

# The Expectations Trap Hypothesis

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## Introduction and Summary

Many countries, including the United States, experienced a costly, high inflation in the 1970s. This article reviews some research devoted to understanding why it happened and what can be done to prevent it from happening again.

We take it for granted that the high inflation was the result of high money growth produced by the U.S. Federal Reserve. But, to make sure that it does not happen again, it is not enough to know who did it. It is also necessary to know *why* the Fed did it. We hypothesize that the Fed was in effect pushed into producing the high inflation by a rise in the inflationary expectations of the public. In the language of Chari, Christiano, and Eichenbaum (1998), we say that when a central bank is pressured to produce inflation because of a rise in inflation expectations, the economy has fallen into an *expectations trap*. We call this hypothesis about inflation the expectations trap hypothesis.

We argue that the dynamics of inflation in the early 1970s are consistent with the expectations trap hypothesis. We describe two versions of this hypothesis. We also describe an alternative hypothesis, which we call the Phillips curve hypothesis. According to this hypothesis, inflation occurs when a central bank decides to increase money growth to stimulate the

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economy and is willing to accept the risk of high inflation that that entails. The expectations trap hypothesis and the Phillips curve hypothesis both maintain that high inflation is a consequence of high money growth. Where they differ is in the motives that they ascribe to the central bank.

Much of our analysis assessing the various hypotheses about inflation is based on an informal review of the historical record. We supplement this discussion by studying a version of the expectations trap hypothesis using a general-equilibrium, dynamic macroeconomic model. There are two reasons that we do this. First, we want to demonstrate that the expectations trap hypothesis can be integrated into a coherent view of the overall macroeconomy.<sup>1</sup> Second, we want to document that that hypothesis has the potential to provide a quantitatively realistic account for the 1970s takeoff in inflation.

The model we use is the limited-participation model studied in Christiano and Gust (1999).<sup>2</sup> It requires a specification of monetary policy in the 1970s, and for this we use the policy rule estimated by Clarida, Galí, and Gertler (1998). The account of the early 1970s that we produce using the model posits that a bad supply shock (designed to capture the various commodity shortages of the early 1970s) triggered a jump in expected inflation, which then became transformed into higher actual inflation because of the nature of monetary policy. We find that, consistent with the data, the model predicts stagflation. We view this result as supportive of the expectations trap hypothesis.

We compare our model with an alternative quantitative model of the 1970s inflation proposed by Clarida et al. That model can also explain the rise in inflation in the 1970s as reflecting a self-fulfilling increase in inflation expectations. It is a sticky-price, rational-expectations version of the IS-LM model.<sup>3</sup> When we use that model to simulate the 1970s, we find that it is inconsistent with the observed stagflation of the time. It predicts that the rise in expected and actual inflation triggered by a bad supply shock is associated with a sustained *rise* in employment. We conclude that the limited-participation model provides a better account of the high inflation of the 1970s than does the sticky-price, IS-LM model with Clarida et al.'s representation of policy. This result is potentially of independent interest, since the latter model is currently in widespread use.

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1. Also, see Chari, Christiano, and Eichenbaum (1998).

2. This model is a modified version of the model in Christiano, Eichenbaum, and Evans (1998).

3. The model is derived from a dynamic general-equilibrium model with maximizing agents and cleared markets. The possibility that such a model could, under the sort of policy estimated by Clarida et al. using data from the 1970s, have an equilibrium in which inflation expectations can be self-fulfilling was first discovered by Kerr and King (1996).

We begin with a description of the expectations trap hypothesis and what it implies for policy. Then, we review the 1960s and 1970s and provide an informal assessment of the expectations trap and Phillips curve hypotheses. We provide a quantitative evaluation of the expectations trap hypothesis using the limited-participation model as a vehicle. We then provide an assessment of the Clarida et al. model.

## 1 What Is an Expectations Trap?

We begin with an abstract definition of an expectations trap. We then describe two particular types of expectations traps. Finally, we ask, What is the ultimate cause of inflation under the expectations trap hypothesis?

### 1.1 The trap, defined

An expectations trap is a situation in which an increase in private agents' expectations of inflation pressures the central bank into increasing actual inflation.<sup>4</sup> There are different mechanisms by which this can happen. However, the basic idea is always the same. The scenario is initiated by a rise in the public's inflation expectations. Exactly why their inflation expectations rise doesn't really matter. What does matter is what happens next. On the basis of this rise in expectations, private agents take certain actions which then place the Fed in a dilemma: either respond with an accommodating monetary policy which then produces a rise in actual inflation or refuse to accommodate and risk a recession. A central bank that is responsive to concerns about the health of the economy could very well wind up choosing the path of accommodation, that is, falling into an expectations trap.

### 1.2 A cost-push trap and a working capital trap

We describe two versions of the expectations trap hypothesis, which differ according to the precise mechanism by which higher inflation expectations pressure the Fed into supplying more inflation. One mechanism, presented in Chari, Christiano, and Eichenbaum (1998), is similar to the conventional *cost-push* theory of inflation. We call it a cost-push expectations trap. Here is how it works. Higher inflation expectations lead people to demand, and receive, higher wage settlements. Firms are happy to pay the increased wages because, expecting a rise in the general price level, they think they can pass along the higher wage costs in the form of higher prices. This puts

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4. In this paper, we focus on expectations traps in which inflation is high. The opposite—an expectations trap in which inflation is low—is also a possibility.

the Fed in the dilemma mentioned above. The Fed can produce the inflation everyone expects by raising money growth. Or, if it does not, it will put the economy through a recession. Under some circumstances, the Fed will not be willing to tolerate the recession and will feel compelled to produce inflation. In this case, the Fed ends up validating the original rise in inflation expectations. We call this hypothesis about inflation, the cost-push version of the expectations trap hypothesis.<sup>5</sup>

We shall see that this version of the expectations trap hypothesis encounters some difficulties explaining the high inflation of the 1970s. We now describe another version of this hypothesis, which does not have these problems.

The limited-participation model of money, which is analyzed below, highlights a different mechanism by which an expectations trap can occur. We call this a *working-capital* expectations trap. It relies on the assumption that firms must borrow funds in advance (acquire working capital) in order to finance some or all of the inputs needed to carry on production. Under these circumstances a high nominal interest rate has a negative impact on economic activity because it raises the cost of working capital. To see how this mechanism works, suppose, again, that there is a jump in inflation expectations. Private agents, correctly perceiving that the central bank is afraid of the negative output effects of high interest rates, anticipate that the higher future inflation will be associated with low real interest rates. This leads them to cut back on saving, putting upward pressure on interest rates in the market for loanable funds. This places the central bank in a dilemma. If it keeps the money supply unchanged, then the higher expected inflation will not occur. However, the reduced saving would result in high interest rates. By drying up the supply of working capital, this would significantly slow the economy. A central bank that is concerned about the health of the private economy may prefer a second option: prevent a substantial rise in interest rates by injecting money into the economy. This has the effect of validating the initial jump in inflation expectations. Choosing this second

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5. The cost-push expectations trap is very close to the hypothesis Blinder advances as an explanation of the takeoff of inflation in the early 1970s:

Inflation from special factors can “get into” the baseline rate if it causes an acceleration of wage growth. At this point policymakers face an agonizing choice—the so-called accommodation issue. To the extent that aggregate nominal demand is *not* expanded to accommodate the higher wages and prices, unemployment and slack capacity will result. There will be a recession. On the other hand, to the extent that aggregate demand *is* expanded (say, by raising the growth rate of money above previous targets), inflation from the special factor will get built into the baseline rate. (Blinder 1982, 264)

option is another way to fall into an expectations trap. We call this hypothesis about inflation the working-capital version of the expectations trap hypothesis.

### 1.3 Ultimate cause of inflation

Where, under the expectations trap hypothesis, does the ultimate responsibility for inflation lie? To answer this requires identifying the *cause* of the rise in inflation expectations. According to the expectations trap hypothesis, the cause lies with monetary institutions themselves. If, for example, the nature of those institutions is such that people cannot imagine a set of circumstances in which the central bank would accommodate a rise in inflation, then there is little reason for inflation expectations to suddenly jump. Expectations traps just couldn't happen.

