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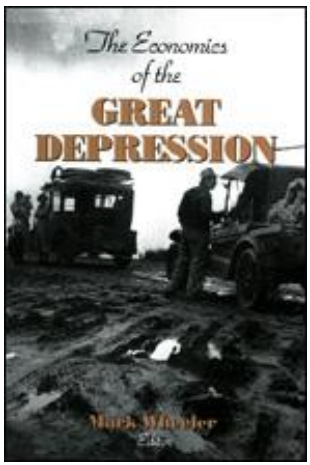
Propagation of the Depression:
Theories and Evidence



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4 Propagation of the Depression

Theories and Evidence

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Despite the fact that it has been more than six decades since the onset of the Great Depression, the factors involved in propagating this dramatic decline in economic activity remain subjects of debate and interest. My objective is 1) to review the received wisdom on how the Great Depression evolved through time, and 2) to reintroduce into the discussion one of the original theories of the Depression that has been subjected to relatively little empirical analysis, the debt-deflation hypothesis.[1]

Let me emphasize that my objective is to discuss the "propagation mechanism" operative in the early 1930s rather than to try to isolate the initiating factor(s) for the Great Depression. I omit lengthy discussion of the initial impulse only to keep the current discussion manageable and not because it is inherently less interesting or important.

Until fairly recently, the received wisdom on the propagation mechanism included two schools of thought. The first, developed by Friedman and Schwartz (1963) and now called the "money view" explanation, argues that inappropriate monetary policy caused what otherwise would have been a (perhaps severe) recession to become the Great Depression. The second, derived from Temin (1976), argues that the impetus for the Depression was the autonomous behavior of consumption.

Recently, a new view of the Depression has emerged. Bernanke (1983) has augmented the money view analysis with what is now called the "credit view." The credit-view model demonstrates how a deflationary shock can disrupt the credit intermediation process and cause a sustained decline in output. Specifically, deflation lowers the net worth of borrowers by raising their real indebtedness. If the deflation is sufficiently severe, debtor insolvency jeopardizes the financial condition of creditors (banks), increasing the fragility of the credit

intermediation process. If bank failures result, local "information capital" on the quality of borrowers is lost, raising the cost of credit intermediation and lowering economic efficiency.[2]

THE BEHAVIOR OF OUTPUT

Figure 1 shows the behavior of output (measured as monthly levels of industrial production) over most of the inter-war period. This longer period provides a background against which to evaluate the time period of interest for present purposes, August 1929 to March 1933. As is evident, industrial production declined precipitously over this three-and-a-half-year period. Whatever the initial impulse, the objective here is to describe and evaluate the dynamics (i.e., the propagation mechanism) in the economy that caused this impulse to have its prolonged effect.

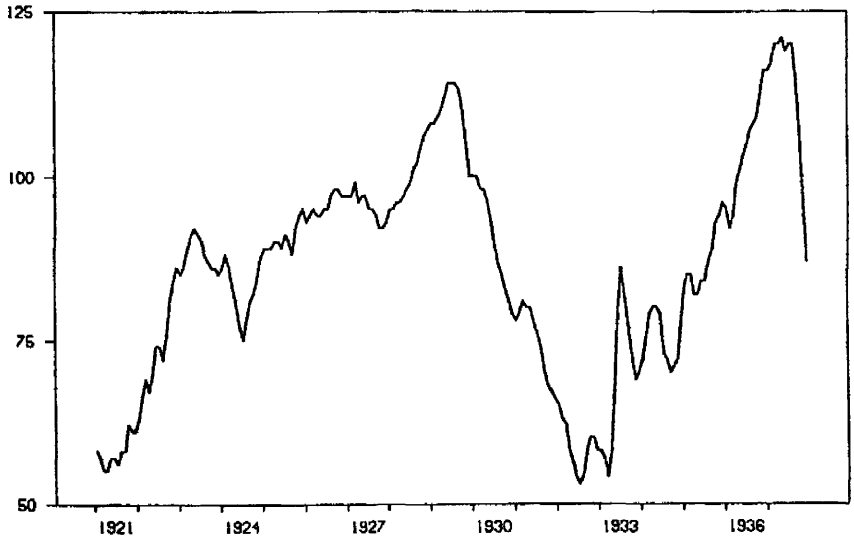
The path of output displayed in Figure 1 suppresses potentially important parts of the story. Specifically, the focus is on the behavior of a single, aggregate measure of output. An expanded analysis would also investigate the interactions among the components of this single measure of output; that is, attention would be paid to the "comovement" of output across sectors of the economy. For example, interesting elements of the story revolve around the agricultural and housing sectors. Unfortunately, time does not permit detailed analysis of sectoral interactions.

THEORIES OF THE PROPAGATION MECHANISM

The Money View

One time-honored interpretation of the decline in output that began in the fall of 1929 is the money view of Friedman and Schwartz (1963). Their argument proceeds by first building a statistical case, using roughly a century's worth of data, that changes in the money stock cause subsequent changes in output. Second, beginning in late

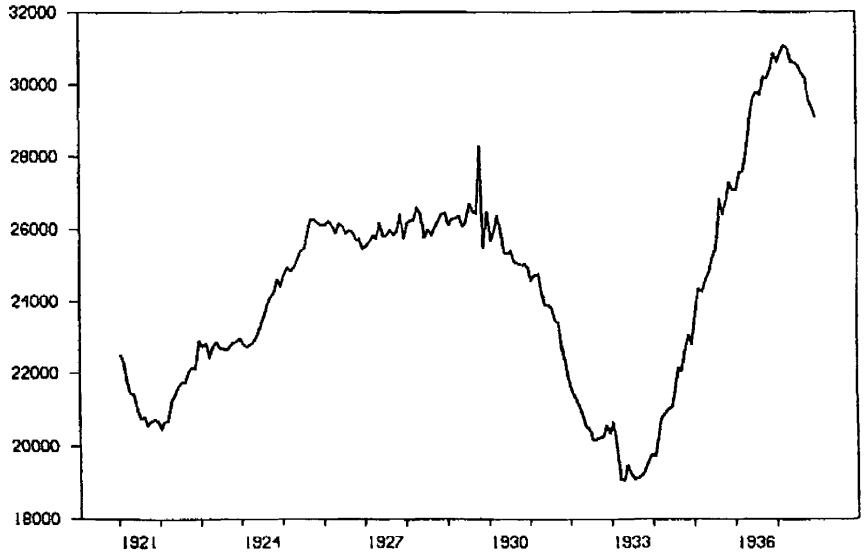
Figure 1 Industrial Production Index, January 1921 to December 1937 (base period 1935–1939 = 100)



1929 and accelerating in late 1930, declines in the money supply occurred due to what they referred to as the "inept" response of officials of the Federal Reserve System to the emerging crisis (Figure 2).[3] The Friedman-Schwartz argument is that the Depression was both deeper and more prolonged than need be due to this inappropriate monetary policy.[4] Finally, a contributing factor was the fall in wealth of both bank shareholders and depositors associated with widespread bank failures. Among other effects, these wealth shocks likely contributed to falling demands for consumption goods, further contributing to the downward spiral in production.

While the sharp decline in output certainly accompanies the dramatic fall in the money stock, a deeper look at the data suggests that the links between money and output may be decidedly more complex. In particular, the stock of money in the economy is the result of interactions among the Federal Reserve, the banking sector, and the nonbank public. The Fed sets the quantity of base money (B) in the economy. The banking system and the nonbank public then use this

Figure 2 M1 Money Supply, January 1921 to December 1937 ($ millions)



monetary base to produce the money supply (M1). A "bare bones" expression of this relationship is the money multiplier model:

$$M1 = m^*B,$$

where the money multiplier is

$$m = (1 + c)/(r_d + e + c)$$

with r_d being the required reserve ratio for demand deposits, with c being the ratio of currency to demand deposits (C/D) held by the public, and with e being the ratio of excess reserves to demand deposit liabilities (ER/D) held by banks. Note that the money supply is determined in part by Fed policy that sets the required reserve ratio and the monetary base, in part by banks as they choose the quantity of excess reserves to hold relative to deposit liabilities, and in part by the nonbank public as it chooses the level of currency to hold relative to deposits.

