Discussion

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Christopher Sims's paper sheds light on an important question: "Does monetary policy play an important role in business cycles?" For at least two reasons, many think the answer must be "Yes." First, a casual look at postwar data shows that short-term interest rates generally rise sharply just before a recession (Figure 1). Since short-term interest rates are thought to be controlled by the Fed, it seems only natural to conclude that the Fed is responsible for the run-up in rates and for the subsequent recessions.[1] Second, there is general agreement with the Friedman and Schwartz (1963) view that, although bad monetary policy may not have caused the Great Depression, it greatly exacerbated it. Those who find these and other reasons compelling will find Sims's paper very provocative. That is because he presents an empirical model which suggests that the role of monetary policy in business cycles may be negligible.

The most dramatic part of Sims's paper is his conclusion that monetary policy played little or no role in the Great Depression. This is the focus of my comment. I argue that Sims's method for reaching his conclusion is flawed. However, when I apply what I think is a superior method, I confirm Sims's result. Overall, Sims's paper represents a fascinating and thought-provoking challenge to those who believe that monetary policy plays an important role in business cycles.

It is useful to organize my discussion of Sims's paper around the notion of a monetary policy rule:

$$R_t = f(\Omega_t) + \varepsilon_t.$$

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[1] On three occasions, 1957, 1966, and 1984, the federal funds rate rose sharply and yet no recession followed. Still, in each case, growth in GDP slowed significantly afterward.

This breaks down the monetary authority's actions, R_t, into a part, f, that is systematically related to the state of the economy, Ω_t, and a part that is not, namely, the monetary policy shock, ε_t. In general, R_t would be a vector of all the variables that the monetary authority controls, and f specifies the authority's strategy for manipulating these variables in response to different contingencies as captured by Ω_t. In addition to an interest rate, these variables would include others, among them variables that might be used in an emergency, such as a bank panic. This might include suspension of convertibility from deposits to currency, buying up of the assets of a bank having liquidity problems, and so on. In this paper, Sims focuses his analysis by measuring monetary policy with a single variable, the discount rate. This is the interest rate paid by banks when they borrow from the Federal Reserve.

The paper breaks down the basic question of interest into two parts, corresponding to the two parts of the decomposition. The first part is "How much have monetary policy shocks contributed to business cycle fluctuations?" Sims concludes that the answer is "Very little." He finds that around 6 percent of postwar and interwar business fluctuations are due to monetary policy shocks. Sims has reached this conclusion in previous papers. I will not comment on this aspect of the analysis, since it is not what is new and interesting about this paper.[2]

The second question is "How much has the monetary policy rule contributed to business cycle fluctuations?" This is the really interesting question. It is also the difficult one. The question corresponds to the following counterfactual exercise: "If the monetary authority had adopted a different policy rule, would the business cycle have been very different?" Sims asks the question in the context of the postwar and interwar U.S. business cycle experiences. In both cases, his answer is a surprising "No." Although I disagree with the method that Sims uses to reach this conclusion, when I adopt what I think is a more reasonable alternative, I reach the same conclusion. In the following section, I explain Sims's approach and why I believe it is flawed. I then describe the results based on an alternative approach. The last section provides concluding remarks.

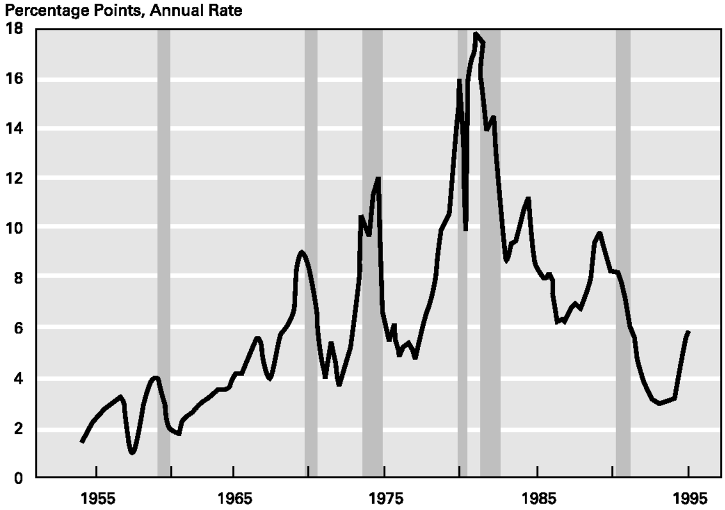
The 1930s under Sims's Representation of the Postwar Monetary Policy Rule

