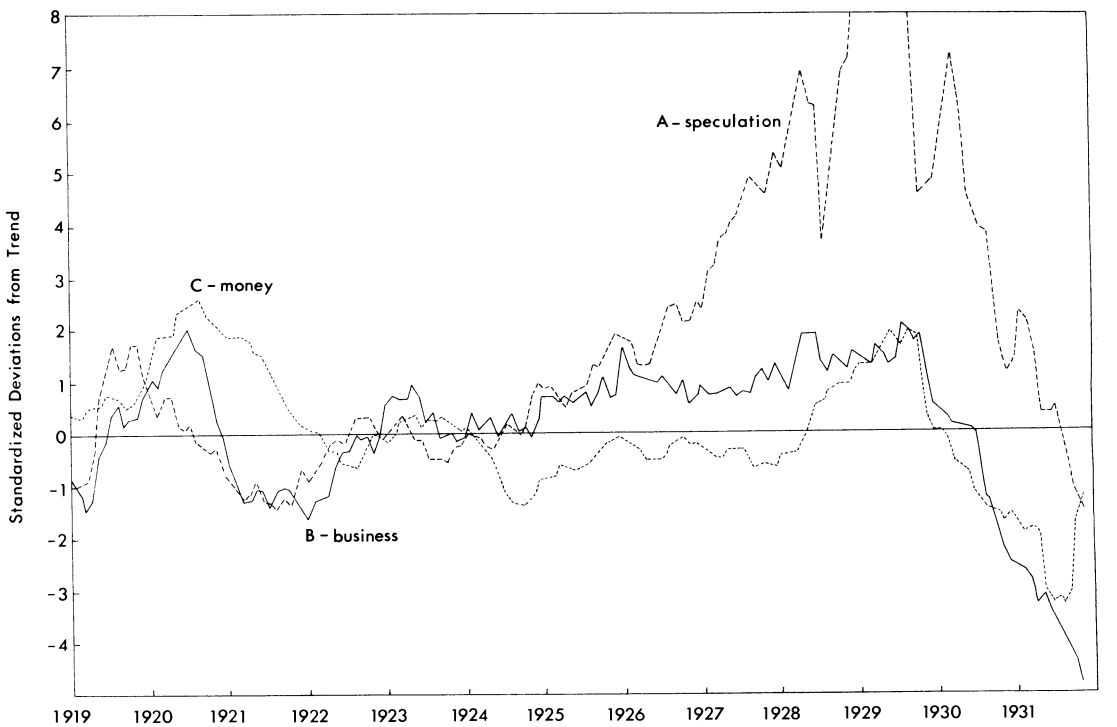

FIGURE 2. HES INDEXES, 1919–31

do not appear at first glance to support Crum's story that the HES indicators forecast a recession in the summer of 1929. All three indexes appear to lag the Crash, rather than anticipate it. Close reading of the HES brochure suggests, however, that it is possible that the statistical assistant foresaw a collapse or at least a downturn at this point. The brochure states that "the index [*C*] forecasts speculation [*A*]" and that "a persistent rise in interest rates was the forerunner of a decline in security prices; after such a decline in security prices, a decline in business [*B*] of several months duration...." [Harvard University Committee on Economic Research (1923b), p. 11).] In the period 1927–29 curve *C* had reflected exactly such a persistent rise in interest rates, and while it is not clear from the service's description exactly when such a rise should ultimately be expected to imply a stock market downturn, it is entirely possible that by the summer of 1929 the assistant saw a market decline as imminent. More importantly, the speculation index (*A*) shows a major decline during the second quarter of 1929. It peaked in March and by June had declined by over 10 percent. This major but transitory decline is almost lost in a graph of curve *A* including the Crash, but it would have looked substantial during the second quarter.[6]

If at least some on the Harvard staff believed that the data foretold business doom, however, this was not apparent in the HES's public pronouncements through the period of collapse. A detailed chronology of these pronouncements is included in the Appendix. The service painted a fairly gloomy picture earlier in 1929, only to moderate its view as the stock market continued to boom. Immediately after the stock market Crash HES pointed to the fact that interest rates had promptly declined, indicating, in their view, the soundness of Federal Reserve policy. Confidence in an imminent recovery continued until late 1931 when their assessment finally become quite bleak.

[6]This decline is not present in either Fisher's stock price index or Alfred Cowles's (1939) stock price index. Hence, it may be spurious.

B. *Irving Fisher*

Beginning in January 1923, Irving Fisher's Business Page included the Fisher Commodity Price Index and the Purchasing Power of the Dollar Index, along with weekly discussions of relevant economic issues of the time. The Commodity Price index is Fisher's "Ideal" index, a geometric average of base and current period weighted indexes. [Fisher, 1923, p. 835] The Purchasing Power of the Dollar index is simply the inverse of the Commodity Price index. The duplication was, however, central to Fisher's missionary ideas for his service. He aimed to educate the public to eliminate money illusion.[7]

In 1925 Fisher added to his analysis a stock market index, which consisted of a weighted value index for the market, with stocks picked based on a standard of "popularity." The index was computed based on averaging the value of the previous week's fifty best-selling stocks, based on total market value of share turnover. The index was linked across weeks by calculating a composite average based on the subsample of stocks that appeared in both weeks' indexes. [Fisher, 1927]

Unlike HES's, Fisher's forecasts were simple and straightforward applications of the classical paradigm, allowing for some rigidities slowing adjustment. Thus, for example, a falling dollar and rising commodity prices "shows that the volume of money and credit available is increasing faster than its utilization in the production and exchange of goods and services. When more money and credit are applied to the same (or smaller) volume of goods and services, it results in increased competition by the funds for the available goods and services."[8] Rising commodity

[7]Fisher analyzes a number of indices published at the time. In a footnote, Fisher comments on the Harvard index methodology: "One of the most interesting kinds of index number is Prof. Person's new index number for use as a barometer of trade. In this case the selection of the 10 commodities included is based, not on any of the usual criteria, but on their previous behavior in relation to the business cycle." [Fisher, 1927, p. 336]

[8]See Edwin Newdick (1929, p. 2). A brief exposition of Fisher's forecasting methodolgy, "How to Use Fisher

prices would thus engender a forecast of declines in real interest rates, a rising industrial production rate, and increasing inventories due to increases in the value of goods.

Although Fisher's economic analyses are less chartist than HES's, his predictions in the period before and after the Crash were no closer to the mark than those of his Harvard brethren. Indeed, his analyses during 1930 and 1931 were consistently even more optimistic than Harvard's.[9] Immediately after the Crash he noted that price/earnings ratios of less than eleven for industrial stocks were too low given expected earnings and dividend growth in the future. Throughout 1930 Fisher continued to compare favorably the current situation to the 1920–21 recession. Even by late 1931, Fisher continued to read good news into the bad. He believed that commodity prices had temporarily leveled off and business was soon to see a long overdue turnaround.