The money multiplier model suggests an investigation of the base and the multiplier separately. Figure 3 shows the behavior of the base over the inter-war period. Notice in particular the modest (relative to the decline in money) decline in the base over the 1928–1930 period. Figure 4 shows the money multiplier, m, which declined dramatically over the first three years of the Depression. This decline was driven by a rising excess reserve ratio, as banks struggled to maintain liquidity in the face of the possibility of bank runs, and by a rising currency-deposit ratio, as the nonbank public, fearing instability of the banking system in general and the possibility of the failure of their own banks in particular, preferred to hold currency rather than deposits.[5]

Do Figures 3 and 4 mean that the Friedman-Schwartz hypothesis, that the fall in the money stock was due to inept policy, is incorrect? Not necessarily, since the rises in the ratios of currency and excess reserves to deposits may reflect a lack of public confidence in Fed policies. The Fed, after all, could have chosen to flood the financial market with money, though perhaps at the cost of giving up alternative policy goals.

The initial impression from Figures 2 to 4 is that the Friedman-Schwartz money view certainly appears consistent with the data. But since advanced economies are complex, other hypotheses may also be supported by the data as well. We now turn to two popular alternatives.

Autonomous Spending Shocks

The second of the time-honored hypotheses about the propagation mechanism is due to Temin (1976), who argued that the impetus for the Depression was the autonomous behavior of consumption. In his view, the Depression began as a recession, which was brought about by a variety of factors. First, there was an oversupply in the housing market. Second, financial markets were uneasy because of the stock market boom and the Federal Reserve's efforts to burst this speculative bubble. These forces led to a fall in income. The stock market crash in October 1929 was an additional major force leading to the economic collapse. In Temin's view, the crash propagated its deflationary effect through consumption, which was in part depressed due to the decline in consumer wealth and an increase in consumer leverage.[6] But even after considering the magnitudes of the negative effects of lower

Figure 3 Monetary Base, January 1921 to December 1937 ($ millions)

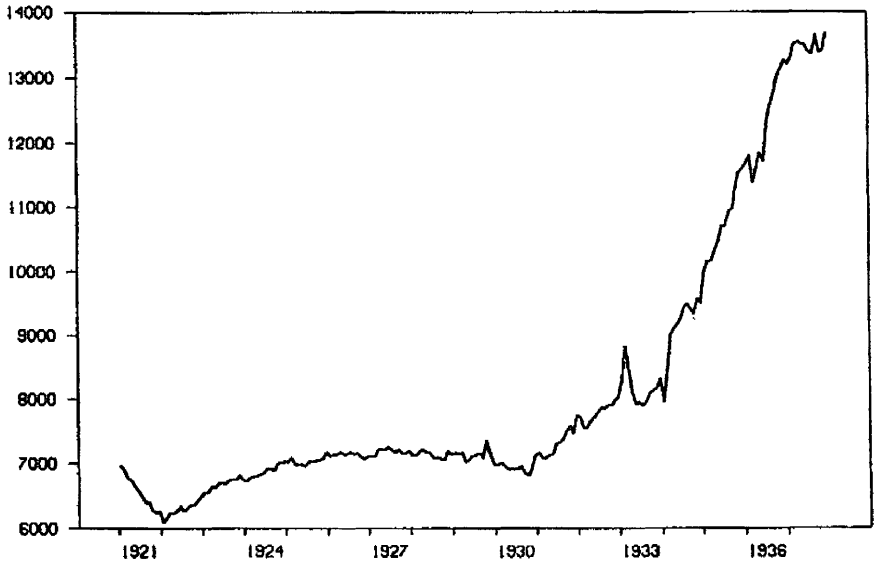
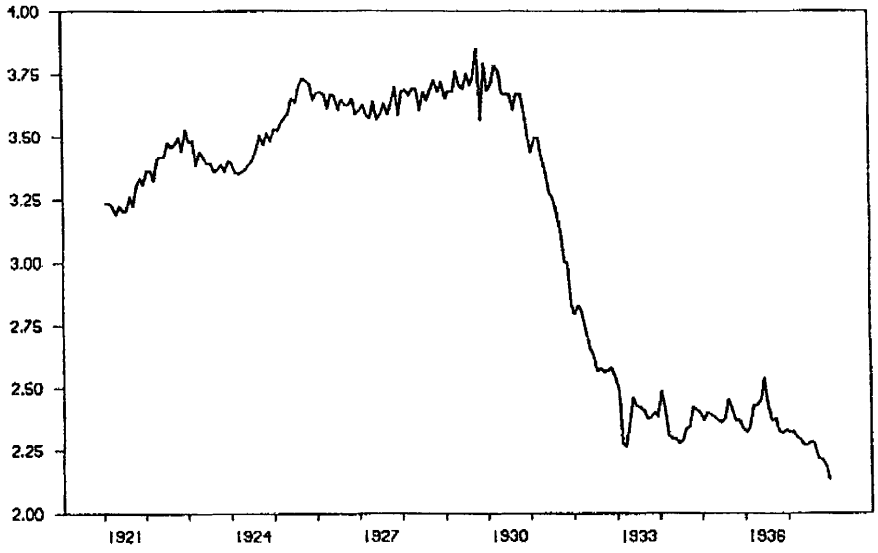


Figure 4 M1 Money Multiplier, January 1921 to December 1937



wealth, increased leverage, potentially pessimistic expectations, and deflationary shocks from the agricultural sector of the United States, there is still a large portion of the fall in consumption in 1929 that Temin considered unexplained or "autonomous." He states (Temin 1976, p. 83): "It is somewhat unsatisfactory to say that the Depression was started by an unexplained event, but this alternative is preferable to statements that are inconsistent with the data." Thus, he claimed that nonmonetary and nonfinancial forces played the primary causal role in the Depression.[7]

In contrast to Friedman and Schwartz, Temin views the behavior of money as responding to, but not causing, the economic decline; for Temin, money is a passive, endogenous variable. Specifically, he argues that "there is no evidence of any effective deflationary pressure from the banking system between the stock market crash in October 1929 and the British abandonment of the gold standard in September 1931" (Temin 1976, p. 169). Temin reached this conclusion because short-term interest rates fell, contrary to what would be expected during a period of monetary stringency. He argued further that the approximate constancy of the real money supply throughout this period hardly signals that contractionary movements in output are the response to monetary tightening.[8]

Romer (1988) has recently revisited the issue of the aberrant behavior of consumption in the early stages of the Depression. Consistent with the results of Mishkin (1978) and Temin, Romer argues that neither wealth nor income effects can account for all of the fall in consumption. Rather, her hypothesis is that the drop in consumption was the result of increased uncertainty during 1929.[9]

She concludes that "uncertainty effects due to stock market variability can explain most of the unusual behavior of consumer spending on durable and semidurable goods in the first year and a half of the Great Depression" (p. 29). That is, the stock market crash made consumers sufficiently uncertain of the future to induce them to decrease their consumption, and thus provided an impetus for the initial fall in economic activity in 1929 that marked the beginning of the Depression. She also provides contemporary accounts from business forecasters that suggest the uncertainty persisted well into 1930.[10]

Romer's analysis suggests that a substantial portion of the drop in consumption was due to increasing uncertainty about the state of the

economy. Further, this decline in consumption may account for some of what Temin viewed as "autonomous." For the consumption explanation of the propagation mechanism to be plausible, some type of proxy showing increased consumer uncertainty should be available. Figure 5 shows a measure of uncertainty: changes in the 12-month moving variance of stock prices. As expected, near the end of 1929, these changes become much more pronounced. Further, the plausibility of the argument that consumption declines were the primary driving force for the tailspin in output in the early 1930s would be enhanced with evidence that monetary policy was not unusually restrictive. Following Temin's argument, Figure 6 shows the interest yield on Treasury securities maturing in three to six months, and at first glance it provides support for Temin's claim that monetary policy was not "tight" at the outset of the Depression. Specifically, after the rise in rates engineered in 1928 by Fed officials concerned with stock market speculation, rates began to fall well in advance of the outset of the downturn and continued to fall through the middle of 1931.[11] Taken together, the casual evidence in Figures 5 and 6 does not obviously discount the hypothesis that consumption shocks played an important role in the decline in output.