To see this, imagine there is an oil shortage. Certainly, one might reasonably expect this to lead to a rise in the price level. Because of various lags, this rise might actually take place over a period of time, maybe even a year or two. But, there is nothing in conventional economic reasoning that would connect an oil shortage to the sustained, decade-long rise in prices that we call inflation. Anyone who inferred from a 10 per cent jump in the price level in one year that prices would continue jumping like this and be 100 per cent higher in ten years, would be viewed as a crank. Such a person would seem as foolish as the person who, seeing the temperature outside drop one degree from one day to the next, forecasts a drop in the temperature by 100 degrees over the next 100 days.

Now consider an economy whose monetary institutions are known to assign a high priority to output and employment. In addition, suppose that that economy's central bank has no way of credibly committing itself in advance to keeping money growth low. In a society like this, the idea that inflation could take off seems quite plausible. In such a society, even seemingly irrelevant events could spark a rise in inflation expectations. For example, a person who revised upward their inflation forecast in the wake of an oil shock would now not necessarily seem like a crank. There are a number of ways they could back up their forecast with sensible economic reasoning. Such a person could use either of the two expectations trap arguments described above.

So, the expectations trap hypothesis lays responsibility for inflation with monetary institutions. To reduce the possibility of expectations traps, the institutions must be designed so that the central bank's commitment to fighting inflation is not in doubt. Under these circumstances, people participating in wage negotiations who profess to believe inflation is about to take off will be met with disbelief rather than a higher wage settlement.

How exactly monetary institutions should be designed to reduce the likelihood of an expectations trap is controversial. But, there is one point on which there appears to be agreement. The central banker at the very least should make a show of not being too concerned about the health of the economy. An example of this can be found in the reaction to a famous (or infamous) speech by the then vice-chairman of the Federal Reserve, Alan Blinder, at a conference in Jackson Hole, Wyoming, in 1994. In that speech, Blinder acknowledged that it is feasible for a central bank to influence unemployment and output. This generated an uproar. Many who objected probably did not do so because they thought what Blinder said was wrong. Instead, they simply thought it unwise that a central banker should let on that he thinks about such things.<sup>6</sup> Why shouldn't he let on? One possibility—the one emphasized in the expectations trap hypothesis—is that the greater the apparent concern by the central bank for the real economy, the greater is the risk of falling into an expectations trap.

## 2 Background Events

We provide a brief review of the basic economic events leading up to the high inflation of the 1970s. We argue that the data appear consistent with the hypothesis that the United States became ensnared in an expectations trap by the late 1960s and early 1970s. We then compare the expectations trap hypothesis about inflation with another hypothesis. According to that hypothesis, the Fed consciously produced the high inflation as a necessary, though unfortunate, by-product of its aggressive attempts to stimulate the economy. We call this the *Phillips curve hypothesis*, because it involves the Fed's attempts to exploit the Phillips curve. Finally, we look at the data to identify the economic consequences of the takeoff in inflation in the early 1970s.

### 2.1 Events leading up to the 1970s: Setting the trap

An important part of the story of the inflation of the 1970s begins with the recession of the early 1960s. That recession helped bring the administration of John F. Kennedy into power. Kennedy brought with him the best and the brightest Keynesian minds of the time. The chairman of the Council of Economic Advisers (CEA) was the very distinguished Keynesian economist, Walter Heller. Members of the CEA included another distinguished Keynesian economist, the future Nobel laureate, James Tobin. Government policy was animated by the Keynesian conviction that if the economy was performing below its potential, then it was the responsibility

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6. For one prominent commentator who takes this position, see Barro (1996, 58–60).

of the government to use the fiscal and monetary policies at its command to restore it to strength. Figure 1 displays the federal funds rate and the growth rate of the monetary base, using annual data. Also exhibited are the years designated by the NBER to be periods of business cycle contraction (shaded area) and expansion (non-shaded area).<sup>7</sup> The figure shows that the growth rate in the monetary base began to pick up in the early 1960s. The CEA also set to work to craft an expansionary fiscal policy, and one of the products of those efforts was the tax reduction legislation of 1964. Confidence in the feasibility and desirability of Keynesian stabilization policy soared with the long expansion of the 1960s.

Figure 2 shows that inflation started to pick up with a few years' delay, in 1965.<sup>8</sup> As these observations suggest, that initial rise in inflation is probably not an example of an expectations trap. It is probably best understood in terms of the Phillips curve hypothesis: It was the consequence of expansionary monetary policy, deliberately undertaken to stimulate a weak economy. It is the dynamics of inflation after the initial uptick in the 1960s that appears to take on the character of an expectations trap.

Figures 1 and 2 show that inflation proceeded to hit three peaks, one in the early 1970s, one in early 1975, and the final one in late 1980. The initial pickup in inflation in the 1960s was noted with alarm by policy-makers, who responded with a very sharp rise in the federal funds rate in 1969. This policy tightening is often credited with producing the 1970 recession. Policy-makers expressed dismay that the inflation rate continued to be high, even as the economy began to slide into recession (see Figure 1). Arthur Burns, the chairman of the Federal Reserve at this time, said in a speech at Pepperdine College, Los Angeles, on 7 December 1970:

The rules of economics are not working in quite the way they used to. Despite extensive unemployment in our country, wage rate increases have not moderated. Despite much idle industrial capacity, commodity prices continue to rise rapidly. (Burns 1978, 118)

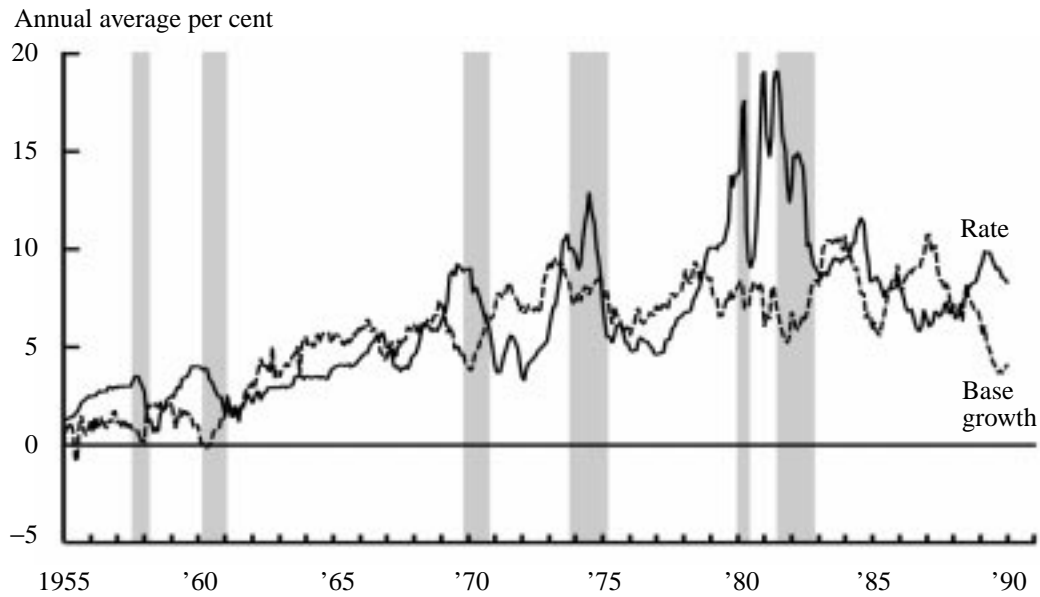
The policy establishment became convinced that the underlying driving force of inflation was inflation expectations and that these expectations were all but impervious to recession. In a statement before the Joint Economic Committee of the U.S. Congress in 1971, Burns explained the role of inflation expectations as follows:

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7. The data are taken from Citibase. The mnemonic for the federal funds rate is fyff, and the mnemonic for the monetary base is fmbase.