The standard approach to assessing the impact of f is to undertake counterfactual experiments with alternative fs.[3] The classic example is

[2] For a survey of Sims's and other work on the importance of monetary policy shocks in business cycles, see Christiano, Eichenbaum, and Evans (1998).

[3] An alternative, "historical approach," has been used, too. An example of this is Taylor (1998), which compares U.S. economic performance under various different policy rules like

Figure 1
Federal Funds Rate and NBER Recessions



Friedman and Schwartz (1963). They conjecture that if the Fed had adopted the f in place in 1907, the Fed would have suspended convertibility from demand deposits to currency during the first wave of bank failures in 1930, and the Great Depression might not have been so "great."[4] Thus, they conclude that f matters a lot. The distinguishing characteristic of the Friedman and Schwartz approach is that the economic model being used for the analysis is not spelled out explicitly. In effect, the counterfactual experiment is run in their heads. What distin-

the gold standard, and the pre- and postwar Fed. Taylor interprets the differences in economic performance across these episodes as reflecting the effects of varying the monetary policy rule. Of course, this approach is not without its pitfalls. The implicit assumption, that the primary changes in the U.S. economy over this time centered on the monetary policy rule, is debatable.

[4] Friedman and Schwartz (p. 167) refer to the counterfactual approach as "conjectural history." They say (pp. 167–68): "If the 1907 banking system had been in operation in 1929, restriction of payments [for example, suspension of convertibility from demand deposits to currency] might have come in October 1929 when the stock market crashed . . . [the restriction] would have prevented the collapse of the banking system and the drastic fall in the stock of money that were destined to take place, and that certainly intensified the severity of the contraction, if they were not indeed the major factors converting it from a reasonably severe into a catastrophic contraction." Later (p. 313) they argue that there were signs in early 1931 that the economy was reviving. They say, " . . . if those tentative stirrings of revival had been reinforced by a vigorous expansion in the stock of money, they could have been converted into sustained recovery. But that was not to be."

guishes Sims's work is that, to a much greater extent, he does spell out the model used for the counterfactual analysis. An advantage of this is that if you disagree with the results, you have something concrete to point to and to argue about.[5]

The most surprising result in Sims's paper is his finding that monetary policy during the Great Depression did not matter. This result runs contrary to the conventional wisdom stemming at least from the analysis of Friedman and Schwartz mentioned above. According to that wisdom, the Fed may not have actually started the Great Depression. However, bad monetary policy is what converted it from what might have been a very severe recession into a major catastrophe.[6] Sims's model suggests that this conventional wisdom deserves rethinking.

To put Sims's counterfactual experiment as concretely as possible, he asks the following question:

> If we dropped Alan Greenspan into the United States of the 1920s and 1930s and made him Fed Chairman at the time, would the Great Depression have been averted or at least mitigated?

To answer this question, Sims estimates a model for the interwar U.S. economy and replaces the monetary policy equation with the one characterizing U.S. monetary policy in the postwar period. In making the policy change, he makes and defends the assumption that the equations characterizing the private economy are invariant to the change in policy rule.

A consequence of Sims's invariance assumption is that the private economy can essentially be modeled as a reduced form, a black box. A potential advantage of this approach, assuming the invariance assumption is correct, is robustness to the type of specification errors that can occur with a more structural approach. An important potential pitfall, of course, lies in the possibility that the invariance assumption is false. This is the possibility emphasized in the famous Lucas critique. A source of concern, in this regard, is that the comparison between inter- and postwar periods offers perhaps the most dramatic example of the Lucas critique. In particular, monetary policy in the postwar period, with the Federal Deposit Insurance Corporation as its backbone, left little reason to doubt that the Fed would work to guarantee the liquidity of the banking system. The interwar evidence clearly shows that the Fed was less committed to

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[5] Other papers that do counterfactual experiments using an explicit model include Bordo, Choudri, and Schwartz (1995) and McCallum (1990). Both these papers find that alternative monetary policies could have made a big difference to the outcome of the Great Depression.