Debt-Deflation and the Credit View

The debt-deflation hypothesis originated with Fisher (1933), who argued that there are two dominant factors that account for the "great" booms and depressions: overindebtedness and deflation. To see the mechanics by which debt-deflation operates, consider first some initial level of nominal debt. A "small" negative price shock raises the real obligation of the debtor. At the same time, the creditor is being repaid in dollars with higher real value. Under the usual assumption that distributional effects are at most of second-order importance, little macroeconomic effect is predicted. Next, assume an initial state of overindebtedness. A sufficiently large price decline forces debtors into insolvency; nominal incomes fall along with prices, so that not only does the real value of the debt obligation rise, the ability to service the debt declines. In the event of bankruptcy of the debtor, the creditor (a bank, for example), ends up owning the asset. The bank, with a given level of nominal liabilities (deposits), finds itself in possession of

Figure 5 Change in the 12-Month Moving Variance of Stock Prices, January 1921 to December 1937

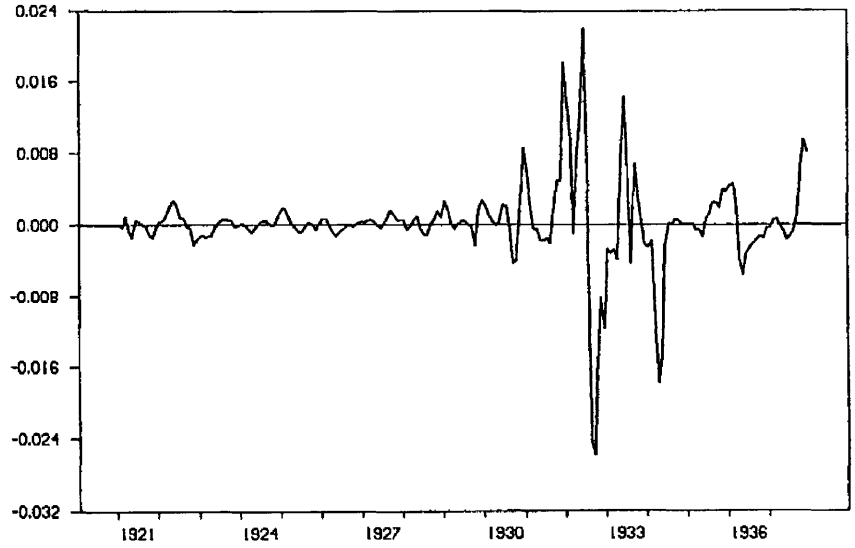
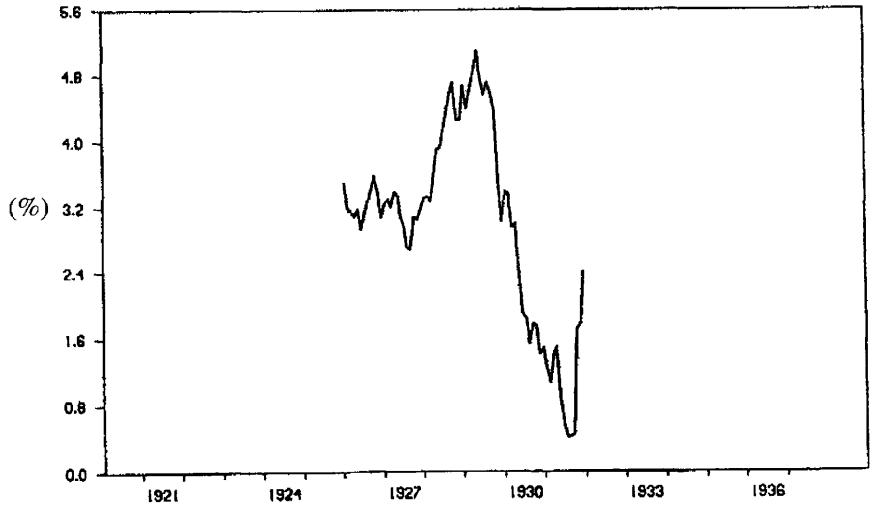


Figure 6 Interest Rate of Treasury Bills, January 1921 to December 1937



assets whose prices are falling and which are costly to sell. The decline in prices may lower the nominal value of (illiquid) assets below this nominal value of liabilities, forcing insolvency onto the bank as well. As banks find their balance sheets becoming increasingly precarious, they may respond by raising the fraction of their assets held in the form of "safe" assets (excess reserves and government securities), lowering funds available for loans. Further, as bank balance sheets deteriorate, concerned depositors may withdraw funds from the bank, increasing its vulnerability to a "run." Thus, "excessive" debt combined with deflation may both lower wealth and jeopardize the credit intermediation process, contributing to a downward spiral in output and prices. If a bank fails, information capital in the form of specialized knowledge about borrowers by local creditors is lost.[12]

If debt-deflation is to explain at least part of the path of output during the Depression, then two important conditions would need to hold. First, there should be evidence of overindebtedness, so that price declines can have the potential of raising real obligations enough to cause a wave of bankruptcies. Second, there should be evidence that a major part of the deflation of the early 1930s was unanticipated at the time agents assumed debt, either in the open market or in the form of bank loans.[13]

Was there an "excessive" debt build-up prior to the onset of the Depression? This is a difficult question to assess. Fisher recognized the complexity of the issue when he noted that overindebtedness is always measured relative to a variable such as wealth or income and that overindebtedness depends in part on the maturity structure of the debt. Further, the assessment may be complicated when relative measures give conflicting evidence on a debt build-up.[14] Some evidence does support the existence of a relatively large rise in debt. First, according to Clark (1933), in the early 1930s the ratio of debt service to national income rose from 9 percent in 1929 to 20 percent in 1932–1933. Second, Persons (1930) reported that urban real estate debt rose by nearly 150 percent between 1920 and 1929, from about $11 billion to $27 billion. Further, he notes that the $16 billion increase exceeds by $5 billion "the entire debt of this character amassed in all the earlier years of our urban development." Third, issuance of corporate bonds and notes rose from $26 billion in 1920 to $47 billion in 1928.

The second issue, whether there was unanticipated deflation, has been the subject of recent literature, which is currently divided regarding whether the deflation was anticipated or not. The data on wholesale and consumer prices are plotted in Figures 7 and 8. Note that there was some precedent for deflation, as the data for 1921 show; agents would not need long memories to allow for the expectation of deflation. However, prices for most of the decade appear stationary, albeit with some variability. The most recent data, for agents assessing price trends as the end of the decade of the 1920s approached, may have suggested continued price stability.

Hamilton (1987, 1992) and Dominguez, Fair, and Shapiro (1988) present empirical evidence consistent with the view that the deflation was unanticipated. However, Cecchetti (1992) critiques Hamilton's findings and concludes that once deflation started, people expected it to continue. Nelson (1991) presents an extensive and detailed examination of the statements of business commentators from April 1929 through December 1930. He concludes that the business press anticipated deflation.

While the debt-deflation mechanism can explain a decline in output over the course of a business cycle, can it alone account for the massive decline in output experienced in the 1930s? Using the debt-deflation hypothesis as a point of departure, Bernanke (1983) presented a new explanation of the experience of the U.S. economy in the early 1930s. In Bernanke's credit-view theory, credit became unavailable for all but the very safest loan prospects, and that disrupted economic activity by eliminating sources of financing for both investment and production. Once the combination of overindebtedness and deflation raised problems of debtor insolvency, "the disruption of the financial sector by the banking and debt crises raised the real cost of intermediation between lenders and certain classes of borrowers" (p. 263). Banks became unwilling to loan to all but the most creditworthy customers, effectively forcing borrowers without access to other sources of credit to lower their levels of economic activity. As banks (and other creditors) engage in a "flight to safety," lending only to the safest prospects and not at all to others, the interest rate spread between "risky" and "safe" loans will widen substantially. This implication is supported in the data, as demonstrated in Figure 9, where the spread more than tripled in the early 1930s.