II. Statistical Analysis

The above discussion of the Harvard and Yale services and the detailed chronology of their pronouncements in the Appendix makes clear that the services neither predicted a downturn before the Crash nor became substantially more pessimistic about the economy following the Crash. In this section, we use time-series methods to study whether these optimistic projections were warranted by the data.

To study the forecastability of the Depression, we estimate a number of vector autoregressive (VAR) models using the Harvard and Fisher data and the modern historical data. The models differ in the number of variables included. The lengths of the estimation periods also differ across models, depending on data availability.

Each equation includes a constant and twelve lags of all the variables in the system. We impose Litterman's Bayesian prior that the variables follow univariate random walks. The standard deviations of the prior take the form

$$(1) \quad S(i, j, k) = \gamma g(k) f(i, j) (s_j / s_i),$$

where i indexes the left-hand side variable, j indexes the right-hand side variables, and k indexes the lag. s_i is the standard error of the unrestricted equation for variable i. We use the parameters $f(i, i) = 1.0$, $f(i, j) = .75$, $i \neq j$, $g(k) = k^{-1}$, and $\gamma = 0.3$.[10]

We also computed all the estimates with a lag length of two with no priors imposed. These results were quite similar to the results using twelve lags, and so only the forecasts using twelve lags are reported below.

The HES variables are the A, B, and C indexes. The data for these variables begin in January 1919. The Fisher variables are his commodity price index and his stock price index. The data for both of these variables are available beginning in January 1925. The modern historical variables are an industrial production index, a producer price index, a stock price index, a three-month interest rate, and a measure of the money stock. We use two indexes of industrial production, one from the Federal Reserve, which begins in January 1919, and one from Babson, which begins in January 1890.[11] The producer price index is the Bureau of Labor Statistics all-commodity wholesale price index; the stock price index is Cowles all-stock index; and the interest rate is the three-month time loan rate of N. Gregory Mankiw, Jeffrey Miron, and David Weil (1987). The data on these three variables are available beginning at least in January 1890. The money stock

Indexes" by Newdick, was part of the *Financial Analysis Service* subscription package.

[9] Again, the chronology in the Appendix supports the following brief summary of Fisher's views.

[10] These priors are somewhat looser than those recommended by Christopher Sims (1987, p. 446). In the RATS programming language, they can be expressed as tightness = 0.3, harmonic decay = 1.0, and other's weight = 0.75. See Thomas Doan and Robert Litterman (1987).

[11] When Babson's index is used, it is scaled to equal the Federal Reserve's index in June 1929. The two indexes are quite close in the period that they overlap. Regressing Babson's index on the Federal Reserve's index and a constant for the period from January 1919 to December 1933 yields an R^2 of .965.

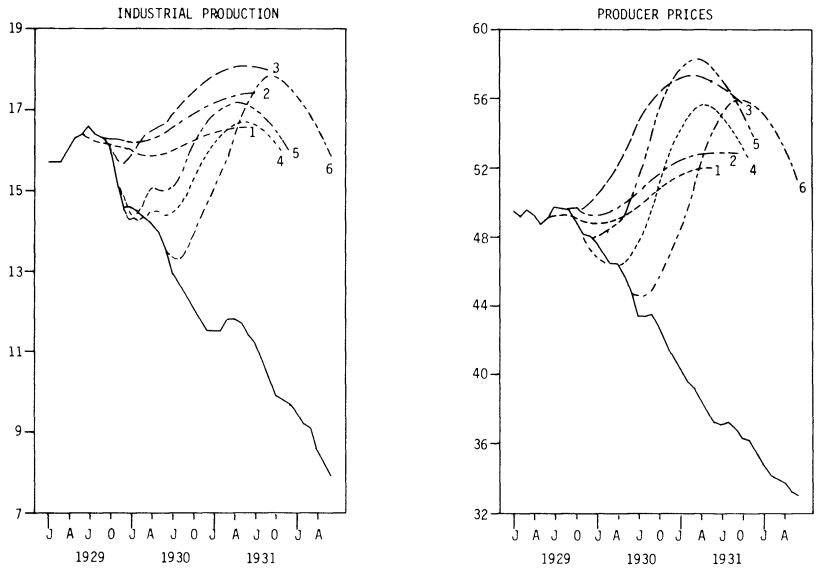

FIGURE 3. ACTUAL AND FORECAST VALUES: MODERN PLUS HES DATA, SAMPLE BEGINS JANUARY 1920. *Note*: System includes industrial production (FRB), producer prices, three-month time loan rate, stock prices, *M*2, and the HES's *A*, *B*, and *C* series. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), December 1929 (5), and June 1930 (6).

series, which begins in May 1907, is Milton Friedman and Anna Schwartz's (1970) *M*2 series.[12] In the estimation work, we use logarithms of the variables except for the *A*, *B*, and *C* variables and the interest rate variable, which were kept in their natural units.

We use the same procedure for each VAR model. The model is first estimated through a particular month. A dynamic, 24-month forecast is then generated using the model, where the forecast begins one month after the end of the estimation period. Six sets of estimates and forecasts are made per model. The first forecast period begins in July 1929 (and so the first estimation period ends in June 1929). The starting dates of the other five forecasts are October 1929, November 1929, December 1929, January 1930, and July 1930. In the figures below we report results only for industrial production and producer prices, although, of course, the forecasts of all the variables in the model underlie these calculations.

The first model consists of eight variables —the five modern variables plus the *A*, *B*, and *C* variables. The estimation periods begin in January 1920. We first test the hypothesis that the *A*, *B*, and *C* variables have coefficients of zero in the industrial production and producer price equations. When two lags are used per variable, the chi-square value is 35.1, which for 12 degrees of freedom rejects the hypothesis at the .01 level. When twelve lags are used, the chi-square value is similar, 38.5, although with the Bayesian priors imposed the number of degrees of freedom is difficult to interpret. At any rate, it thus seems from at least the two-lag case that the *A*, *B*, and *C* variables are jointly significant.

The forecasting results are presented in Figure 3. The solid line indicates the actual data from the beginning of 1929 through the first half of 1932, and the six dashed lines

[12] The data and data sources are discussed in the Appendix.