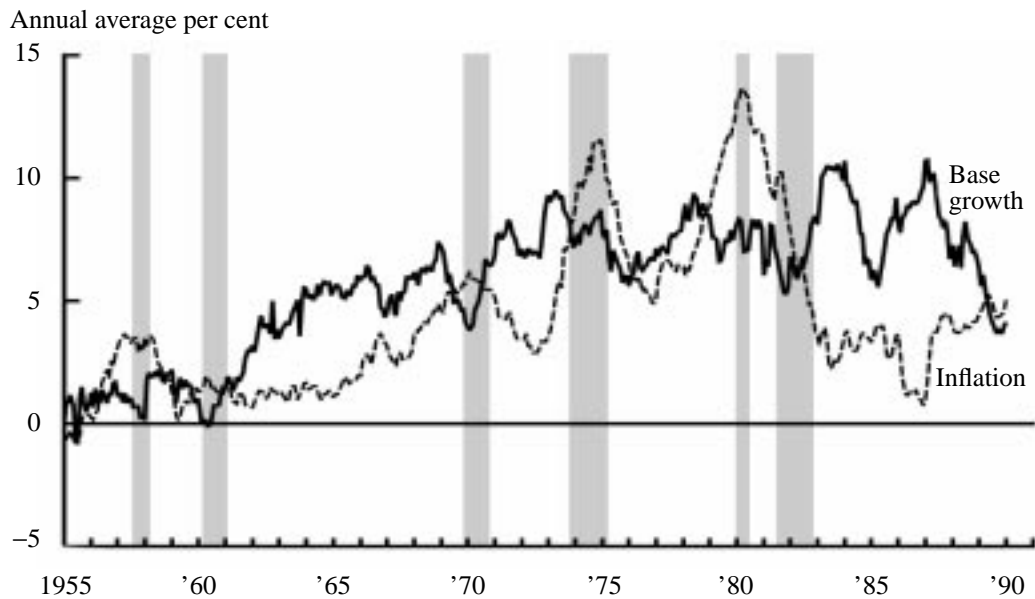
8. Inflation is measured as the annual per cent change in the consumer price index with Citibase mnemonic, prnew (CPI-W: all items).

**Figure 1**  
**Base growth and federal funds rate**



Note: Shaded areas indicate NBER-dated recessions.  
 Source: Based on data from Citibase.

**Figure 2**  
**Base growth and inflation**



Notes: Shaded areas indicate NBER-dated recessions.  
 Inflation is measured as the annual per cent change in the CPI with Citibase mnemonic, *prnew* (CPI-W: all items).  
 Source: Based on data from Citibase.



Consumer prices have been rising steadily since 1965—much of the time at an accelerating rate. Continued substantial increases are now widely anticipated over the months and years ahead. . . . [I]n this environment, workers naturally seek wage increases sufficiently large . . . to get some protection against future price advances. . . . [T]houghtful employers . . . reckon, as they now generally do, that cost increases probably can be passed on to buyers grown accustomed to inflation. (Burns 1978, 126)

Policy-makers understood that, in principle, inflation could be stopped with a sufficiently restrictive monetary policy, but they were concerned that the short-run costs, in terms of lost output, would be intolerable. In an appearance before the House of Representatives, Committee on Banking and Currency, 30 July 1974, Burns said:

One may therefore argue that relatively high rates of monetary expansion have been a permissive factor in the accelerated pace of inflation. I have no quarrel with this view. But an effort to use harsh policies of monetary restraint to offset the exceptionally powerful inflationary forces of recent years would have caused serious financial disorder and economic dislocation. That would not have been a sensible course for monetary policy. (Burns 1978)

In remarks before the Seventeenth Annual Monetary Conference of the American Bankers Association, Hot Springs, Virginia, 18 May 1970, Burns elaborated on his views about the costs of relying on money growth alone (without, say, wage and price controls) to reduce inflation. He thought the costs were so large that the strategy was fundamentally infeasible on political grounds. In his words,

There are several reasons why excessive reliance on monetary restraint is unsound. First, severely restrictive monetary policies distort the structure of production. General monetary controls, despite their seeming impartiality, have highly uneven effects on different sectors of the economy. On the one hand, monetary restraint has relatively slight impact on consumer spending or on the investments of large businesses. On the other hand, the homebuilding industry, state and local construction, real estate firms, and other small businesses are likely to be seriously handicapped in their operations. When restrictive monetary policies are pursued vigorously over a prolonged period, these sectors may be so adversely affected that the consequences become socially and economically

intolerable, and political pressures mount to ease up on the monetary brakes. . . .

An effort to offset, through monetary and fiscal restraints, all of the upward push that rising costs are now exerting on prices would be most unwise. Such an effort would restrict aggregate demand so severely as to increase greatly the risks of a very serious business recession. If that happened, the outcries of an enraged citizenry would probably soon force the government to move rapidly and aggressively toward fiscal and monetary ease, and our hopes for getting the inflationary problem under control would then be shattered. (Burns 1978)<sup>9</sup>

Policy-makers were so pessimistic about the prospects of getting inflation under control by restrictive monetary policy, that in August 1971 they turned to wage and price controls.

What happened after this may seem to be an embarrassment to the expectations trap hypothesis, particularly the cost-push version: Money growth continued to be high.<sup>10</sup> According to the cost-push expectations trap hypothesis, high money growth is the Fed's response to inflationary wage and price contracts, which are themselves driven by inflation expectations. But, inflationary wage and price contracts became illegal during the wage and price control period, which lasted until 1973. So, this hypothesis seems to predict that money growth would have been low during the wage-price controls, not high.<sup>11</sup>

The key to reconciling the expectations trap with this high money growth lies in interest rates. Policy-makers were convinced that wage-price

9. In the same speech, Burns showed some foresight in warning about another danger associated with the strategy of relying on reduced money growth to stop inflation. He was concerned that the nature of the lags in monetary policy was such that the variance of inflation and money growth would go up in a "stop-and-go" process.

[T]he effects of monetary restraint on spending often occur with relatively long lags. . . . Because the lags tend to be long, there are serious risks that a stabilization program emphasizing monetary restraint will have its major effects on spending at a point in time when excess demand has passed its peak. The consequence may then be an excessive slowdown of total spending and a need to move quickly and aggressively toward stimulative policies to prevent a recession. Such a stop-and-go process may well lead to a subsequent renewal of inflationary pressures of yet greater intensity. (Burns 1978)

10. Money growth in 1970–74 was 5.32 per cent, 7.60 per cent, 7.27 per cent, 8.75 per cent, and 7.99 per cent, respectively. The number for period  $t$  is  $100 \times \log(m(t)/m(t-1))$ , where  $m(t)$  denotes the monetary base,  $t = 1970, 1971, 1972, 1973$ , and 1974.

11. We address the potential for the Phillips curve hypothesis to explain high money growth during the period of wage-price controls in the next subsection.

controls would not be politically feasible if interest rates were allowed to drift up. They thought that if this happened, the controls would be viewed as a cover for redistributing income from people earning wages and salaries to the (typically wealthy) people who earn interest. They feared that if this happened, then political support for the controls would evaporate, and inflation would take off again. So, policy was directed toward keeping the nominal interest rate about where it was before the severe monetary tightening of 1969 (see Figure 3). It is interesting that it required such strong money growth to keep the interest rate at this level. A possible explanation is that this reflects the type of portfolio decisions emphasized in the working-capital expectations trap hypothesis described earlier. That hypothesis predicts that, in the absence of high money growth, household portfolio decisions motivated by concerns about future inflation would drive up the rate of interest.

These considerations suggest to us that although the high money growth during wage-price controls may well be an embarrassment to the expectations trap hypothesis, it isn't necessarily so.