Figure 7 Wholesale Price Index, January 1921 to December 1937 (base year 1926 = 100)

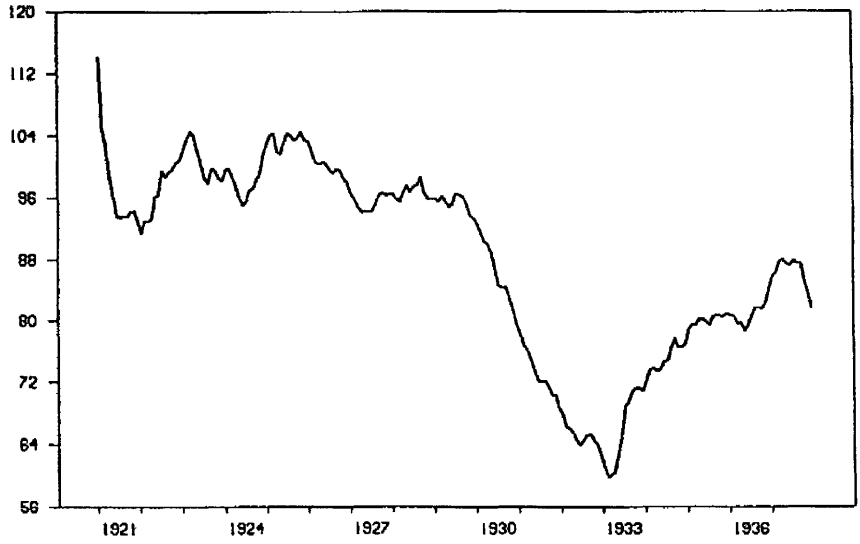


Figure 8 U.S. Cost of Living Index, January 1921 to December 1937 (base year 1939 = 100)

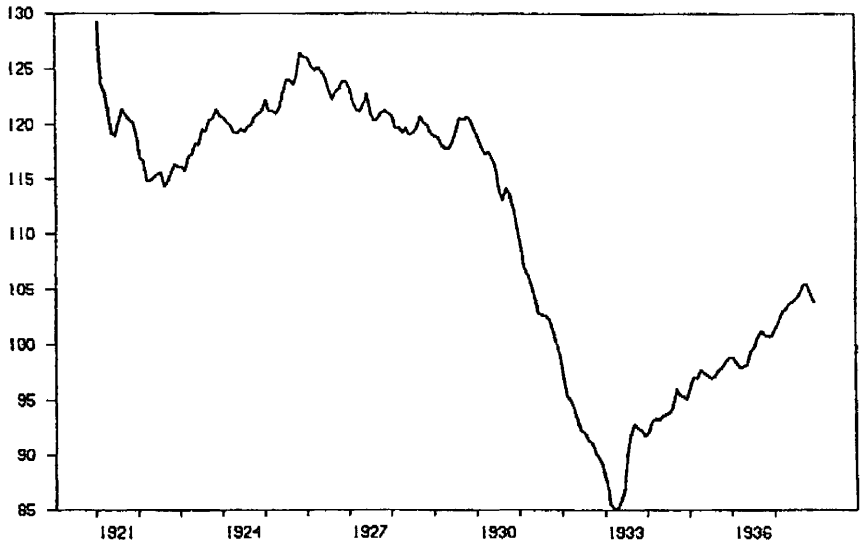
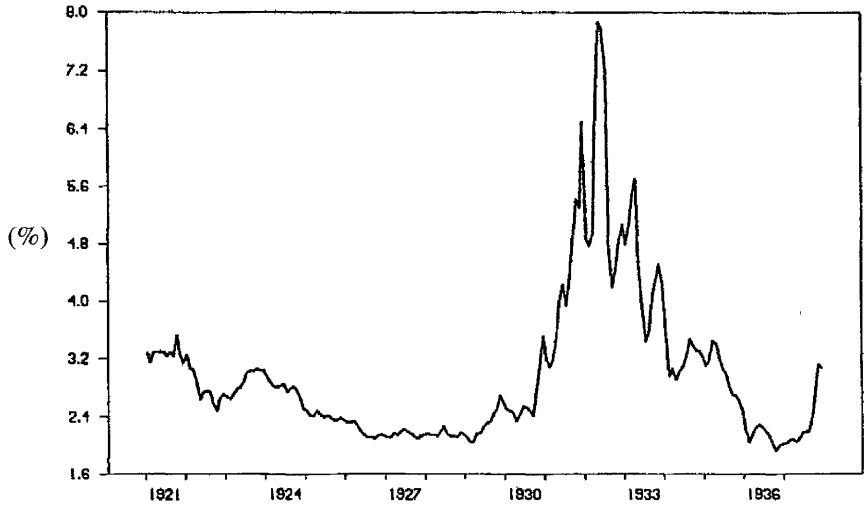


Figure 9 Baa Interest Rate Minus Government Bond Interest Rate, January 1921 to December 1937



In the money view, it is the liability side of the balance sheet of the banking system, reflecting the quantity of money, that determines economic activity and prices. The asset side, and in particular how bank portfolios are allocated between securities and loans, is irrelevant to economic outcomes. In the credit view, banks are important not only because their liabilities serve as the medium of exchange, but also because banks specialize in lending to agents who would find open-market borrowing prohibitively expensive. Thus, a monetary policy that lowers reserves works not only because of the upward pressure on interest rates, as argued by money-view proponents, but also because some borrowers do not have alternative sources of funds as bank lending declines; if bank loans fall, some agents cannot obtain funds elsewhere. The corresponding decline in spending then complements the interest-rate effect of the restrictive monetary policy.

HOW IMPORTANT IS EACH THEORY OF THE PROPAGATION MECHANISM?

The analysis of the previous section suggests that the various hypotheses that purport to explain the downward spiral in output are not only plausible, but appear consistent with a casual look at the data. Let me caution, however, that we need not necessarily look at these hypotheses as competing with one another. One theory may explain events over one time period (for example, consumption shocks may explain events just after the stock market crash) and another over the next time period (for example, credit shocks may explain events subsequent to bank panics). And some may complement each other during a given period (such as debt-deflation and disruptions to the credit intermediation process). The results of a more sophisticated analysis are now examined in the hope that they will allow at least tentative answers to the question posed in the title of this section.[15]

I have analyzed a model of the U.S. macroeconomy for the inter-war period that incorporates each of the hypotheses outlined in the previous section. As indicated in the introduction, I ignore explicit consideration of international events. Viewing the U.S. experience in isolation, while perhaps controversial to some, has as an important precedent recent work by Romer (1993). She argues that, at least until the fall of 1931, domestic factors were the cause of the drop in U.S. output, rather than international constraints.[16] In particular, Federal Reserve policy decisions (from the tightening in 1928 to curb what was seen as excessive stock market speculation to the failure to counteract banking panics in 1930 and in both the spring and fall of 1931), rather than international events, were likely of primary importance in explaining the drop in U.S. production.

Monthly data over the period from January 1921 to December 1937 are used so as to study the Depression era in the broader context of the inter-war period. The data employed are the rate on U.S. government bonds, the M1 measure of money, industrial output, the wholesale price index, bank loans made for purposes other than securities purchases, the spread between the Baa bond rate and the government bond rate, the real liabilities of failing banks, and the par value of outstanding bonds.

While most of these data are well known and require no additional discussion, the loan series and the bond series require some comment. The loan data represent total loans by banks in 101 leading cities net of loans made by banks on securities. By netting out loans made on securities, the resulting loan series should correspond closely to loans made for commercial and industrial purposes, the relevant concept for an evaluation of the credit view of policy.[17] Note that it is not possible to derive a consistent net loan series after 1937, which thus determines the ending point for the sample.

The outstanding bond series is intended to represent indebtedness of borrowers with access to open-market sources of finance. This series is derived by Hickman (1953) and represents the stock of outstanding corporate bonds of railroads, public utilities, and industrial firms. The basic data were annual, with monthly data derived by Hickman by adjusting the data for which the month of issue was known so that their sum equaled the annual total. Since the months of issue of about 95 percent of total par amounts are known, the monthly data should be accurate. In addition, Hickman provides a detailed comparison of this debt series with those available from other major sources, including the *Commercial and Financial Chronicle* and the *Journal of Commerce*. He is able to reconcile his data with that contained in these alternative sources, so that Hickman's degree of confidence in these data is high; see Appendix C in Hickman (1953) for detail.

The final data issues of importance relate to the interest rates series. First, the government bond rate represents a "safe" interest rate on U.S. bonds with 12 or more years to maturity or call date. Second, the interest rate spread is intended to proxy for the difference between the loan rate at banks for bank-constrained borrowers and a safe market rate. Note, however, that the Baa rate corresponds to borrowers who have access to open market sources of funds, so that the spread is far from a perfect measure of the concept it is intended to measure. However, due to problems associated with adverse selection, moral hazard, and credit rationing, the spread between the loan rate series on bank lending and the safe government bond rate may not adequately measure the premium required by banks to lend to "good" risks. Bernanke (1983) represents a precedent for using the interest rate spread employed here.