[6] For an argument that monetary policy may also have been one of the primary impulses underlying the Great Depression, see Hamilton (1987).

this at that time. This policy change from the interwar to the postwar period generated a sharp change in private agents' policy rules. In the early period, they were inclined, at the slightest sign of bad news, to rush to the bank to convert their deposits into currency. In the later period, essentially no runs took place.

The Lucas critique of the invariance assumption used by Sims, and Sims's rebuttal, have been clearly spelled out in the literature. Apart from the note of concern expressed in the previous paragraph, I will not dwell on this issue any further.

Surprisingly, Sims finds that the Great Depression would have unfolded roughly as it did, even if the postwar policy rule had been adopted. According to the calculations in the paper, with Alan Greenspan at the helm the Fed would have allowed M1 to fall by roughly 30 percent (see Sims's Figure 5), and output would have fallen roughly as it did. This is the basis for Sims's conclusion that monetary policy did not matter in the Great Depression.

The 1930s under a Different Representation of the Postwar Monetary Policy

I am skeptical that Sims has correctly captured the postwar policy rule. I am confident that Alan Greenspan would *not* have stood idly by and let M1 drop by 30 percent. Friedman and Schwartz's view, that allowing M1 to collapse in the 1930s was a massive blunder, is widely shared today. Just about *any* economist transported from the post-Friedman and Schwartz world into the 1930s would have fought hard to prevent the drop in M1. Surely, something must be wrong with Sims's representation of the postwar policy rule.

Technically, the reason that replacing the interwar policy rule with the postwar policy rule makes little difference is that the two rules are very similar. So, the demonstration that the Great Depression would have unfolded as it did, even with the postwar policy rule, is just a demonstration of continuity: A small change in one of the equations of Sims's model produces only a small change in the outcome. However, I do not believe that the analysis reported justifies the conclusion that policy did not matter in the Great Depression.

So, suppose Alan Greenspan had been parachuted into Washington in the 1930s. Why is Sims's estimated postwar policy rule unreliable as a guide to what Greenspan would have done? As noted above, monetary policy broadly conceived virtually eliminated bank panics from the postwar data set. As a result, the raw time series used to estimate the postwar policy rule does not carry any information about what the postwar Fed would have done, had a bank panic occurred. Mechanically, we can of course plug in any Ω_t we want into the estimated policy rule. But, there is no reason to have any confidence in the predictions of the estimated policy rule for Ω_ts very different from the sample used for estimation. And, the events of the 1930s were completely unlike anything that happened in the postwar period.

Still, to a first order of approximation, we *know* what the postwar Fed would have done in the 1930s: It would not have permitted the drastic fall in M1. So, I think a better way to address Sims's question is to imagine that a postwar policymaker transplanted to the 1930s would have acted to prevent the fall in M1. I implemented this policy, using Sims's model and using the type of methodology that he has advocated in this paper and elsewhere.[7] In particular, I assumed that all the non-policy shocks throughout the interwar period were as Sims estimated them to be. I also set the pre-August 1929 policy shocks to their estimated values. I then computed a sequence of policy shocks for the period August 1929 until December 1939 that would keep M1 on the same average growth path as the one M1 was on during the 1919–29 period.[8] Technical details appear in the Appendix.

The results are reported in Figures 2 and 3.[9] Figure 2a displays the policy shocks used in the counterfactual simulation. In this figure, the shocks labeled "actual" refer to the pre-August 1929 estimated policy shocks. The shocks labeled "counterfactual" refer to the counterfactual policy shocks used from August 1929 on, designed to keep average M1 growth roughly to what it was in the 1920s. The mean (standard deviation) of these shocks is 0.015 (0.18) and −0.082 (0.62) over the first and second periods, respectively.[10] Thus, the counterfactual policy shocks involve only a negligible reduction in mean relative to the 1920s. Primarily, they involve a threefold increase in standard deviation.