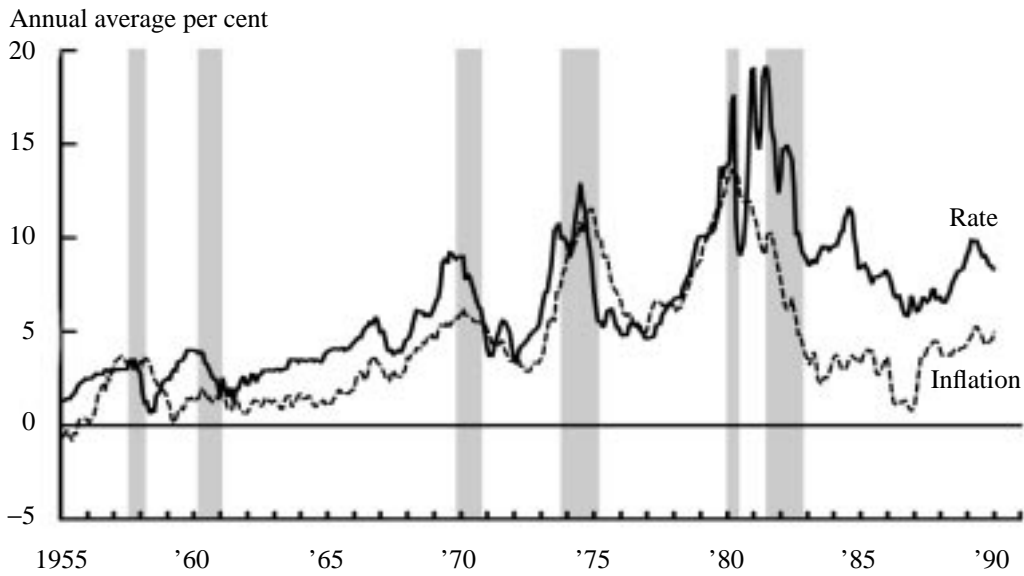
Policy-makers started dismantling wage-price controls in 1973. They were once again surprised by the strength with which inflation took off. They had anticipated some inflationary pressure, and they raised rates sharply in this period (see Figure 3). But, they were surprised at just how strong the rise in inflation was.<sup>12</sup> The increase in rates was greater than one measure of the rise in expected inflation (see Figure 3). And, it just barely kept up with actual inflation (Figure 4).<sup>13</sup> Policy-makers' resolve began to fade when output and investment started to show weakness in the middle of 1973 and hours worked began to soften in late 1973. They had indicated repeatedly that they were unwilling to countenance a severe recession in the fight against inflation. Their concerns about the recessionary costs of fighting inflation seemed credible since they appeared to have been confirmed by the experience of the 1970 recession. Moreover, the 1960s and

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12. To some extent, the rise in inflation was due to the oil shock in late 1973. However, about three-quarters of the price increases of that year occurred before the Yom Kippur War and the October oil embargo. The takeoff in inflation in 1973 may, in part, have reflected the delayed response of prices to the high money growth that occurred during the period of wage-price controls. We attempted to estimate what fraction of the 1973 price rise reflected past money growth, but found that statistical uncertainty is too large to draw a definite conclusion.

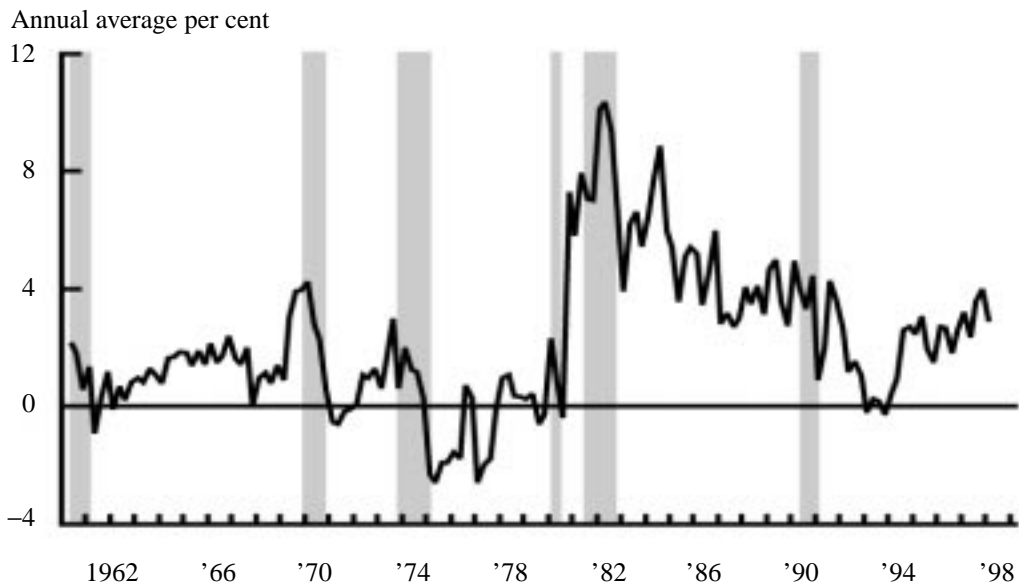
13. We calculated expected inflation for Figure 4 based on a 1-month-ahead forecast of monthly CPI inflation using 5-month lags in monthly inflation, 4-month lags in the federal funds rate, 4-month lags in the monthly growth rate in M2, and 4-month lags in the premium in the return to 10-year Treasury bonds over the federal funds rate. The rise in real rates reported in Figures 4 and 5 would have been somewhat larger if we had used the GDP deflator to measure inflation.

**Figure 3**  
**Federal funds rate and inflation**



Note: Shaded areas indicate NBER-dated recessions.  
 Source: Based on data from Citibase.

**Figure 4**  
**Ex ante real rate**



Note: Shaded areas indicate NBER-dated recessions.  
 Source: Based on data from Citibase.

1970s were times when governments were expected to do good things for their citizens, and hurting a subset of them for the sake of curing a social problem seemed unfair and wrong.<sup>14</sup> In an address before the joint meeting of the American Economic Association and the American Finance Association, on 29 December 1972, Burns expressed the general sense of the time:

Let me note, however, that there is no way to turn back the clock and restore the environment of a bygone era. We can no longer cope with inflation by letting recessions run their course; or by accepting a higher average level of unemployment. . . . There are those who believe that the time is at hand to . . . rely entirely on monetary and fiscal restraint to restore a stable price level. This prescription has great intellectual appeal; unfortunately, it is impractical. . . . If monetary and fiscal policies became sufficiently restrictive to deal with the situation by choking off growth in aggregate demand, the cost in terms of rising unemployment, lost output, and shattered confidence would be enormous. (Burns 1978)

So, toward late 1974, policy-makers reversed course and adopted a loose monetary policy, driving interest rates down sharply, to turn the economy around. Note from Figures 4 and 5 that real interest rates were negative or close to zero. Of course, as the economy entered the deep 1975 recession, inflation came down substantially anyway. But, the turnaround in monetary policy then had the implication that inflation would take off again as soon as the economy entered the expansion.<sup>15</sup> Only later, in 1978 and 1979, did the Fed turn “tough” and consciously adopt a tight monetary policy until inflation came down (see how much higher the federal funds

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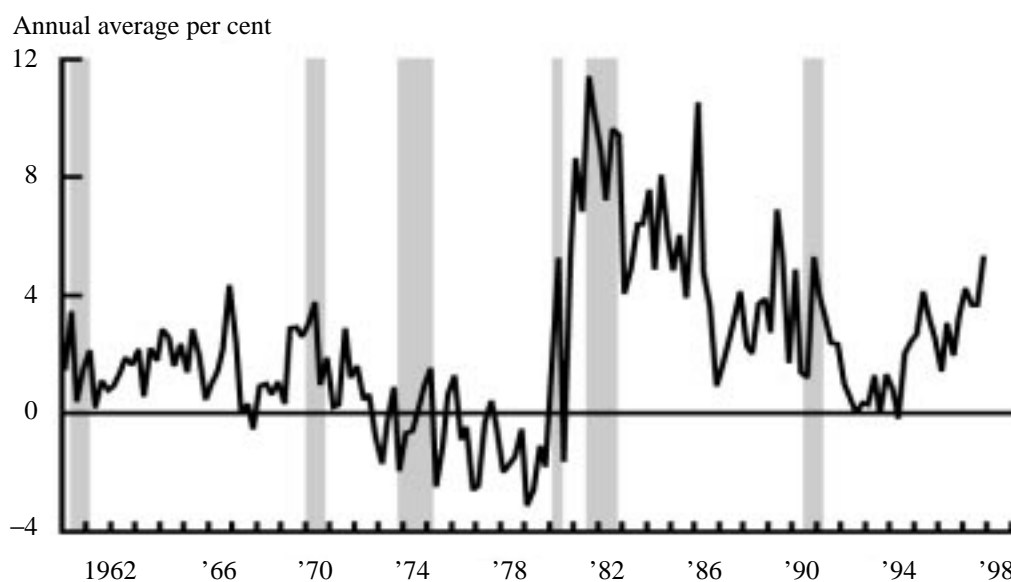
14. With the experience of the Great Depression and the intellectual foundations provided by Keynes’ General Theory, it was generally accepted that governments’ responsibility was to preserve the health of the economy. This was put into law in the Employment Act of 1946, which created the CEA:

There is hereby created in the Executive Office of the President a Council of Economic Advisers . . . to formulate and recommend national economic policy to promote employment, production, and purchasing power under free competitive enterprise.