The model estimated and analyzed is a variant of a standard textbook aggregate demand (AD) and aggregate supply (AS) presentation of the macro economy. Underlying the AD schedule are augmented versions of the IS and the LM schedules. The usual specifications are augmented to account for the market for bank loans and for the volume of open-market credit. The IS curve represents, *inter alia*, the behavior of consumption and investment decisions.[18] The IS curve includes as arguments bank loans, real open-market debt obligations, and the interest rate spread; these variables are intended to capture the debt-deflation/credit-view impacts on the demand for goods and services. The money demand equation underlying the LM schedule includes deposits in failing banks as a variable that represents portfolio shifts undertaken by agents in response to bank failures or panics. That is, the money demand equation includes a proxy for shifts between deposits and currency that alters the money multiplier, as in the money view. The money supply equation underlying the LM schedule includes real open-market obligations, bank loans, and the interest rate spread. These variables are intended to capture the effects of changes in the credit intermediation process on the supply of money, as in the credit view. The money supply curve also includes deposits in failing banks in an effort to account for the effect of bank failures, as a proxy for the excess reserve ratio on the money supply, as in the money view. The financial sector is completed with demand and supply equations for bank loans, as well as equations explaining bank failures as depending on financial distress, as in the credit view, and the volume of open-market credit. Finally, a relatively simple aggregate supply curve is specified; its distinguishing feature is the inclusion of deposits in failing banks as an explanatory variable to take into account the effect of a decline in working capital on production.

The model described above is analyzed in the following way. Each variable in the model contains two parts: a systematic or predictable component and a random component or error term. The systematic component can be thought of as the "predicted" or "forecast" part of the variable; this component represents the "best information" the agent has about the future path of the variable, given the model structure. The random component represents the deviation between the actual data and the systematic or forecast component.[19] Finally, the model is dynamic, so that random shocks to a variable one period can

alter the path of other variables over time. By way of terminology, breaking down output into its systematic and random components is referred to as a "historical decomposition."

As an example of the general procedure outlined in the previous paragraph, consider industrial production ("output"). At a point in time, output can be forecast into the future; this is the systematic component. The error in the forecast—the difference between the forecast and the actual path of output—is due to unforeseen shocks in the economy; this is the random component. This forecast error in output can be the result of a variety of shocks to other variables in the economy. For example, if banks unexpectedly alter their lending preferences and stop lending to some firms, as in the credit view, then output may fall relative to the forecast level if firms cannot obtain enough working capital to finance production. Or, if consumers unexpectedly slow their purchases, firms may reduce production to avoid unwanted inventory build-up. In general, shocks to all variables can have some effect on output.

To see the relative importance of various factors for the path of output, begin by considering Figure 10, which shows the forecast or "base projection" of industrial production, a 95 percent confidence band around the base projection, and the actual path of this measure of output. Given the model parameters, the base projection represents the path for industrial production that would have been predicted in a forecast made at the beginning of October 1929. Visually, the base projection completely fails to capture any of the general pattern of actual movements in industrial production. Statistically, for the entire period, the root mean squared error (RMSE) between the base projection and actual industrial production is 40.8 (Table 1).

The remaining figures present two types of visual evidence on the difference between the base projection and the actual behavior of output. First, the figures provide a way to see whether the error component in some particular variable explains the difference between the base projection of output and its actual level. Second, the figures allow us to form impressions on whether these errors help reproduce the "characteristic phases" (i.e., the turning points and rates of growth) of actual output during various subperiods, even in the absence of closing the gap between the forecast and the actual path of industrial production. The major phases of interest begin with the period between Octo-

Figure 10 Industrial Production Index, October 1929 to December 1933 (base period 1935–1939 = 100)

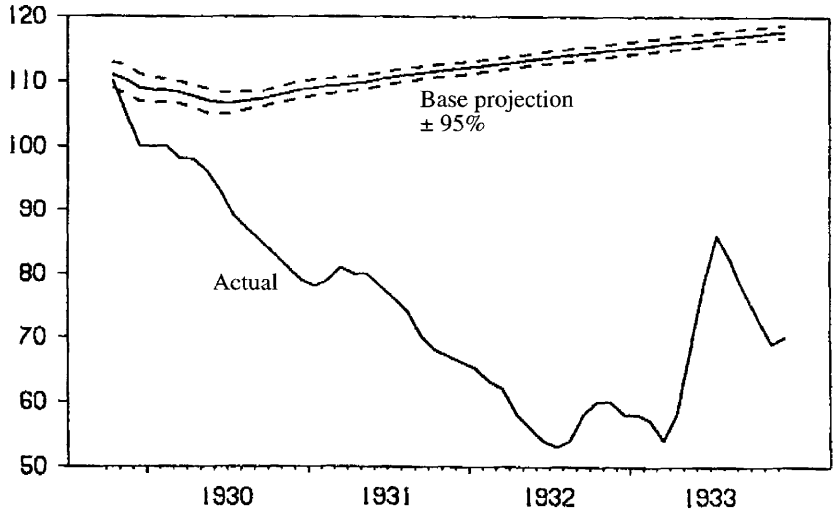


Table 1 Root Mean Squared Errors for Historical Contributions of Selected Variables Relative to Actual Output

Variable(s)	Oct. 1929 to Sept. 1931	Oct. 1929 to Dec. 1933
Base projection (BP)	24.1	40.8
BP + money supply shocks	19.4	35.7
BP + IS shocks	17.0	21.8
BP + deflation shocks	18.2	30.9
BP + bank loan shocks + interest rate differential shocks	24.2	33.3
BP + IS shocks + money supply shocks	13.5	17.7
BP + IS shocks + deflation	11.9	14.2
BP + IS shocks + bank loan shocks + interest rate differential shocks	17.1	16.8
BP + IS shocks + money supply shocks + deflation shocks	9.3	10.8

ber 1929 and January 1931 when the U.S. economy went into a deep, but not historically unprecedented, recession. From February 1931 through May 1931, the economy flattened out. Then output went into a tailspin from June 1931 through July 1932. There was an incipient recovery from August 1932 until October 1932, which was followed by a collapse that hit the bottom in March 1933. The remainder of 1933 displayed a sharp "spike," in that a rapid recovery began in April, peaked in July, and declined to the end of the year.

Figure 11 shows the contribution to the base projection of the errors to the money stock, and so approximately corresponds to the money view advanced by Friedman and Schwartz. This figure suggests that the money supply shocks contributed to declines in output throughout 1930 and again in late 1931. With the exception of a slight uptick in output in early 1930 rather than a relatively flat path for actual output, these patterns are not obviously at odds with the tightening of policy in the late 1920s and the panics in the early 1930s. However, accounting for the money stock errors does little to close the gap between actual output and its forecast path. A quantitative assessment of the role of money supply shocks in determining the path of output is presented in Table 1, where the RMSE of the base projection plus the contribution of money is 35.7 for the entire period, a reduction of 12.5 percent from the base projection of industrial production alone. Note, however, that for the initial stages of the Depression, i.e., the period from the stock market crash through September 1931, the percentage improvement in the RMSE is about 20 percent (an RMSE of 19.4 vs. 24.1).