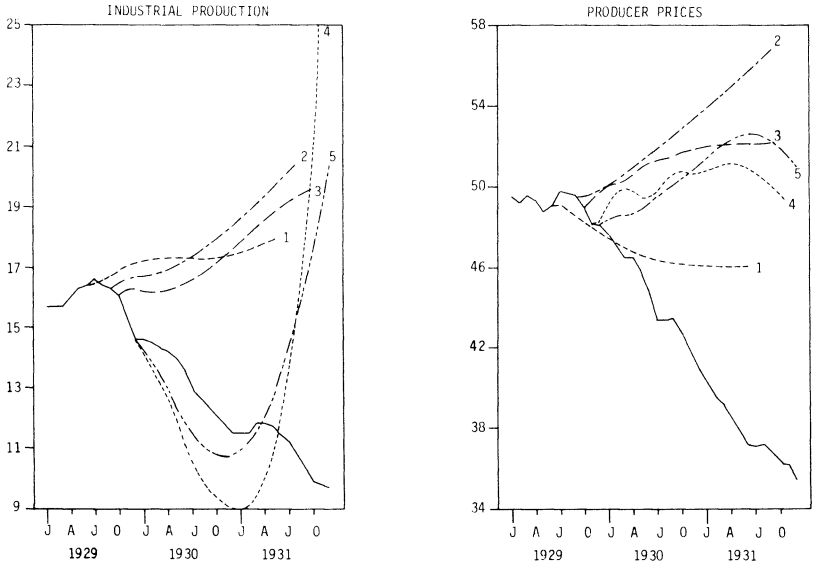

FIGURE 4. ACTUAL AND FORECAST VALUES: MODERN PLUS FISHER DATA, SAMPLE BEGINS JANUARY 1926. *Note*: System includes industrial production (FRB), producer prices, three-month time loan rate, stock prices, *M*2, and Fisher's stock and commodity price indexes. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), and December 1929 (5).

give the 24-month forecasts.[13] It is clear from Figure 3 that neither before nor after the Crash does the VAR system forecast the Depression. Aside from slight dips in output in several of the forecasts for a few months, all the forecasts indicate continued expansion of the economy. All the forecasts thus produce large, negative errors in later periods. The price forecasts similarly systematically overpredict the price level.

The second model consists of the five modern variables plus Fisher's two variables. The estimation periods begin in January 1926. Because Fisher stopped issuing his data in May 1930, we include only the first five forecasts. We also test the hypothesis that the two Fisher variables are zero in the industrial production and producer price equations. In the two-lag case the chi-square value is 14.5, which with 8 degrees of freedom is significant at the .01 level. Again, the value of 14.8 in the twelve-lag case is similar.

Figure 4 presents the forecasting results for this model. The first three forecasts (through the estimation period ending in October 1929) show rapid expansion in output. The implied annual growth rates approach double digits. Once the Crash is embodied in the initial conditions, the forecasts show sharp declines in output followed by sharp rebounds in about a year. Except for the slight deflation forecast before the Crash, the forecasts of the producer price index are essentially flat, and so they imply large forecast errors.

The two models examined so far are based on estimation periods that contain only observations from the 1920s. Aside from the sharp recession at the beginning of the decade, the 1920s witnessed strong and sustained economic growth. It thus may be that the poor performance of the models is simply due to the use of estimation periods that

[13]Although the estimates are based on logarithms of industrial production and producer prices, the results are reported for levels of these variables.

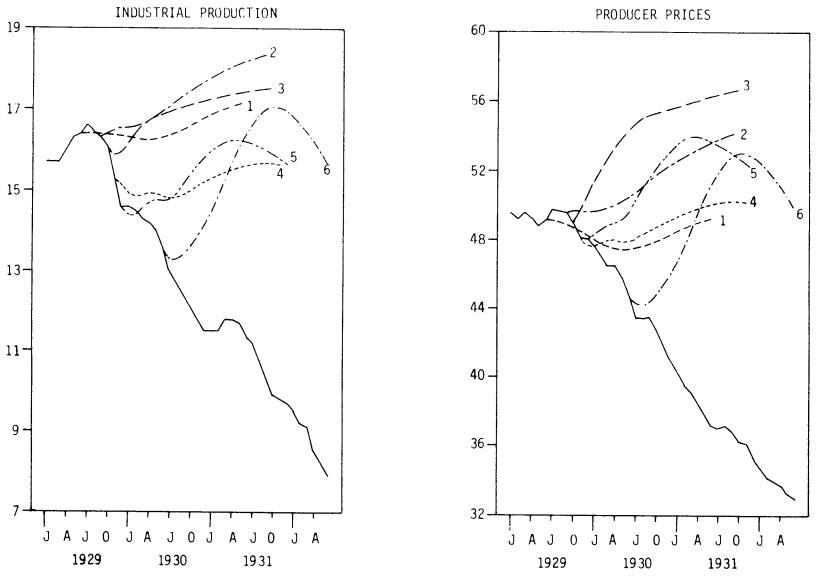

FIGURE 5. ACTUAL AND FORECAST VALUES: MODERN DATA, SAMPLE BEGINS JANUARY 1920. *Note*: System includes industrial production (FRB), producer prices, three-month time loan rate, stock prices, and *M2*. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), December 1929 (5), and June 1930 (6).

are too short. In other words, one might not expect to find seeds of the Depression in the data from the 1920s using time-series methods. We can, however, examine whether the poor forecasting performance of the models is due to the small sample by extending the estimation period back much further. If we drop the HES and Fisher variables and use Babson's index of industrial production in place of the Federal Reserve's, we can extend the sample back to January 1907, and if we further drop the money stock variable, we can extend the sample back to January 1890. Eight troughs occurred between 1890 and 1918 according to the National Bureau of Economic Research chronology (Geoffrey Moore and Victor Zarnowitz, 1986, p. 750), some quite severe. These data thus provide a much firmer basis for attempting to forecast the Depression using time-series methods.

Before extending the sample backward, we present estimates based on the modern variables only, but using the same sample periods as for the HES and Fisher data. These estimates show how the HES and Fisher data affect the forecasts. In Figure 5 we present forecasts from the model using only the five modern variables for the estimation periods beginning in January 1920. These forecasts are comparable to those in Figure 3 except that the HES data are excluded. The forecasts in Figure 5 are close to those in Figure 3, which suggest that the HES variables have little incremental value in forecasting industrial production and producer prices, even though they are jointly significant in the two equations.

We next estimated the model using only the five modern variables for the estimation periods beginning in January 1926. The forecasts are presented in Figure 6. These forecasts are comparable to those in Figure 4 except that Fisher's data are excluded. As in Figure 4, output is forecast to grow much faster than it did, but the size of the forecast errors are smaller than when Fisher's data are included.

Figures 5 and 6 show that the HES and Fisher data do not much affect the forecasts of the Depression based on data from the

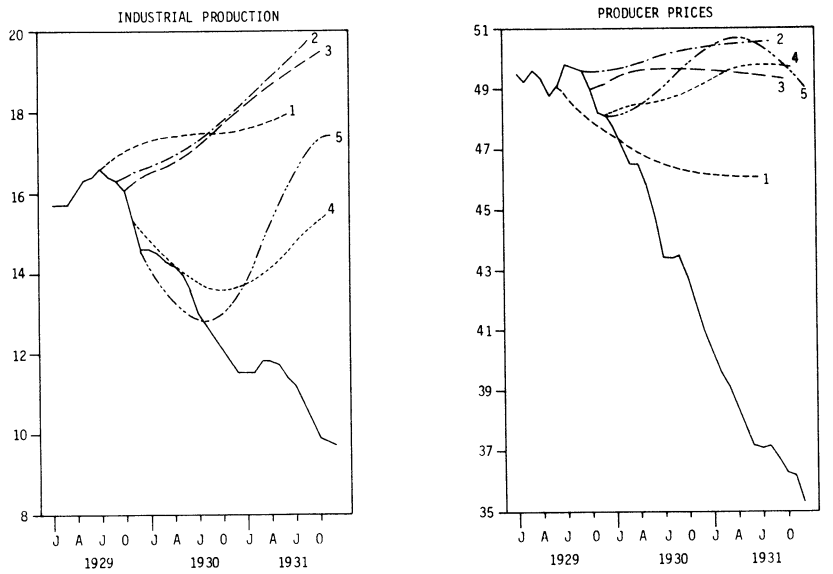

FIGURE 6. ACTUAL AND FORECAST VALUES: MODERN DATA, SAMPLE BEGINS JANUARY 1926. *Note*: System includes industrial production (FRB), producer prices, three-month time loan rate, stock prices, and *M2*. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), and December 1929 (5).