See De Long (1995) for a discussion of the post-WWII intellectual climate regarding the proper role of government in the economy and the sharp contrast with the pre-WWII climate. As noted earlier, the feasibility of the notion that the government ought to stabilize the economy seemed to be confirmed with the apparent success of stabilization policy in the 1960s.

15. This was precisely the stop-and-go process that Burns feared, as mentioned in note 9. For another discussion of the stop-and-go nature of inflation in this period, see Barsky and Kilian (2000).

**Figure 5**  
**Ex post real rate**



Note: Shaded areas indicate NBER-dated recessions.  
Source: Based on data from Citibase.

rate went in the early 1980s, and note how it stayed up—with the exception of a brief period of weakness in mid-1980—until after the inflation rate began to fall).

We interpret these observations as being consistent with the view that by the late 1960s and early 1970s, the U.S. economy had fallen into an expectations trap. Through their words and actions, policy-makers sent two clear messages to the population:

- It is technically feasible for policy-makers to stop inflation.
- The costs of doing so were greater than policy-makers could accept.

Under these circumstances, it was perhaps reasonable for people to expect higher inflation. When wage-price controls began to be dismantled in 1973, it would have been reasonable for the public to think that there was now nothing left standing in the way of high inflation. Inflation expectations were even stronger than before. One indication of this is that actual inflation took much longer to begin falling during the 1974 recession than it did in the 1970 recession (see Figure 3). Ironically, while policy-makers expressed frustration with the public for the seeming intransigence of their inflation expectations, the true cause of that intransigence may have been the nature of the monetary policy institutions themselves. This is the implication of the expectations trap hypothesis.

## 2.2 Phillips curve hypothesis

We now briefly consider the Phillips curve hypothesis about the takeoff in inflation that occurred in the early 1970s. Like the expectations trap hypothesis, this hypothesis is also fundamentally monetarist in that it interprets the rise in inflation as reflecting an increase in money growth. It differs from the expectations trap hypothesis by highlighting a different set of motives on the part of the Fed. Policy-makers believed the CEA estimates that output was below potential in 1971. Under the Phillips curve hypothesis, the Fed responded to this by adopting an aggressively expansionary monetary policy for the same sort of reasons that they appear to have done so in the early 1960s, to restore output and employment.

To see that the economy was below at least one measure of potential in 1971, consider the results in Figures 6 and 7. Figure 6 displays quarterly data on (log) real GDP in the United States for the period 1966Q1 to 1973Q4. In addition, we report two estimates of potential GDP based on the Hodrick and Prescott (1997) filter.<sup>16</sup> One is computed using data covering the period, 1948Q1–1998Q1. A possible problem with this is that by using currently available data we may overstate the estimate of potential GDP available to policy-makers in the early 1970s. They would not have been aware of the slowdown in trend (that is, potential) GDP that started around that time (Orphanides 1999). This motivates our second estimate of potential output, which is based only on data for the period 1948Q1–1973Q4. Note from Figure 6 that the qualitative difference between the two estimates of potential is as expected. However, quantitatively, the difference in levels is quite small. The implied estimates of the output gap appear in Figure 7.<sup>17</sup>

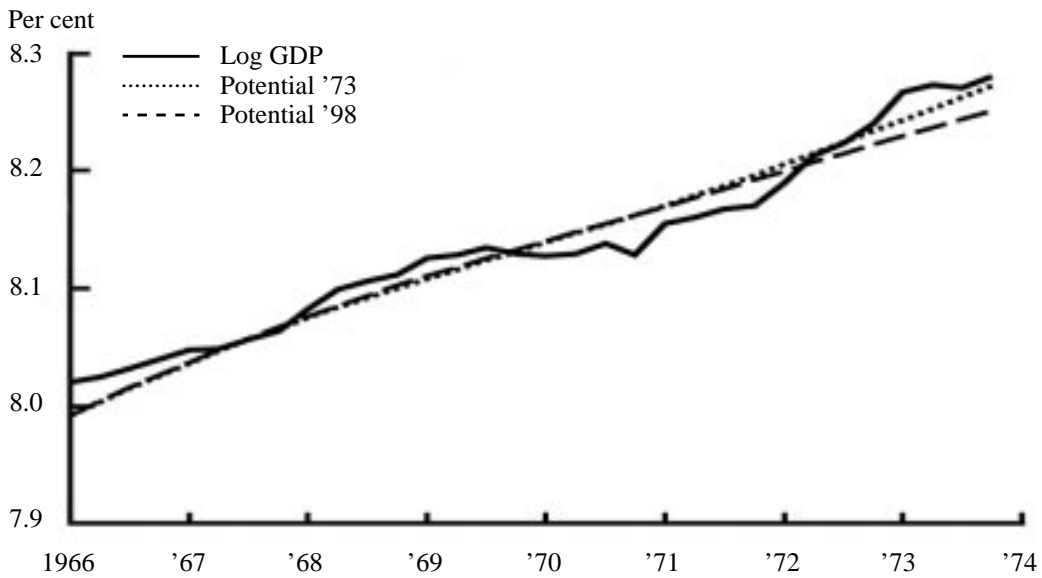
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16. The trend implicit in the H-P filter is a fairly standard way to estimate potential GDP. For example, the Organisation for Economic Co-operation and Development (1999, 205) reports estimates of the output gap computed in this way. Taylor (1999a) also uses this method to compute the output gap. Finally, according to Orphanides and van Norden (1999, 1), “The difference between [actual output and potential output] is commonly referred to as the *business cycle or the output gap* [italics added].” For an analysis of the statistical properties of this way of computing the output gap, see Christiano and Fitzgerald (1999).

There are other output-gap measures based on a different notion of trend. In these, the trend corresponds to the “non-accelerating inflation” level of the variable: the level which, if it occurred, would produce a forecast of zero change in the rate of inflation in the near future. Gap concepts like this are fundamentally multivariate. To see how the H-P filter can be adapted to correspond more closely to this alternative gap concept, see Laxton and Tetlow (1992) and St-Amant and van Norden (1997). We assume that, for our purposes, it does not matter significantly whether the output gap is measured based on the adjusted or unadjusted versions of the H-P filter.

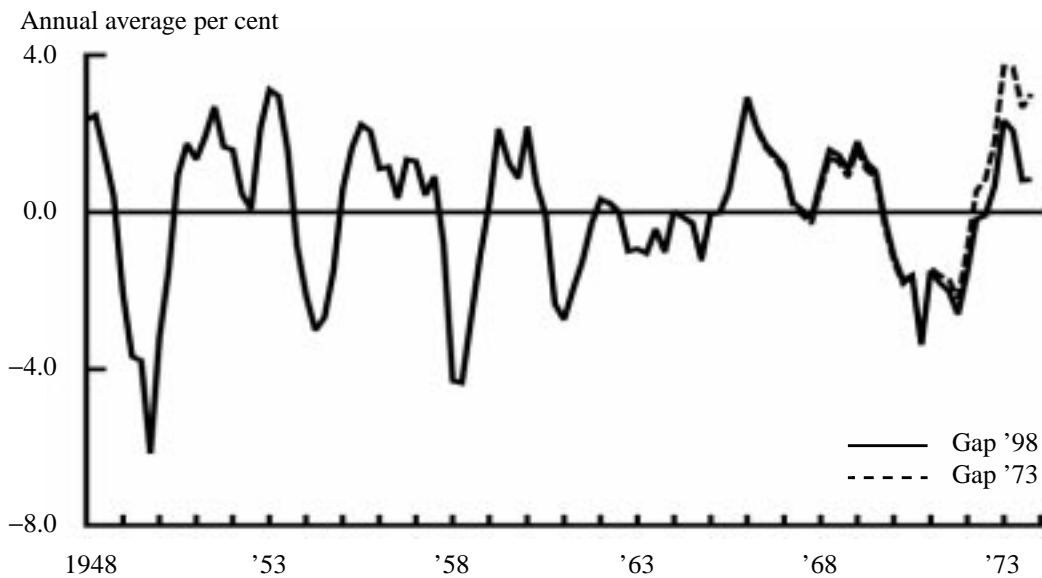
17. The output gap is measured as  $100 \times (\log GDP - \log GDP^{trend})$ , where  $\log GDP^{trend}$  is the trend in log GDP implied by the H-P filter.