Figures 2b to 2f report actual data for the entire interwar sample, and they also exhibit the data for the counterfactual simulation. Note from Figure 2b that the counterfactual policy indeed does keep M1 in the 1930s roughly on the 1920s growth path. Figure 2c shows that this implies a very large increase in currency. Also, Figures 2d and 2e show that the counterfactual policy would have prevented the drastic decline in prices that occurred.

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[7] I am very grateful to Sims for providing me with his model parameter values and his data, which I used in the analysis described below.

[8] Since, according to Sims's model, the money stock is not influenced within the month by a policy shock, the best that policy can do is influence the expected money supply starting in the next month. The assumption that the money stock is predetermined within the period relative to a policy shock is not unusual in the monetary policy literature. See, for example, Christiano, Eichenbaum, and Evans (1998).

[9] The data and mnemonics are as in Sims's paper.

[10] Figure 2a and these statistics refer to the policy shock as defined in the policy rule displayed above in the text. Thus, they refer to the fifth element of Sims's shock, ε_t, *after* division by the fifth diagonal element of his A_0. As a result, the shocks are expressed in units of the interest rate, which in turn is expressed in percentage points, at an annual rate.

Figure 2
Interwar Model Results with Counterfactual Policy Shocks Designed to Prevent a Fall in M1