1920s. We now consider the effects of lengthening the estimation period. The forecasts in Figure 7 are based on the use of the five modern variables for the estimation periods beginning in May 1908.[14] The beginning of the estimation periods is dictated by the money data, which are available beginning in May 1907. The first forecast in Figure 7, based on information through June 1929, shows a moderate downturn in production. This is not true, however, for the other five forecasts. The forecasts for the price level in Figure 7 are more striking. The dramatic deflation of the early 1930s is predicted in the forecasts based on data through the first months after the Crash. Interestingly enough, the last two forecasts, whose initial conditions clearly reflect the actual start of the deflation, do not forecast the continuation of the deflation.

The forecasts in Figure 8 are based on the same estimation periods as those in Figure 7, but the money stock variable is dropped. The model thus consists of only four modern variables. The third forecast in Figure 8 predicts the continuing fall in output fairly well, although the others do not. As in Figure 7, the first three forecasts of the price level predict the deflation quite well. Because similar results are obtained without the money data in Figure 8, the forecasts of the deflation in Figure 7 do not depend on the use of the money data.

Finally, the forecasts in Figure 9 are based on the use of the four modern variables (excluding the money stock) for the estimation periods beginning in January 1891. This sample period is the longest at our disposal with these data. The results show that except for slight downturns in the forecasts based on data through October and November 1929 (the third and fourth forecasts) industrial

[14]Given that the estimation period now begins before the Federal Reserve's industrial production index is available, these and subsequent results use the Babson index. Forecasts based on the use of Babson's index for the estimation periods beginning in January 1920 are almost identical to those presented in Figure 5 using the Federal Reserve's index.

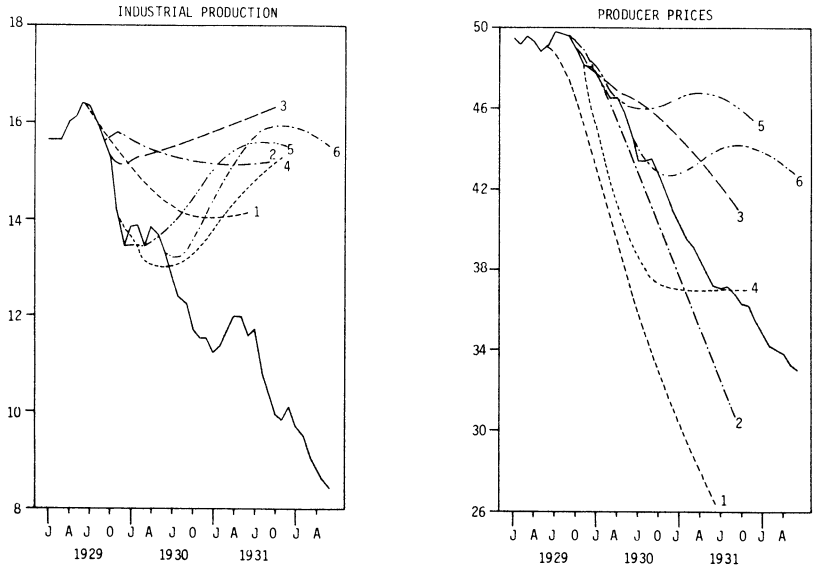

FIGURE 7. ACTUAL AND FORECAST VALUES: MODERN DATA, SAMPLE BEGINS MAY 1908. *Note*: System includes industrial production (Babson), producer prices, three-month time loan rate, stock prices, and *M*2. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), December 1929 (5), and June 1930 (6).

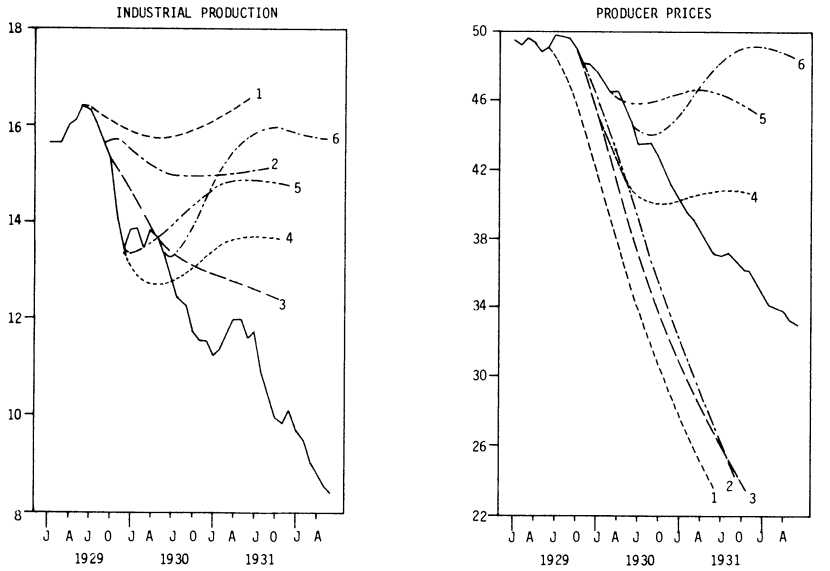

FIGURE 8. ACTUAL AND FORECAST VALUES: MODERN DATA EXCLUDING MONEY STOCK, SAMPLE BEGINS MAY 1908. *Note*: System includes industrial production (Babson), producer prices, three-month time loan rate, and stock prices. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), December 1929 (5), and June 1930 (6).