**Figure 6**  
**Real GDP and two measures of potential GDP**



Source: Based on data from Citibase.

**Figure 7**  
**Two measures of GDP gap**



Source: Based on data from Citibase.



Note that the two sets of estimates virtually coincide through 1970, and then diverge a little after that. Each estimate implies that the gap in 1971 averaged around 2 per cent.<sup>18</sup>

The 2 per cent gap was substantial by historical standards (Figure 7). Still, the notion that policy-makers actively solicited higher inflation as a way to fight a weak economy conflicts sharply with the words of the chief monetary policy-maker, Burns. Burns was very clear about his distaste for exploiting the Phillips curve for the sake of short-term gains. He certainly accepted the notion that policy could achieve higher output by increasing inflation. After all, his fears about the consequences of fighting inflation with reduced money growth were fundamentally based on a belief in a short-term Phillips curve. His view, which corresponded to the one espoused by Milton Friedman (1968), was that attempts to exploit the Phillips curve for short-term gains would only produce more trouble in the long run.<sup>19</sup> As he put it in testimony before Wright Patman's House Committee on Banking and Currency, 30 July 1974:

We have also come to recognize that public policies that create excess aggregate demand, and thereby drive up wage rates and prices, will not result in any lasting reduction in unemployment. On the contrary, such policies—if long continued—lead ultimately to galloping inflation, to loss of confidence in the future, and to economic stagnation. (Burns 1978, 170)

It is hard to doubt the sincerity of these words. To Burns, an important lesson of the inflation of the 1970s was that price increases produced by temporary forces could lead to an intractable inflation problem later on. It would have taken an extraordinary amount of duplicity to, on the one hand, complain about the serious economic damage caused by past policy mistakes in not counteracting temporary forces, and on the other hand contribute to them himself.<sup>20</sup>

### **2.3 Springing the trap**

To evaluate our models, we require a simple characterization of what happened when the economy fell into the expectations trap in the early 1970s. For this, consider Figures 8–10, which display the logarithm of real

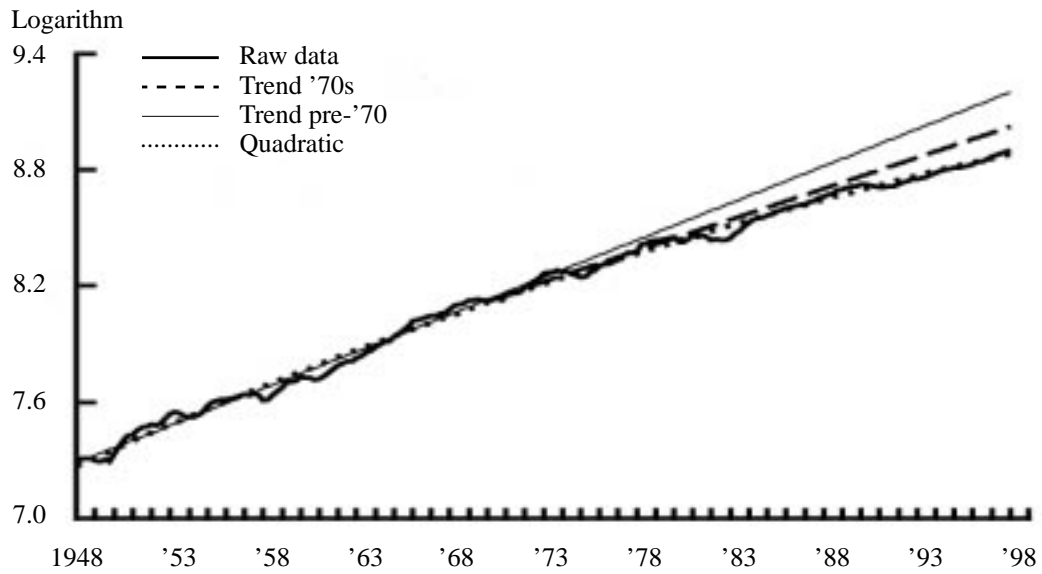
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18. The average gap for 1971 was  $-1.75$  per cent according to the full sample estimate and  $-1.99$  per cent according to the sample that stops in 1973Q4.

19. See Wells (1994, 72) for a further discussion of Burns' view about the Phillips curve.

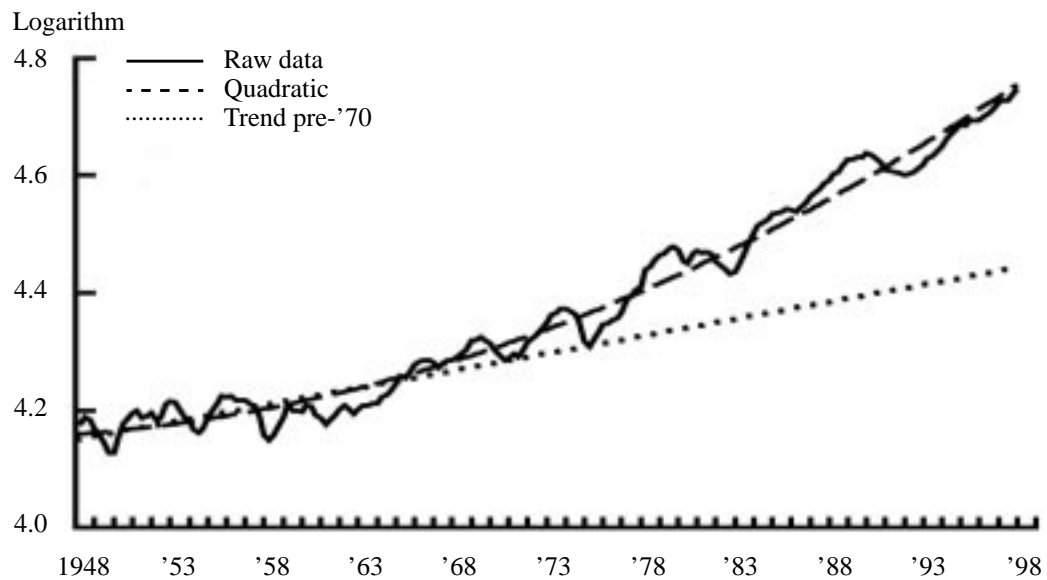
20. It has been argued that even if Burns was not himself duplicitous, President Nixon was, and Burns acted at the behest of Nixon. To us, the record is inconsistent with this view. See the appendix.

**Figure 8**  
**Gross domestic product and trends**



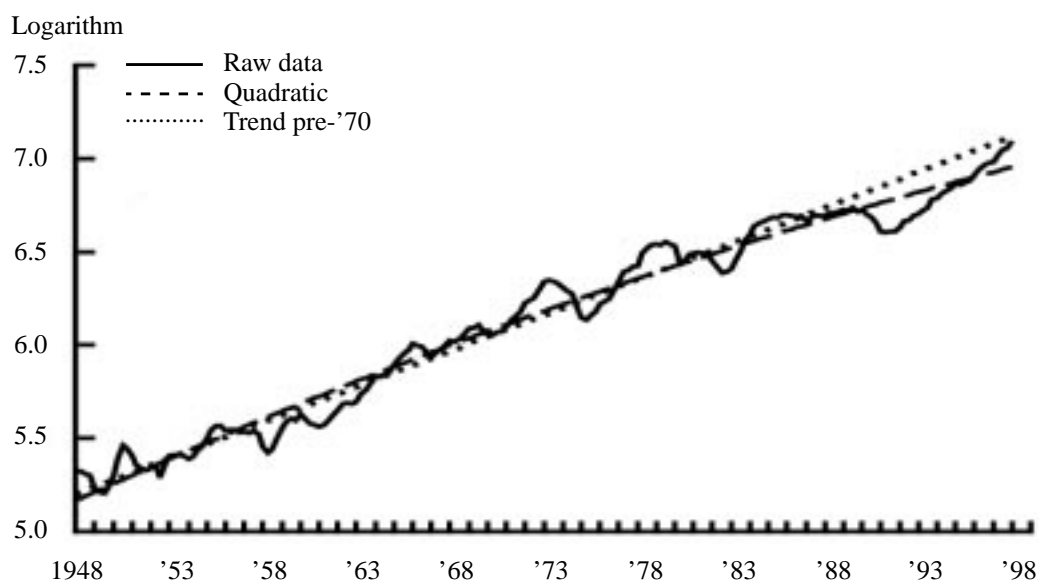
Source: Based on data from Citibase.