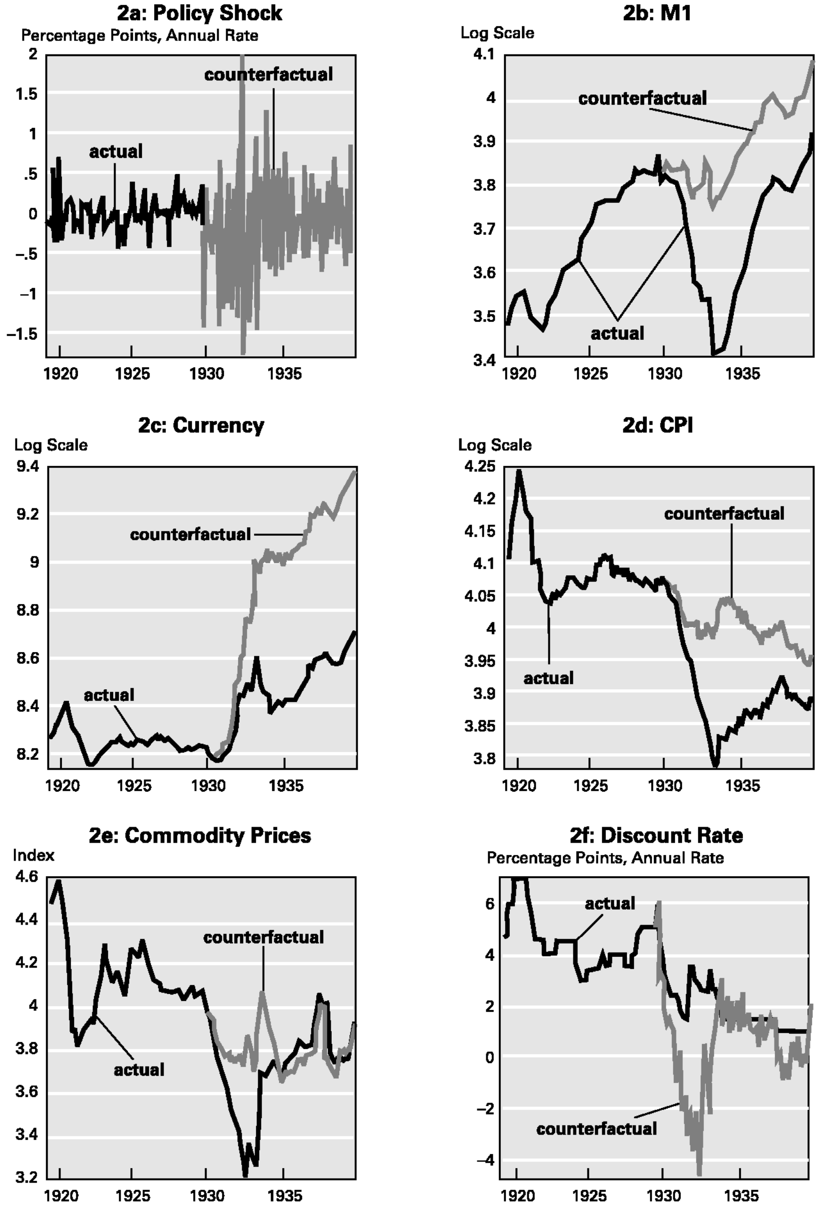

Figure 3
Impact of the Counterfactual Simulation on Industrial Production

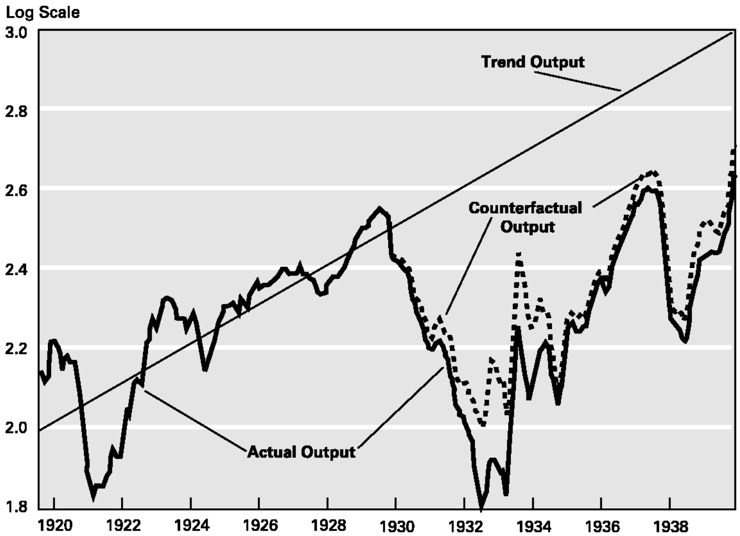

Figure 2f shows that the discount rate is driven down relative to its historical value. In fact, the discount rate goes negative (as it does in Sims's own experiments). If the discount rate were a market rate, this would be impossible. With a negative interest rate of, say, −5 percent, lenders would require only 95 cents back for every dollar loaned. In this case, borrowers in effect receive a 5 cent gift with each one-dollar loan transaction. To make this gift as large as possible, borrowers would try and borrow as much as they could. No matter what supply was, demand would always be larger; no equilibrium could exist in a loan market with a negative rate of interest. But, the interest rate in Sims's model is not a market rate of interest. As noted above, it is the rate that the Fed charges on loans to banks. The "gift" associated with a negative discount rate is just a bank bailout. So, the counterfactual policy implies that the Fed bails out some of the member banks of the Federal Reserve System.

Figure 3 shows the impact of the counterfactual simulation on output. Surprisingly, even though the drastic fall in M1 was prevented under the counterfactual simulation, the basic course of the Great Depression would not have been much different, according to Sims's model.

Conclusion

The calculations reported here support Sims's basic conclusion: According to his model, monetary policy does not matter. His model suggests that if M1 had been prevented from falling during the Great Depression, the calamitous fall in output would have occurred anyway. But, what about the other facts that suggest that money matters? For example, in the introduction to my remarks I cited the fact that high interest rates precede recessions. If the results implied by Sims's model hold up to further scrutiny, then nonmonetary explanations for these observations should be explored.[11]

Sims's results are so surprising, I suspect that most will find them unacceptable. I too am suspicious. But, the results have been produced using an explicit, quantitative model. For anyone who disagrees, Sims has presented something very concrete to shoot at.