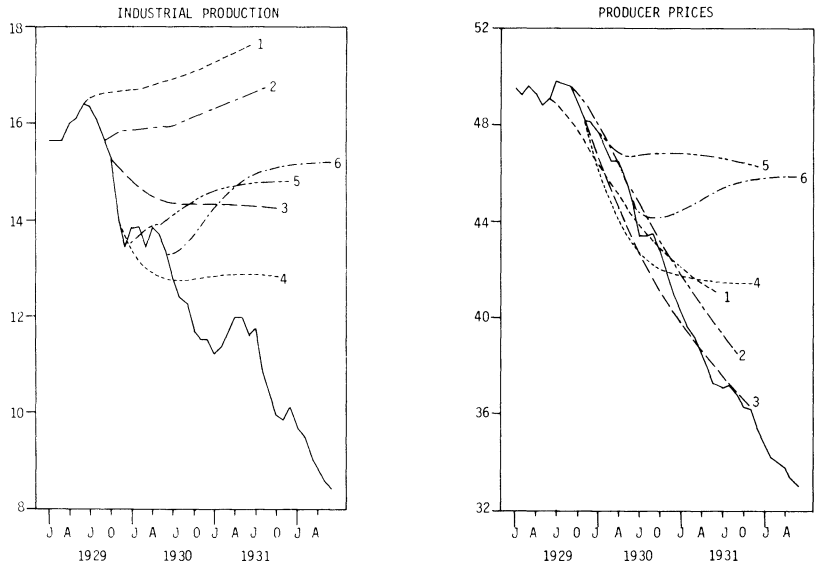

FIGURE 9. ACTUAL AND FORECAST VALUES: MODERN DATA EXCLUDING MONEY STOCK, SAMPLE BEGINS JANUARY 1891. *Note*: System includes industrial production (Babson), producer prices, three-month time loan rate, and stock prices. Solid lines are actual data. Dashed lines are forecasts conditional on data through June 1929 (1), September 1929 (2), October 1929 (3), November 1929 (4), December 1929 (5), and June 1930 (6).

production is predicted to grow on trend. As in Figures 7 and 8, the early forecasts for the price level give very accurate forecasts for the deflation, but these are revised upward in the forecasts based on information through December 1929 and June 1930.

In summary, the results in Figures 3 through 9 show that the large declines in output at the beginning of the Depression were essentially not predicted in both the months before the Crash and once the news of the Crash is taken into account. In a few of the systems, small output declines are predicted, but even these more accurate predictions disappear over longer horizons and as the forecasts adjust to the changing initial conditions. Similarly, the large deflation was not systematically predicted by the systems. In the estimates based on the long samples (Figures 7–9), the early forecasts, which are conditional on data leading up to and just following the Crash, are quite accurate. These forecasting successes should not be overemphasized, however, because the forecasts are very unstable as the initial conditions and coefficient estimates change. Hence, aside from a hint of forecastability of the deflation, the Depression was unforecastable using our time-series methods. Therefore, the Harvard Economic Service, Irving Fisher, or an econometrician endowed with modern time-series methods and data would be justified in appearing optimistic about the economy on the eve of and in the months following the Crash.

III. Conclusion

Our results imply that the Harvard and Yale forecasters cannot necessarily be faulted for remaining optimistic after the Crash. Their continued optimism is consistent with our conclusion based on time-series methods that the Depression was not forecastable. They were both justified in holding what *ex post* was an incorrect view. Thus, one might conclude that Harvard and Yale tied.

Our finding that the Depression was not forecastable should be interpreted cautiously. Our time-series findings do not rule

out the possibility that a structural model based on restrictions from economic theory could forecast the Depression. None of the major theories of the Depression, however, necessarily imply that the Depression was forecastable. Friedman and Schwartz (1963) place the blame for the Depression on mistakes made by the Federal Reserve, in particular the fact that the money stock fell by over a third from August 1929 to March 1933. No one suggests that these mistakes were forecastable. Peter Temin (1976) stresses autonomous declines in aggregate demand, and insofar as these were unforecastable, his theory does not make the Depression forecastable. Charles Kindleberger's (1986) account of the Depression stresses the role of financial panics and the collapse of commodity prices. Again, these are not likely to be forecastable. James Hamilton (1987) does argue that the monetary contraction started in 1928. If this early monetary contraction were an important cause of the Depression, our regressions could in principle detect it. Yet, Hamilton (1987, pp. 167–68) does not suggest that the monetary contraction in 1928 was sufficient to cause the Depression, so the failure of time-series techniques to forecast the Depression may not contradict his account. The leading explanations of the Depression are thus based on unforecastable policy and economic disturbances. Therefore, finding that the Depression is unforecastable does not help distinguish among these explanations of its cause.

APPENDIX

Chronology of the Services' Forecasts. This section of the Appendix contains the evolution of pronouncements made by the Harvard Economic Service and Irving Fisher on the status of the economy, from early 1929 through 1931. It clearly demonstrates that both failed to forecast the Depression and remained optimistic following the Crash of the stock market in October 1929.

Harvard Economic Service. In April 1929, HES issued the following warning about the overheated economic environment:

> Recent developments—notably the weakness of certain commodity prices, as well as the money tension—suggest some recession from the present level of business.... A renewed unsettlement of stock prices, perhaps a protracted liquidation, might well result under present conditions of money tension.... Business is not in the strained condition which has led to real depression in the past; and, while interest rates are now higher than at any other time since 1921, the present large resources of the reserve system give assurance that no shortage of credit for industrial purposes will develop.
> [HES, 4/20/1929][15]

This view persisted through the summer of 1929. In May, the Service noted that "The signs pointing to recession continue to pile up" [HES, 5/18/1929].

By mid-September, when the speculation index was rising, the tone moderated considerably:

> Recent developments (reduced volume of construction projects, below average crop prospects, unfavorable international trade balances) have tended to emphasize the unfavorable elements in the business (as distinguished from the financial) situation.... But no sharp decline has appeared in general business, and activity remains high. [HES, 9/21/1929]

The week prior to Black Friday, the assessment was that

> If recession should threaten serious consequences for business (as is not indicated at present) there is little doubt that the reserve system would take steps to ease the money market and so check the movement.
> [HES, 10/19/1929]

This tone persisted as calamities mounted over the coming year. Immediately following the Crash, in early November, the appraisal was that

> Doubtless the losses entailed by the decline in stocks will increase the extent of the present business recession. On the other hand, money rates have declined promptly and considerably... this is in itself evidence of the soundness of the present business situation. Under such conditions, we believe that the present recession, both for stocks and business, is not the precursor of business depression, but will prove intermediate in character. [HES, 11/2/1929]

By late December 1929, the Harvard staff was even forecasting recovery:

> Today a depression seems improbable, and continuance of business recession is all that is in prospect. This justifies a forecast of recovery of business next spring, with further improvement in the fall, so that 1930, as a whole, should prove at least a fairly good year.
> [HES, 12/21/1929]

Confidence then continued as the downturn worsened:

> Since our monetary and credit structure is not only sound but unusually strong, commercial credits are liquid, and production for some months has probably been less than current demands, there is every prospect that the recovery which we have been expecting will not be long delayed, and that the only change that need be made in our forecast is that this fall business will not acquire as much impetus as we have been expecting.
> [HES, 8/20/1930]

[15] This and the following quotations from the Harvard Economic Service (HES) appeared in the *Weekly Letter* on the indicated date.