Figure 12 shows the contribution to the base projection of shocks to the IS curve. Note that while this figure is in the spirit of Temin, the factors underlying this chart are much broader than those in his original hypothesis. In particular, the shocks underlying the IS curve include, in addition to consumption shocks, shocks to investment and shocks from elsewhere in the world.[20] With this caveat, it should nonetheless be noted that the IS shocks underlying the early months in Figure 12 are unlikely to be due to exports; exports rose by about 3 percent between 1928 and 1929, and real exports were a relatively small fraction of GNP. As is evident from Figure 12, over the first several months after the stock market crash, IS shocks roughly mimic the monetary shocks displayed in Figure 11, showing an initial decline fol-

Figure 11 Industrial Production Index, Base Projection + Money Supply, October 1929 to December 1933 (base period 1935–1939 = 100)

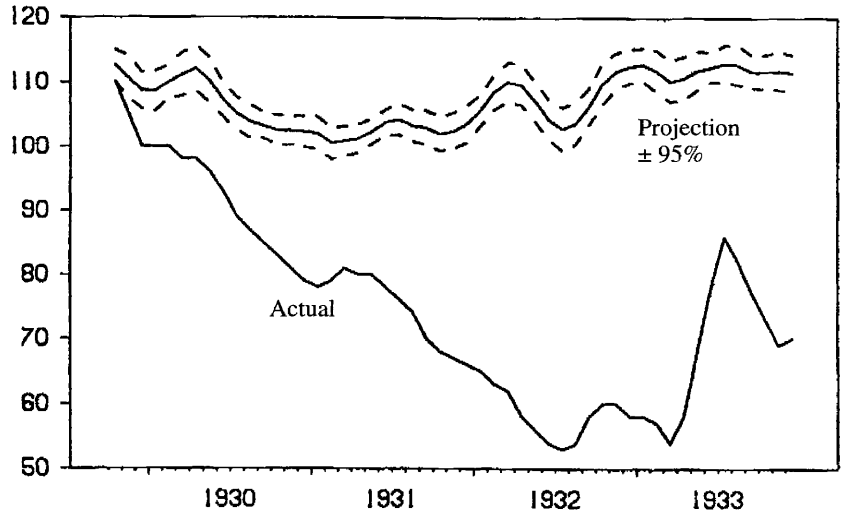
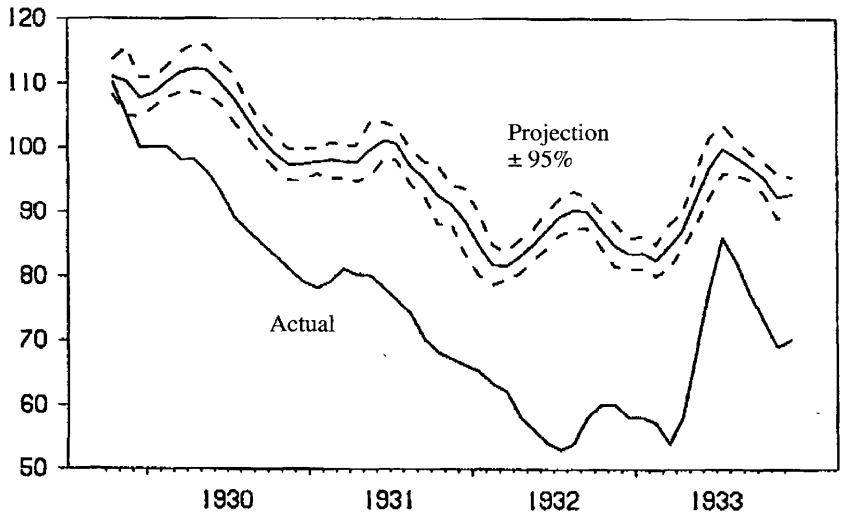


Figure 12 Industrial Production Index, Base Projection + IS Curve, October 1929 to December 1933 (base period 1935–1939 = 100)



lowed by a modest rise in early 1930. From mid 1930 on, however, IS shocks appear to provide a more complete explanation of both the actual path of output and the characteristic phases of output during the Depression era. More precisely, the results reported in Table 1 show that the IS shocks nearly halve the RMSE of the base projection for the period ending in December 1933. These IS shocks also dominate the monetary shock explanation for the initial phase of the Depression, but not nearly so completely as for the entire period. For the initial phase, the RMSE of the base projection falls from 24.1 to 17.0, a 30 percent improvement. Note, however, that most of the improvement relative to the monetary explanation appears to occur after late 1930, so the initial months of the Depression don't seem to be dominated by either theory.

Figure 13 shows the ability of the debt-deflation hypothesis to account for the path of output. Note that this plot represents the effects of deflation without the complementary effects associated with the credit view; independent shocks associated with the credit view are discussed below. However, compared with the monetary explanation, deflation surprises provide some explanatory power for the path of output, especially over the entire period. The notable aspect of this figure is that, unlike the results displayed in Figures 10, 11, and 12, the deflation shocks do not produce a path in which output rises in late 1929 and early 1930. The RMSE associated with the initial two years of the Depression is 18.2, midway between those for money and IS shocks. For the period ending in December 1933, the RMSE for the base projection plus the effects of deflation surprises is 30.9.

Figure 14 provides a representation of the credit view, where shocks to the market for bank loans and the interest rate differential are combined with the base projection of output. Visual inspection suggests that, like shocks to the IS curve but unlike the monetary and deflation explanations, the credit view reasonably captures the characteristic phases of the period. Notice in particular that industrial production tends to fall in periods following banking panics in this plot, consistent with firms being forced to lower production due to drops in the availability of working capital. However, as reported in Table 1, the credit view explains less of the scale effects of the Depression than does the debt-deflation hypothesis, with a full period RMSE of 33.3 and an initial period RMSE of 24.2. Of particular interest to credit-view proponents should be the declines in output accounted for by

Figure 13 Industrial Production Index, Base Projection + Deflation, October 1929 to December 1933 (base period 1935–1939 = 100)

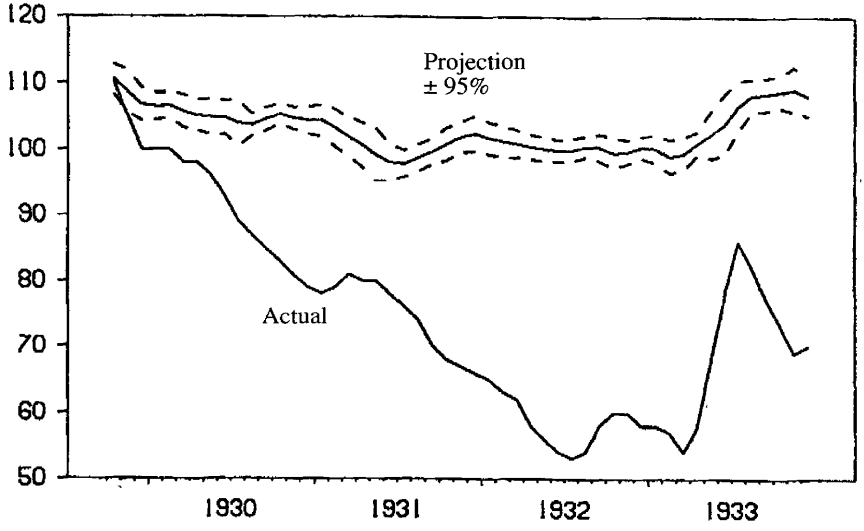
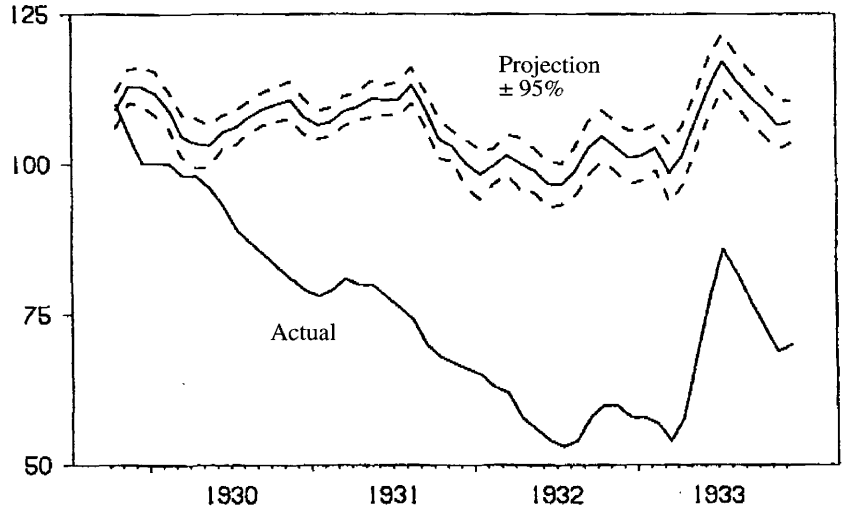


Figure 14 Industrial Production Index, Base Projection + Loans and Interest Rate Differential, October 1929 to December 1933 (base period 1935–1939 = 100)



shocks in the bank loan market around the first and second banking panics in late 1930 and mid 1931, and the accounting for rising output following the bank holiday in 1933.