**Figure 9**  
**Hours of all persons, business sector, and trends**



Source: Based on data from Citibase.

**Figure 10**  
**Business fixed investment and trends**



Source: Based on data from Citibase.

GDP, total hours worked in nonagricultural business, and business fixed investment, respectively. In addition, we display linear trends, computed using the data from the beginning of the sample to 1970Q1, and extrapolated through the end of the sample. These lines draw attention to the trend change that occurred in these variables in the early 1970s. In addition, in each case we also fit a quadratic trend to the entire sample of data.

Consider the GDP data in Figure 8 first. In this case, we have also included a linear trend fit to the data for the 1970s and extrapolated to the end of the sample. What is clear, by comparing the raw data with the two linear trends, is that the growth slowdown that started in the early 1970s became even more severe in the 1980s and the early 1990s. We infer from the fact that the slowdown persisted—even accelerated—in this period, that the inflation and other transient shocks that occurred in the early 1970s must have had little to do with it. Now consider hours worked in Figure 9. Note how they take off beginning in the early 1970s, and how the growth rate seems to just increase continuously throughout the following decades. Again, we infer from the fact that the growth rate continued to rise after the inflation stopped that the inflation and other temporary factors in the early 1970s were not a factor in this development. Finally, note that investment shows very little trend change in the 1970s (see Figure 10). After a pause during the 1974–75 recession, investment returns to its former growth path. Investment does display weakness in the late 1980s and the 1990 recession. But after that, it grows again, returning to the pre-1970s trend line by 1997.

These trend changes in hours worked and output complicate our attempts to assess alternative explanations of the inflation of the 1970s. Ideally, we would like to remove the effect on the data reflecting the factors underlying the persistent change in trend, and study the remainder. We have not found a clean way to do this. The approach we take removes a quadratic trend from each variable and assumes that the result reflects the effects of the inflation and bad supply shocks of the early 1970s. The results are displayed in Figures 11–13. In the 1974–75 recession hours worked fell to around 6 per cent below trend, investment was down 11 per cent, and output was down 3 per cent. At the same time, inflation rose from 4 per cent in 1972 to 10 per cent by the end of the recession. The federal funds rate went from around 4 per cent in 1972 to a peak of around 12 per cent near the end of the recession. The episode is a classic stagflation, with inflation going up and the economy, down.

### 3 Models

We now report on a quantitative evaluation of the expectations trap hypothesis. For this, we need a mathematical representation of the way the central bank conducts monetary policy and of the way the private economy is put together. We describe two models of the private economy: the limited participation model of Christiano and Gust (1999) and the sticky-price, IS-LM model of Clarida et al.<sup>21</sup>

#### 3.1 Monetary policy rules

There is widespread agreement that the right way to model the Fed's monetary policy is along the lines proposed by Taylor (1993, 1999b). He posits that the Fed pursues an interest rate target, which varies with the state of the economy. A version of this policy rule was estimated using data from the 1970s by Clarida et al. They estimated that the Fed's monetary policy causes the actual federal funds rate,  $R_t$ , to evolve as follows:

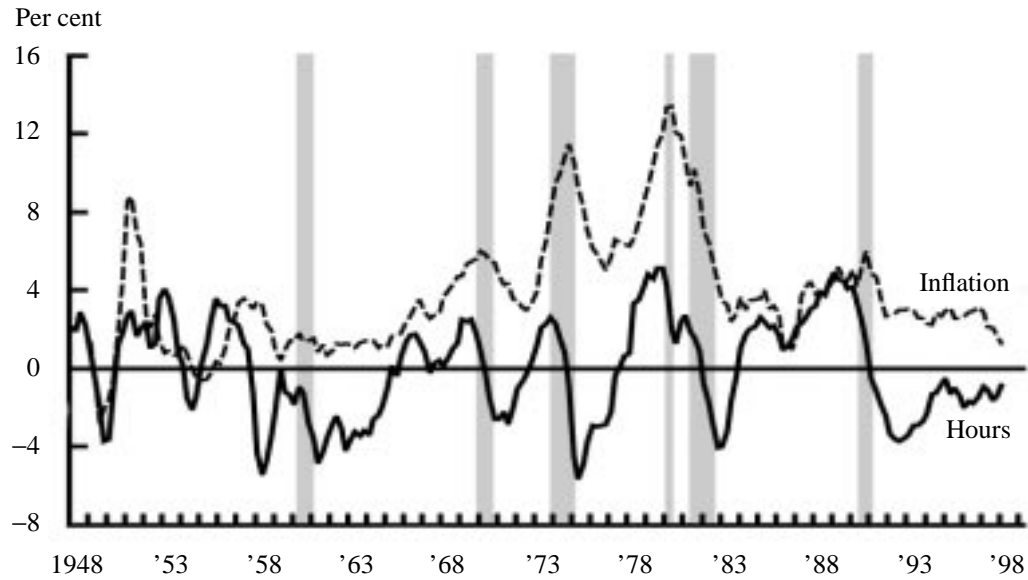
$$R_t = \rho R_t + (1-\rho)R_t^*. \quad (1)$$

In words,  $R_t$  is a weighted average of the current target value,  $R_t^*$ , and of its value in the previous period. By setting  $\rho = 0$ , the Fed would achieve its target,  $R_t = R_t^*$  in each period. It might instead prefer  $0 < \rho < 1$  if  $R_t^*$  exhibits more volatility than it wishes to see in the actual funds rate. The target interest rate is determined according to the following expression:

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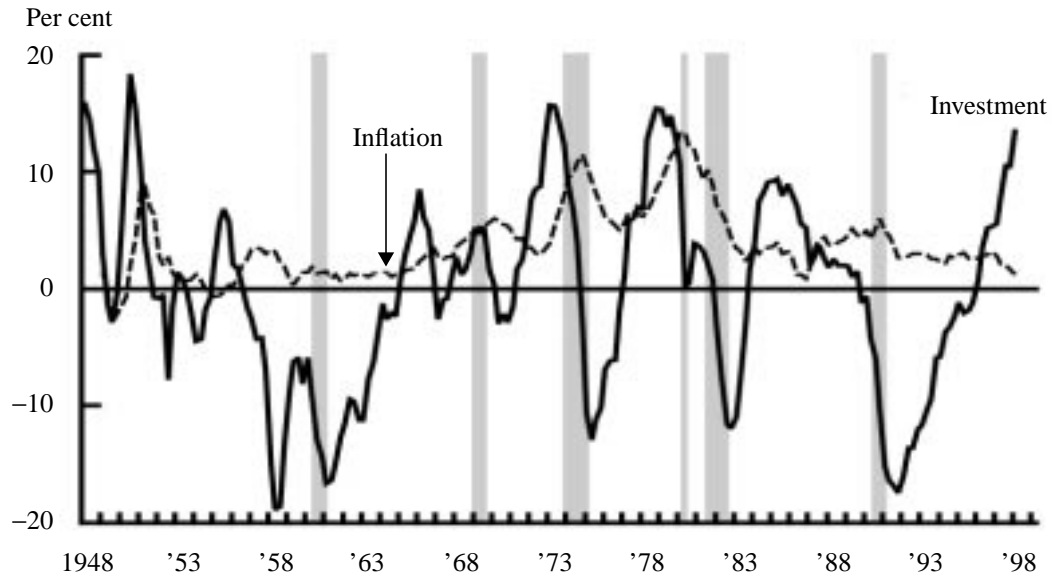
21. The limited-participation model that we use is a modified version of the model in Christiano, Eichenbaum, and Evans (1998).