Except in construction activity, the current depression seems to be following much the same course as that of 1920–21, as respects the length and severity of decline and the inception of recovery; and we conclude that improvement in business volumes, the first step in business recovery, is already underway. [HES, 6/30/1931]

A dawning awareness that this economic downturn was not similar in nature to those preceding it is found in the final months of 1931. In August, the Service noted that "If financial unsettlement continues in Europe, real business recovery here may be prevented..." [HES, 8/22/1931]. And by December of that year, the assessment had finally become quite bleak:

But though the threatening elements in the situation are fewer, adequate grounds for forecasting business revival have not yet appeared. [HES, 12/19/1931]

Irving Fisher. In September 1929, Fisher was bullish about future economic prospects, seeing none of the potential warning signs that Harvard service had noted through the summer of that year.[16]

We have witnessed probably the greatest expansion in history, within any similar period of time, of the real income of a people.... The alarm over the supposed inflation of security values seem unjustified by the recent record of dividend yields, increases which doubtless will be followed by much larger increases. [Fisher, 9/2/1929][17]

The day before Black Friday, Fisher continued bullish in the face of the (relatively) small perturbations that had rocked the market in recent weeks and stirred concern on Wall Street.

The [stock market] break certainly exhibited signs of a market rendered topheavy by the activities of shoals of speculators, acting unintelligently, who at last became frightened and dumped millions of shares in a way temporarily to swamp the Exchanges.... The only event which can bring about a serious decline in stock value is a severe business slump, which does not seem likely from present indications. [Fisher, 10/28/1929]

Immediately after the Crash, the outlook remained optimistic:

The price of industrial stocks at less than 11 times their earnings seems too low a ratio, in view of the expectation of a faster rate of earnings in future and of the diminished risks of modern investment methods.... The market has, therefore, good reason for recovering on a new plateau. [Fisher, 11/4/1929]

As the recession deepened, Fisher's optimism bordered on advocacy, inveighing against dire interpretations of the direction of current indicators:

It should be noted that while the stock exchange endured the severest panic in history, this did not suffice to shake the price level of stocks off a warrantable high new plateau, which had been built up since 1922.... The function of the stock market is to reflect the discounted value of future increased business, as clearly foreshadowed in the increasing rate at which earnings are plowed-back into industry. [Fisher, 12/30/1929]

While prediction is always hazardous in economic statistics, and I wish to avoid making any definite prediction, it would not be surprising if by next month the worst of the recession will have been felt and improvement looked for. [Fisher, 1/20/1930]

In the early summer of 1930, Fisher remained unwilling to read calamity into the current economic situation. Comparisons with the 1920–21 recession predominated in his analysis—as they did in Harvard's—but Fisher's brand of optimism remained both stronger and more colorful:

It seems manifest that thus far the difference between the present comparatively mild business recession and the severe depression of 1920–21 is like that between a thunder-shower and a tornado. [Fisher, 5/19/1930]

By winter of that year, Fisher finally acknowledged the seriousness of the economic situation; yet like members of the Harvard group, he continued to see the potential for an imminent upturn and expressed his hopes with mounting drama:

Doubtless, to many, this will be the winter of our discontent, and to all of us it is as gloomy as the darkness that preceeds dawn.... One would expect the bottom to be reached in the stock market prior to the upturn in commodity prices. Since the middle of November this seems to have been the case. [Fisher, 12/1/1930]

In attempting to review and estimate the business situation, it is sometimes necessary, during a business depression such as this, to find hopeful signs in negative figures. Such a potential state of affairs holds true just now. [Fisher, 2/2/1931]

The industrial giant has become conscious again. He is beginning to move around slowly in an effort to regain his feet, as the cobwebs from a knockout blow gradually clear from his brain. [Fisher, 2/23/1931]

By the end of 1931, when the Harvard team had begun to admit to the reality contained in the steady flow of bleak economic data, Fisher maintained his optimism.

Business showed further gain last week, and if improvement continues at the present rate, September should mark the low of the depression. Particular attention is called to the fact that commodity prices for both raw materials and agricultural products were strong. No single factor would be as helpful to business as a cessation in the commodity price decline that has been continued for the past two years. [Fisher, 10/17/1931]

[16] Fisher's optimism, however, is consistent with his data. In contrast to the Harvard speculation index (*A*), which shows a 10 percent decline from March to June 1929, the Fisher stock price index shows no decline. Similarly, the Cowles (1939) stock price index, which has been widely used in recent studies, has some fluctuations but is essentially flat over the interval.

[17] This and subsequent statements appeared in Fisher's syndicated Business Page on the indicated dates. Copies of the columns are contained in the Fisher collection housed in the Manuscript and Archive Collection, Sterling Memorial Library, Yale University.

Data Sources. This section gives the details of the data used in this paper. Table A1 gives the HES's *A*, *B*, and *C* series and Fisher's stock and commodity prices. The source for these series and the modern historical data are as follows:

Harvard Economic Services Curve-*A*, Curve-*B*, and Curve-*C* were collected from various issues of *The Review of Economic Statistics* 1919–22, and the Harvard *Weekly Letter*, 1923–31.

Fisher's Wholesale Price Index appeared in various issues of the *Journal of the American Statistical Association*, 1923–30; a revised series appeared in *JASA* Reprint, September 1930.

Fisher's Stock Index was collected from Fisher's Scrapbooks 1925–27 (Yale Manuscript and Archive Collection) and *Index Number Institute* releases 1928–30.

The Industrial Production Index is a revised seasonally adjusted series published by the *Federal Reserve Board* in Statistical Release G12.3, July 18, 1985.

Babson's index of industrial production closely tracks the FRB's during the period of overlap. It is published beginning monthly on a seasonally adjusted basis beginning in 1889 in Moore (1961, p. 130).

The interest rate series is the three-month time loan rate collected and analyzed by Mankiw, Miron, and Weil (1987, p. 372). These data are available beginning in 1890.

The money series is Friedman and Schwartz's (1970) *M*2 series. They are available on a monthly seasonally adjusted basis beginning in May 1907.

Our price index is the Bureau of Labor Statistics Wholesale Price Index (now called the Producer Price Index). The annual wholesale price index is Series E23 in *Historical Statistics*. We obtained the monthly series from the BLS beginning in 1913. The monthly series from 1890 through 1912 is from Bureau of Labor Statistics, *Index Number of Wholesale Prices on Pre-War Base, 1890–1927* (1928). We have been unable to locate this series in present-day BLS sources.

The stock price is Cowles's (1939) all commodity stock price index (Series *P*-1).