Given that shocks to the IS curve generate the lowest RMSEs and most accurately capture the characteristic phases of the Depression over the full horizon, the remaining charts investigate the joint abilities of shocks to the IS curve and other explanations of the Depression to account for the path of output.

Consider Figure 15, which shows the joint contributions of shocks to the IS curve and the money supply; roughly, this plot represents the combined effects of the time-honored explanations of Temin and Friedman and Schwartz. Compared with Figure 12, the addition of money tends to bring the projected path of industrial production somewhat closer to the actual path. Specifically, as reported in Table 1, the RMSE of the base projection plus both IS shocks and money supply shocks is 17.7 for the full period, in contrast to an RMSE of 21.8 for the contribution of IS shocks alone; thus, the addition of money supply shocks lowers the RMSE by about 19 percent relative to the RMSE associated with IS shocks alone. Roughly the same percentage improvement occurs during the first two years of the Depression.

Figure 16 shows the joint contributions of IS and deflation shocks. As compared with Figure 12, the inclusion of deflationary shocks allows a closer description of the path of output than do just the IS shocks. This appearance is confirmed in Table 1, where the RMSE for the projected path relative to the actual path is 14.2 for the full period and where it is 11.9 for the initial phase of the Depression.

Figure 17 combines the base projection with shocks to the IS curve and the variables associated with the credit view. Unlike previously described alternatives, the output decline is noticeably faster after the second banking panic in 1931 and most closely parallels the upward spike in output after the 1933 bank holiday. However, this combination of IS shocks with the credit view shocks does not provide much initial explanatory power for the early part of the Depression. Thus, the RMSE for this combination is 17.1 over the first two years of the era (about the same as for IS shocks alone) but is 16.8 for the entire period.

Finally, Figure 18 combines the deflationary shocks associated with the debt-deflation hypothesis with those from the money view and

Figure 15 Industrial Production Index, Base Projection + IS Curve + Money Supply, October 1929 to December 1933 (base period 1935–1939 = 100)

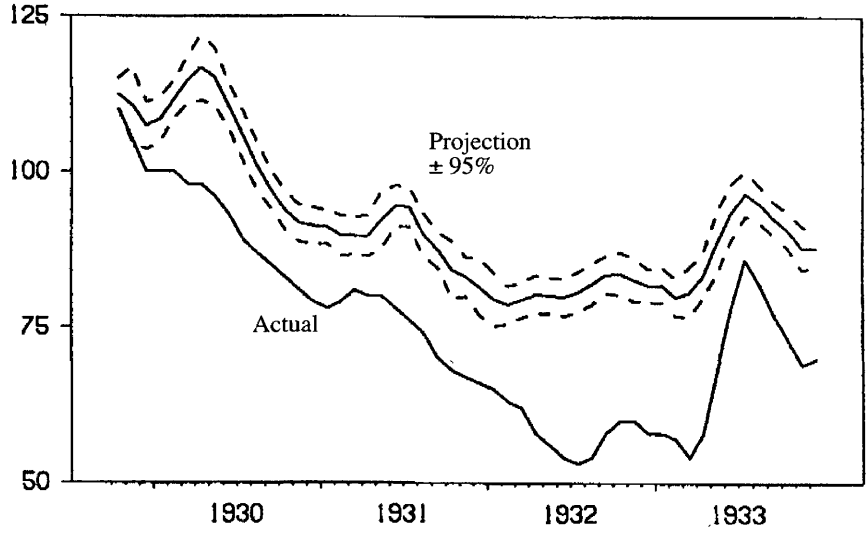


Figure 16 Industrial Production Index, Base Projection + IS Curve + Deflation, October 1929 to December 1933 (base period 1935–1939 = 100)

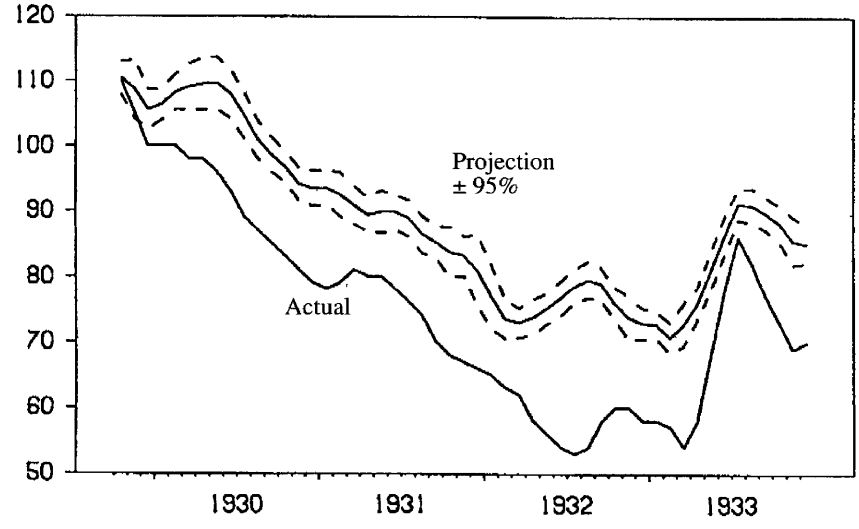


Figure 17 Industrial Production Index, Base Projection + IS Curve + Loans and Rate Differential, October 1929 to December 1933 (base period 1935–1939 = 100)

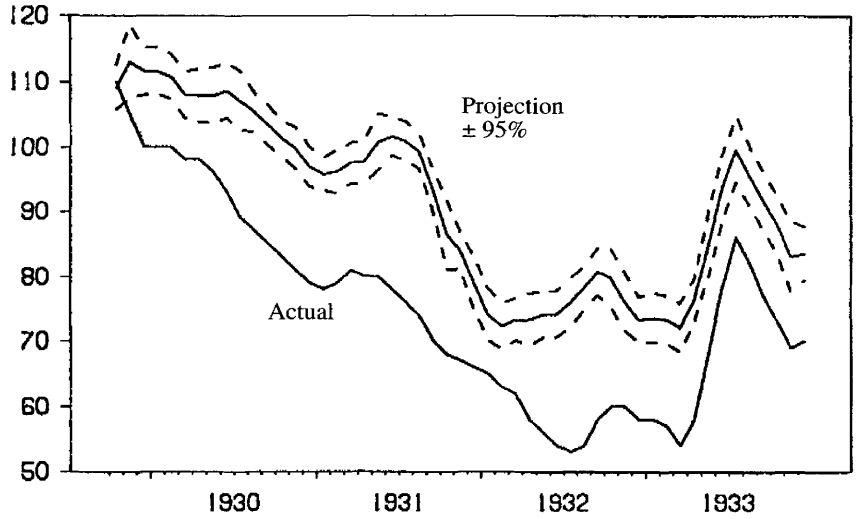
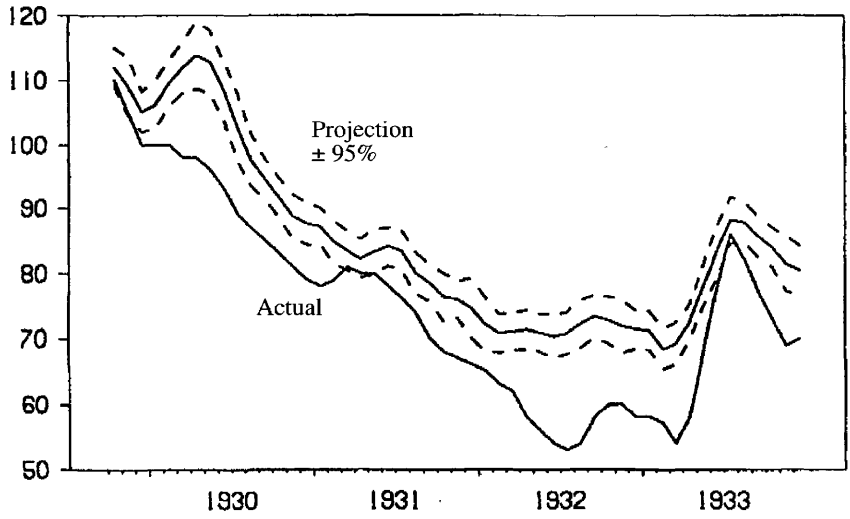


Figure 18 Industrial Production Index, Base Projection + IS Curve + Money Supply + Deflation, October 1929 to December 1933 (base period 1935–1939 = 100)



the autonomous shocks influencing the IS curve. While not capturing all of the Depression, the implied multicausal view of propagation of the Depression does capture most of the drop in output and closely describes the characteristic phases of the period, with the exception of the early months of 1930.