Appendix: The Counterfactual Experiment

In this appendix I describe how I computed a sequence of monetary policy shocks that would have kept money growth in the 1930s roughly on its 1920s growth path. Let the vector of data be as in Sims's paper, that is,

$$Y_t = [\log(GDP_t), \log(CPI_t), \log(currency_t), \log(M1_t), \log(R_t), \log(Pcomm_t)],$$

where R_t is the discount rate and $Pcomm_t$ is an index of commodity prices. The vector autoregressive representation for Y_t is:

$$Y_t = B_0 + B_1 Y_{t-1} + B_2 Y_{t-2} + \ldots + B_7 Y_{t-7} + A_0^{-1}\varepsilon_t, \tag{A.1}$$

where ε_t is a 6×1 vector of shocks that is uncorrelated over time and has a variance-covariance matrix equal to the identity matrix. Also, A_0 and B_i, $i = 1, \ldots, 7$, are 6×6 matrices and B_0 is a 6×1 vector of constants estimated by Sims.[12] The monetary policy shock is the fifth element of ε_t. The identifying restrictions imposed by Sims on A_0 imply that all elements above the diagonal of A_0^{-1} are zero, except the (5,6) element, which is non-zero.

The estimation procedure implemented by Sims produces a sequence of fitted shocks, ε_t, for t = January 1919 to t = May 1939. When these and the initial observations on Y_t for the last seven months of 1918 are incorporated into (A.1), the simulated Y_ts for the period January 1919 to May 1939 reproduce the actual data exactly. The counterfactual experiment keeps the non-policy historical shocks unchanged at their historical values too. It keeps the pre-1929 values of the policy shocks at their historical values too. It simply replaces the post-December 1928 policy shocks by values that keep money growth roughly on the same growth path as it followed in the 1920s. That is, I compute a date t policy shock to keep $E_t\log(M1_{t+1}) - \log(M1_t)$ close to 0.0033 for t = January 1929 to t = May 1939.

The period t policy shock is computed as follows. The fifth element of ε_t is to be determined, while the others are determined by their historical values. Let $\tau = [0\ 0\ 0\ 1\ 0\ 0]$, and note that

$$\log(M1_t) = \tau(B_0 + B_1 Y_{t-1} + B_2 Y_{t-2} + \ldots + B_7 Y_{t-7} + A_0^{-1}\varepsilon_t).$$

[11] For initial steps in this direction, see Christiano and Fisher (1998) and Sims (1980).

[12] For an extensive review of the identification issues involved in inferring the B_is and A_0 from a sample of data, see Christiano, Eichenbaum, and Evans (1998).

Since the fifth element of ε_t does not enter this expression, $\log(M1_t)$ is well defined. Then,

$$0.0033 = E_t \log(M1_{t+1}) - \log(M1_t)$$

$$= \tau[B_0 + B_1B_0 + (B_1B_1 + B_2)Y_{t-1} + \ldots + (B_1B_6 + B_7)Y_{t-6}$$

$$+ B_1B_7Y_{t-7} + B_1A_0{}^{-1}\varepsilon_t] - \log(M1_t).$$

Given that $\log(M1_t)$ is determined, this represents one equation in the one unknown element of ε_t. Denote the policy shock generated by this computation, $\tilde{\varepsilon}_{5t}$. Denote the historical value of the policy shock by $\hat{\varepsilon}_{5t}$. I found that replacing $\hat{\varepsilon}_{5t}$ by $\tilde{\varepsilon}_{5t}$ resulted in counterfactual simulations in which all variables but $\log(M1_t)$ oscillated so wildly that the scales on the graphs had to be expressed in scientific notation. The results reported in the comment are instead based on replacing $\hat{\varepsilon}_{5t}$ by $0.7\hat{\varepsilon}_{5t} + 0.3\tilde{\varepsilon}_{5t}$. This completes the discussion of the computation of the period t policy shock. With ε_t in hand, Y_t may be computed using (A.1). I then proceed to compute ε_{t+1} and Y_{t+1}, and so on.

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