TABLE A1—HARVARD ECONOMIC SERVICE AND IRVING FISHER'S DATA

Month and Year	Harvard Economic Service			Fisher	
	Speculation (A)	Business (B)	Money (C)	Commodity Prices	Stock Prices
Jan. 19	−1.13	−0.88	0.39	NA	NA
Feb. 19	−1.00	−1.14	0.36	NA	NA
Mar. 19	−0.96	−1.46	0.45	NA	NA
Apr. 19	−0.44	−1.23	0.55	NA	NA
May 19	0.62	−0.40	0.56	NA	NA
June 19	1.00	−0.16	0.73	NA	NA
July 19	1.69	0.35	0.74	NA	NA
Aug. 19	1.22	0.54	0.64	NA	NA
Sept. 19	1.24	0.18	0.52	NA	NA
Oct. 19	1.63	0.26	0.61	NA	NA
Nov. 19	1.62	0.34	0.83	NA	NA
Dec. 19	1.16	0.76	1.02	NA	NA
Jan. 20	0.88	1.07	1.46	NA	NA
Feb. 20	0.38	0.95	1.87	NA	NA
Mar. 20	0.82	1.20	1.91	NA	NA
Apr. 20	0.88	1.44	1.93	NA	NA
May 20	0.15	1.76	2.27	NA	NA
June 20	0.05	1.94	2.44	NA	NA
July 20	0.14	2.02	2.50	NA	NA
Aug. 20	−0.19	1.68	2.61	NA	NA
Sept. 20	−0.28	1.50	2.33	NA	NA
Oct. 20	−0.36	0.84	2.20	NA	NA
Nov. 20	−0.34	0.35	2.17	NA	NA
Dec. 20	−0.64	−0.01	1.95	NA	NA
Jan. 21	−0.97	−0.58	1.85	NA	NA
Feb. 21	−1.10	−0.88	1.87	NA	NA
Mar. 21	−1.24	−1.27	1.73	NA	NA
Apr. 21	−1.20	−1.25	1.68	NA	NA
May 21	−0.95	−1.09	1.57	NA	NA
June 21	−1.30	−1.14	1.53	NA	NA
July 21	−1.36	−1.42	1.10	NA	NA
Aug. 21	−1.46	−1.16	0.85	NA	NA

TABLE A1—CONTINUED

Month and Year	Harvard Economic Service			Fisher	
	Speculation (A)	Business (B)	Money (C)	Commodity Prices	Stock Prices
Sept. 21	−1.31	−1.08	0.63	NA	NA
Oct. 21	−1.41	−1.09	0.46	NA	NA
Nov. 21	−1.04	−1.35	0.24	NA	NA
Dec. 21	−0.74	−1.44	0.20	NA	NA
Jan. 22	−0.94	−1.66	0.07	NA	NA
Feb. 22	−0.74	−1.34	0.07	NA	NA
Mar. 22	−0.60	−1.25	−0.06	NA	NA
Apr. 22	−0.24	−1.20	−0.26	NA	NA
May 22	−0.14	−0.64	−0.35	NA	NA
June 22	−0.20	−0.38	−0.46	NA	NA
July 22	−0.02	−0.38	−0.55	NA	NA
Aug. 22	0.20	−0.08	−0.61	NA	NA
Sept. 22	0.28	−0.14	−0.39	NA	NA
Oct. 22	0.30	−0.10	−0.22	NA	NA
Nov. 22	−0.02	−0.34	−0.06	NA	NA
Dec. 22	−0.12	0.10	−0.06	NA	NA
Jan. 23	−0.04	0.52	−0.14	100.6	NA
Feb. 23	0.14	0.71	−0.01	103.2	NA
Mar. 23	0.24	0.69	0.24	106.7	NA
Apr. 23	0.12	0.72	0.27	107.6	NA
May 23	−0.12	0.98	0.31	104.5	NA
June 23	−0.17	0.62	0.14	101.2	NA
July 23	−0.43	0.20	0.22	97.0	NA
Aug. 23	−0.48	0.38	0.22	96.9	NA
Sept. 23	−0.49	−0.13	0.29	98.8	NA
Oct. 23	−0.56	−0.06	0.20	100.0	NA
Nov. 23	−0.34	−0.03	0.14	98.4	NA
Dec. 23	−0.24	−0.16	0.07	97.8	NA
Jan. 24	−0.16	−0.14	0.09	98.0	NA
Feb. 24	−0.09	0.39	0.00	99.9	NA
Mar. 24	−0.10	0.01	−0.12	98.0	NA
Apr. 24	−0.26	0.10	−0.25	96.6	NA
May 24	−0.33	0.24	−0.45	96.0	NA
June 24	−0.18	−0.12	−0.76	95.4	NA
July 24	0.03	0.16	−1.14	97.3	NA
Aug. 24	0.21	0.36	−1.29	98.9	NA
Sept. 24	0.09	−0.01	−1.32	99.2	NA
Oct. 24	0.08	0.10	−1.35	101.4	NA
Nov. 24	0.62	−0.08	−1.20	102.6	NA
Dec. 24	0.93	0.24	−0.92	103.5	NA
Jan. 25	0.84	0.66	−0.81	106.7	74.6
Feb. 25	0.90	0.66	−0.79	107.5	76.5
Mar. 25	0.74	0.58	−0.59	107.3	74.7
Apr. 25	0.50	0.66	−0.63	103.5	73.0
May 25	0.79	0.56	−0.67	103.5	77.7
June 25	0.82	0.64	−0.63	104.0	82.1
July 25	0.94	0.78	−0.60	105.8	85.3
Aug. 25	1.26	0.50	−0.49	105.6	88.5
Sept. 25	1.26	0.69	−0.37	104.6	93.5
Oct. 25	1.50	1.06	−0.21	103.6	102.4
Nov. 25	1.78	0.64	−0.17	105.2	106.8
Dec. 25	1.87	0.75	−0.12	105.2	107.8
Jan. 26	1.82	1.65	−0.14	105.4	111.2
Feb. 26	1.74	1.28	−0.24	104.2	114.4
Mar. 26	1.35	1.11	−0.27	101.0	101.2
Apr. 26	1.24	1.06	−0.47	99.6	94.9
May 26	1.34	1.01	−0.49	100.5	95.5