CONCLUSIONS

A number of conclusions emerge from this analysis. First, for the period as a whole, there does not appear to be a single, dominant explanation of the Depression; no factor alone can explain both the magnitude of the decline in output along with the characteristic phases of the Depression. Overall, the factor that does the "best" at explaining the various facts is the shock term to the IS curve. This term probably represents consumption early in the horizon, but later also probably reflects shocks to investment, fiscal policy, and external events.

Second, as indicated in Table 1, among shocks to the individual equations, those to the IS curve produce the lowest RMSE over the two years following the stock market crash. However, as was visually evident from Figures 11 to 14, only the debt-deflation hypothesis, as embedded in deflation surprises, suggested a downward path for output at the onset of the Depression. In fact, the RMSE for the base projection alone for the first year following the crash was 12.8. Among the various theories, only the RMSE associated with the debt-deflation hypothesis (10.6) shows a noticeable drop in the RMSE through September 1930; the RMSE associated with money was 12.6, with IS shocks was 13.2, and with shocks to the bank loan market was 13.0. This result seems to suggest that further investigation of the role of deflationary surprises may be warranted.

Third, the credit view that disruptions to the market for bank loans help explain the depth and length of the Depression is consistent with the data presented here. Specifically, the credit view seems to work well in explaining the rate of decline in output around the banking panics in the early 1930s.

Fourth, note that the credit view appears to contain explanatory power over the period from the stock market crash through the end of

1933, even in the presence of money shocks. This result stands in some contrast to that of Bordo, Rappoport, and Schwartz, who argue that for an earlier period, the evidence for the credit view is weakened by the presence of the money stock.

Notes

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1. This theory was first proposed by Irving Fisher (1933). Recently, Calomiris and Hubbard (1989) and Bordo, Rappoport, and Schwartz (1992) have addressed some of the issues that arise in debt-deflation. Calomiris and Hubbard estimated a "credit view" model of the 1884–1909 period; Bordo, Rappoport, and Schwartz investigated "hybrid credit view" and "hybrid money view" models that attempt to sort out the relative roles of money and credit for economic activity over 1880–1914, a period that encompasses the Calomiris-Hubbard period. In contrast to these papers, the focus of this paper is (most of) the inter-war period, 1921–1937.
2. Eichengreen (1992) has argued that the breakdown of the gold standard that had governed international monetary arrangements prior to World War I and again over the first part of the inter-war period was the driving force behind the sharp and protracted decline in output. I do not address this explanation for the propagation mechanism explicitly. However, as argued by Bernanke (1994), the "comparative approach" to understanding the Depression stimulated by the rise and fall of the gold standard in the inter-war period enhances the confidence in model identification when assessing the Depression experience of an individual country.
3. The data plotted in Figure 2 are for the M1 stock of money. A plot of M2 shows the same pattern of steep declines over the early 1920s.
4. Recent support for this hypothesis is presented by Schwartz (1981) and McCallum (1990). Schwartz presents Granger-causality tests consistent with the hypothesis of unidirectional causality from money to income during the Depression. McCallum demonstrates with counterfactual simulations that a monetary base rule aimed at keeping nominal GNP growing smoothly at a noninflationary rate would have avoided most of the decline in output during the 1930s. However, other evidence suggests that there remains room for additional explanations. For example, Gordon and Wilcox (1981) argue that money does not play an important role in the decline in output in the initial stages of the Depression. Burbidge and Harrison (1985) report similar results.
5. Recall that deposit insurance was not introduced until later in the decade.
6. Mishkin (1978) discusses the effect on wealth of the stock market crash. It seems clear that consumption in 1929 was adversely affected by the crash.

7. Recent research supportive of Temin's view is provided by Romer (1988) and Flacco and Parker (1992), who argue that consumption fell due to increased uncertainty. Support for the premise of increased uncertainty is included in Nelson (1991), who documents accounts from the contemporary business press. Arguments attempting to refute the basic Temin hypothesis are included in Mayer (1978), Meltzer (1976), and Hamilton (1987).
8. Hamilton (1987) convincingly demonstrated that monetary policy was contractionary as early as January 1928. It follows that Temin must implicitly believe that monetary policy does not operate with a lag in its effect on real economic activity in order for the thrust of his nonmonetary arguments to go through. Moreover, if this is not believed, "much of the substance of Temin's objection disappears" (Hamilton 1987, p. 155). Given a constant real money stock and falling nominal interest rates, Hamilton also concludes that Temin's position—that shifts in the IS curve are more important than shifts in the LM curve—"seems to be little more than an *a priori* specification that the parameters are such that monetary policy was unlikely to exert much of an effect on the economy anyway" (p. 158).
9. Romer's discussion of uncertainty is in terms of its impact on consumption and at face value may be viewed as supportive of the Temin explanation of the Depression. However, Romer's analysis is also consistent with other explanations of the Depression, since what matters is the impact of uncertainty on consumption rather than the source of the uncertainty.
10. There are, of course, many reasons other than stock market volatility that can explain why uncertainty would have persisted beyond 1929 and increased subsequent to mid 1930. Events such as massive unanticipated deflation, the Hawley-Smoot tariffs, Federal Reserve inaction, excessive government optimism, political dissension over the proper economic course, the doubling of tax rates in 1932, the failure of the Bank of the United States, the collapse of the Kredit-anstalt in Austria, Britain's departure from the gold standard, and the near complete collapse of the U.S. financial system are some sources of uncertainty that could well have kept consumption depressed for the entire October 1929–March 1933 period. Indeed, increasing uncertainty may have been pervasive up until March 1933, when the government finally stepped in.
11. Note, of course, that the plot shows a nominal rate of interest. If the rate of deflation is high, then real rates may be high even though nominal rates are low. If the ultimate impact of monetary policy on the economy is through real rates of interest, then low nominal interest rates can be consistent with restrictive monetary policy.
12. In Fisher's analysis, other factors such as the quantity of money, its velocity, business confidence, and interest rates play secondary roles in the propagation of economic fluctuations.
13. Suppose for a moment that the deflation is anticipated. Rational borrowers and lenders would take the anticipated deflation into account when drafting the loan contract. This might take the form of specifying the repayment schedule in real terms (e.g., adjusting the loan payments for movements in a broadly based price

index such as the consumer price index) or altering the term to maturity of the loan (e.g., arranging for repayment to be complete prior to the onset of the deflation if it is expected to occur some reasonable amount of time in the future), or some other type of arrangement. That is, presumably most of the debt burden leading to insolvency and bankruptcy can be avoided if the deflation is foreseen.

14. As a contemporary example, consider the evidence presented in Bernanke and Campbell (1988) for the decade of the 1980s in which, at least from the perspective of the popular press, there was a period of "excessive" debt build-up. This view can be supported from the perspective of the ratio of interest payments to firm cash flow. However, corporate debt-equity ratios did not change much in the 1980s and were below their peaks attained in the 1973–74 recession. Thus, determination of whether there existed excessive debt in the period leading up to the Depression, for which data are not nearly as complete as are available today, may not be easy to discern.
15. Technical details on the model are included in an appendix, available from the author on request.
16. In September 1931, Britain left the gold standard. A fear of devaluation may have led foreign depositors to withdraw funds from the U.S. financial system. Domestic agents responded by raising their currency/deposit ratios, afraid that flows of funds from an already-weakened banking sector could result in additional losses for depositors. However, just prior to Britain leaving gold, the United States held about 40 percent of the world's monetary gold stock, so these fears may not have been justified. That is, primary focus on domestic events beyond the fall of 1931 may still be approximately correct.
17. In practice, of course, some of these loans are likely made to borrowers who are not constrained to borrow from banks; the data likely mix bank-constrained borrowers with nonconstrained borrowers. However, we will generally interpret the loan series as representing bank-constrained borrowers.
18. As indicated earlier, shocks to the IS curve also may originate elsewhere in the world. These shocks are not considered explicitly in the model.
19. Notice that the sum of the systematic and random components equals the data itself.
20. Shocks from the international economy are not explicitly modeled here, but rather are subsumed in the errors terms.

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