TABLE A1—CONTINUED

Month and Year	Harvard Economic Service			Fisher	
	Speculation (A)	Business (B)	Money (C)	Commodity Prices	Stock Prices
June 26	1.75	0.98	−0.50	100.5	105.0
July 26	2.04	1.14	−0.43	98.8	114.1
Aug. 26	2.40	0.84	−0.27	97.5	127.2
Sept. 26	2.46	0.74	−0.18	97.9	127.2
Oct. 26	2.18	0.99	−0.14	98.0	117.9
Nov. 26	2.19	0.55	−0.23	99.7	119.4
Dec. 26	2.47	0.65	−0.23	97.3	126.3
Jan. 27	2.40	0.82	−0.28	96.0	125.1
Feb. 27	3.06	0.76	−0.41	94.4	131.4
Mar. 27	3.27	0.72	−0.46	92.9	139.9
Apr. 27	3.63	0.76	−0.45	92.5	147.4
May 27	3.82	0.80	−0.35	92.5	156.0
June 27	4.08	0.66	−0.30	92.4	164.9
July 27	4.14	0.78	−0.32	92.2	174.1
Aug. 27	4.46	0.66	−0.55	93.2	186.7
Sept. 27	4.88	1.05	−0.65	95.8	207.2
Oct. 27	4.66	1.20	−0.63	96.2	209.4
Nov. 27	4.56	0.98	−0.62	96.4	216.9
Dec. 27	5.11	1.22	−0.63	96.1	245.3
Jan. 28	5.32	1.23	−0.47	95.5	260.0
Feb. 28	5.07	0.79	−0.41	96.7	263.0
Mar. 28	5.52	1.26	−0.41	97.6	295.4
Apr. 28	6.26	1.82	−0.21	99.1	339.3
May 28	6.94	1.93	0.07	99.1	369.1
June 28	6.37	1.92	0.43	98.0	358.0
July 28	6.23	1.38	0.56	99.6	365.0
Aug. 28	3.70	1.16	0.71	99.8	399.4
Sept. 28	4.72	1.46	0.86	99.7	470.4
Oct. 28	5.54	1.33	0.92	98.8	527.4
Nov. 28	6.82	1.20	0.92	97.5	606.3
Dec. 28	7.14	1.55	1.15	97.0	636.4
Jan. 29	8.28	1.40	1.33	97.4	717.0
Feb. 29	8.48	1.31	1.33	97.7	749.5
Mar. 29	8.98	1.64	1.43	98.3	823.8
Apr. 29	8.44	1.54	1.75	97.1	837.9
May 29	8.30	1.26	1.95	95.9	874.6
June 29	8.08	1.38	1.85	96.9	844.6
July 29	9.27	2.03	1.68	98.5	951.3
Aug. 29	10.08	1.96	1.92	97.3	1038.3
Sept. 29	10.63	1.74	1.90	96.0	1132.1
Oct. 29	8.33	1.84	1.43	94.4	998.1
Nov. 29	4.60	1.30	0.49	92.7	719.7
Dec. 29	4.68	0.58	0.05	92.8	735.8
Jan. 30	4.80	0.31	0.04	93.3	731.6
Feb. 30	5.78	0.16	−0.08	92.7	808.2
Mar. 30	6.48	0.14	−0.51	90.8	885.1
Apr. 30	7.29	0.10	−0.63	90.6	985.2
May 30	6.31	0.02	−0.78	88.6	921.5
June 30	4.61	−0.33	−1.03	86.4	NA
July 30	4.26	−1.04	−1.27	NA	NA
Aug. 30	3.96	−1.23	−1.41	NA	NA
Sept. 30	3.84	−1.32	−1.47	NA	NA
Oct. 30	2.26	−1.74	−1.53	NA	NA
Nov. 30	1.68	−2.24	−1.66	NA	NA
Dec. 30	1.16	−2.50	−1.59	NA	NA
Jan. 31	1.35	−2.63	−1.73	NA	NA
Feb. 31	2.25	−2.90	−1.86	NA	NA

TABLE A1—CONTINUED

Month and Year	Harvard Economic Service			Fisher	
	Speculation (A)	Business (B)	Money (C)	Commodity Prices	Stock Prices
Mar. 31	2.10	−3.25	−1.85	NA	NA
Apr. 31	1.42	−3.17	−1.93	NA	NA
May 31	0.39	−3.45	−2.96	NA	NA
June 31	0.39	−3.72	−3.22	NA	NA
July 31	0.44	−3.96	−3.20	NA	NA
Aug. 31	−0.08	−4.14	−3.23	NA	NA
Sept. 31	−0.72	−4.41	−3.12	NA	NA
Oct. 31	−1.16	−4.84	−1.87	NA	NA
Nov. 31	−1.42	NA	−1.26	NA	NA

REFERENCES

Cowles, Alfred 3rd and Associates, *Common Stock Indexes*, Cowles Commission for Research in Economics Monograph No. 3, 2nd ed., Bloomington, IN: Principia Press, 1939.

Doan Thomas, A. and Litterman, Robert B., *RATS User Manual*, VAR Econometrics, Evanston, IL, 1987.

Fisher, Irving, *The Making of Index Numbers*, New York: Houghton-Mifflin, 1922.

_____, "A Weekly Index Number of Wholesale Prices," *Journal of the American Statistical Association*, September 1923, *18*, 835–40.

_____, "Wholesale Price Index of Commodities, 1923–30," *Journal of the American Statistical Association*, reprint, September 1930.

_____, "The 'Total Value Criterion': A New Principle in Index Number Construction," *Journal of the American Statistical Association*, December 1927, *22*, 419–41.

Friedman, Milton and Schwartz, Anna J., *A Monetary History of the United States 1867–1960*, Princeton, NJ: Princeton University Press, 1963.

_____ **and** _____, *Monetary Statistics of the United States*, New York: NBER, 1970.

Hamilton, James, "Monetary Factors in the Great Depression," *Journal of Monetary Economics*, March 1987, *19*, 145–69.

Kindleberger, Charles P., *The World In Depression, 1929–1939*, revised ed., Berkley, CA: University of California Press, 1986.

Mankiw, N. Gregory, Miron, Jeffrey A. and Weil, David N., "The Adjustment of Expectations to a Change in Regime: A Study of the Founding of the Federal Reserve," *American Economic Review*, June 1987, *77*, 358–74.

Moore, Geoffrey H., ed., *Business Cycle Indicators, Basic Data on Cyclical Indicators*, Vol. II, Princeton: Princeton University Press, 1961.

_____, **and Zarnowitz, Victor,** "The Development and Role of the National Bureau of Economic Research's Business Cycle Chronologies," in Robert J. Gordon, ed., *The American Business Cycle: Continuity and Change*, Chicago: University of Chicago Press, 1986, Appendix A.

Newdick, Edwin, *How to Use Fisher Indexes*, New York: Index Number Institute, 1929.

Persons, Warren, *Interpretation of the Index of General Business Conditions*, Cambridge, MA: Harvard University Press, 1922.

_____, "The Revised Index of General Business Conditions," *Review of Economic Statistics*, July 1923, *5*, 187–95.

Sims, Christopher A., "Comment," *Journal of Business and Economic Statistics*, October 1987, *5*, 443–49.

Temin, Peter, *Did Monetary Forces Cause the Great Depression?*, New York: Norton, 1976.

Harvard Economic Society, *Weekly Letters*, Harvard University Press: Cambridge, MA, *1–10*, 1923–31.

Harvard University Committee on Economic Research, (1923a) *Harvard Economic Service*, Cambridge, MA: Harvard University

Press, 1923.

_____, (1923b) *The Harvard Index of General Business Conditions: Its Interpretation*, Cambridge, MA: Harvard University Press, 1923.

_____, *The Review of Economic Statistics*, Cambridge, MA: Harvard University Press, Preliminary Volumes, *1–4*, 1919–22.

Index Number Institute, *Statistical Release*, Index Number Institute, Inc., New York, 1928–30.

U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Washington: USGPO, 1975.

U.S. Bureau of Labor Statistics, *Index Number of Wholesale Prices on the Pre-War Base, 1890–1927*, Washington: USGPO, 1928.