**Figure 11**  
**Detrended hours and inflation**



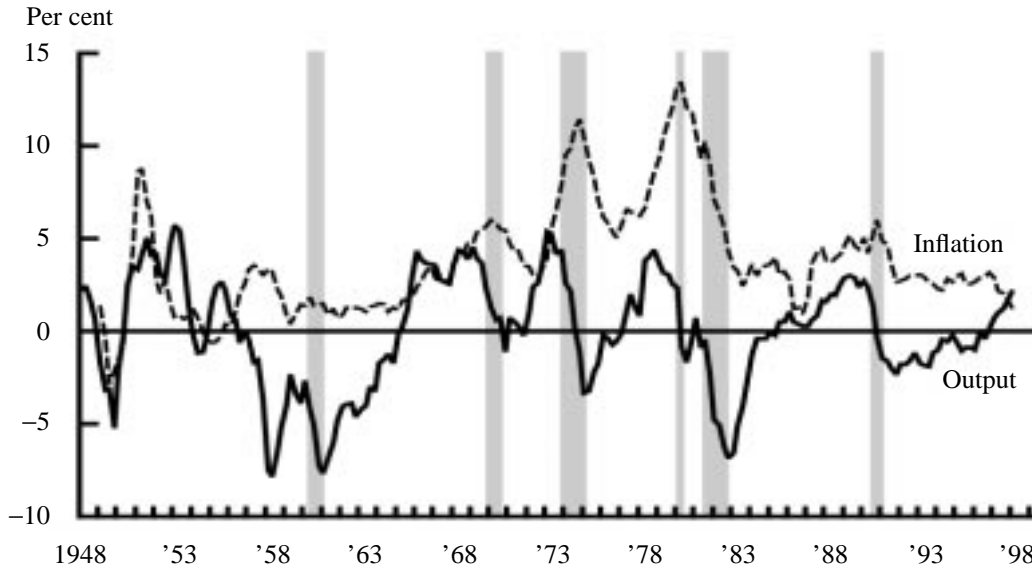
Note: Shaded areas indicate NBER-dated recessions.  
Source: Based on data from Citibase.

**Figure 12**  
**Detrended investment and inflation**



Note: Shaded areas indicate NBER-dated recessions.  
Source: Based on data from Citibase.

**Figure 13**  
**Detrended output and inflation**



Note: Shaded areas indicate NBER-dated recessions.  
 Source: Based on data from Citibase.

$$R_t^* = \text{constant} + \alpha E_t \log(\pi_{t+1}) + \gamma y_t, \quad \pi_{t+1} = \frac{P_{t+1}}{P_t}, \quad (2)$$

where  $P_t$  is the price level,  $E_t$  is the date  $t$  conditional expectation, and  $y_t$  is the per cent deviation between actual output and trend output. The estimated values of  $\rho$ ,  $\alpha$ , and  $\gamma$  are 0.75, 0.8, and 0.44, respectively. We use these parameter values in our analysis.<sup>22</sup>

The idea is that a tough central banker who is committed to low inflation would adopt a rule with a large value of  $\alpha$ . A central banker that is

22. Clarida et al. (1998) use revised data to estimate the policy rule for the 1970s. Orphanides (1997) argues that constructing  $y_t$  using final revised data may give a very different view of  $y_t$  than policy-makers in the 1970s actually had. As noted above, he argues that the productivity slowdown that is thought to have occurred beginning in the early 1970s was not recognized by policy-makers until much later in that decade. As a result, according to Orphanides, real-time policy-makers in the 1970s thought that output was further below potential than current estimates suggest. In private communication, Orphanides has informed us that when he uses real-time data on  $y_t$  and the other variables to redo the Clarida et al. estimation procedure, he finds that the point estimated for  $\rho$ ,  $\alpha$ , and  $\beta$  for the 1970s change. They move into the region where our models no longer imply that self-fulfilling inflation takeoffs are possible. The standard errors on the point estimates are large, however, and a standard confidence interval does not exclude the Clarida et al. point estimates that we use.

less able to commit to low inflation would have a low value of  $\alpha$ . Clarida et al.'s estimate for the 1970s is relatively low. The value they estimate using data after 1979 is higher, and this is a period when monetary policy is thought to have been characterized by greater commitment to low inflation. To see how much tougher monetary policy became in 1979, consider Figures 4, 5, and 14. Figures 4 and 5 show that the real rate was noticeably higher in this period. Figure 14 exhibits the difference between what the federal funds rate actually was and what it was predicted to be based on equation (1). Up until 1979, these differences were on average close to zero. After 1979, the average shifts up noticeably (see the horizontal line). This indicates that the actual funds rate in that period was higher than what a policy-maker following the pre-1979 rule would have allowed.

How well does this policy rule capture our observations about monetary policy in the 1970s? In one sense, it misses. We saw that there were times when the Fed was very tough, and other times when it was accommodating. We think of this policy rule as capturing the Fed's behaviour on average. On average, it was accommodating.

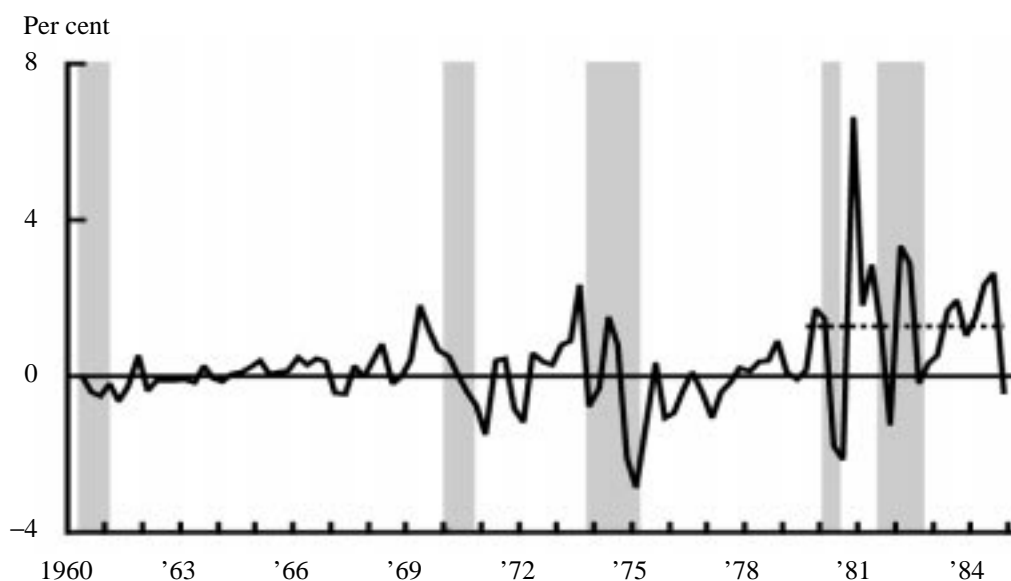
### 3.2 Two models of the private economy

We now present a brief description of the models used in the analysis. The mathematical equations characterizing both models may be found in Christiano and Gust (1999).

Consider the limited-participation model first. Recall that this model emphasizes a working-capital channel in the firm sector: In order to produce output in a given period, firms must borrow funds from the financial intermediary. By increasing and decreasing its injections of liquidity, the central bank can create an abundance or scarcity of those funds. The resulting interest rate fluctuations then have a direct impact on production. A scarcity of funds in the financial intermediary drives up the interest rate and induces firms to cut back on borrowing. With fewer funds with which to hire factors of production, they cut back on production. Similarly, an abundance of funds leads to a fall in the interest rate and an expansion of output.

The mechanism whereby a rise in expected inflation may lead to a rise in actual inflation in this model was sketched earlier, but we summarize it again here for convenience. When there is an increase in expected inflation (that is,  $E_t \log(\pi_{t+1})$  rises) and  $\alpha < 1$ , this translates into a decrease in the real interest rate,  $R_t - E_t \log(\pi_{t+1})$ . This leads households to reduce their deposits with the financial intermediary, and has the effect of creating a scarcity of the funds available for lending to firms. Upward pressure develops on the rate of interest. In pursuing its policy of not letting the interest rate rise too much, the monetary authority must inject some liquidity

**Figure 14**  
**Actual federal funds rate minus value predicted by 1970s rule**



Note: Shaded areas indicate NBER-dated recessions.  
 Source: Based on data from Citibase.

into the banking system. This injection then produces a rise in prices, thus validating the original rise in inflation expectations. Since the monetary authority does permit some rise in the nominal rate of interest (that is,  $\alpha > 0$ ), this has the effect of depressing output, employment, consumption, and investment. Thus, the limited-participation model predicts that a self-fulfilling inflation outburst is associated with stagflation.

The pure logic of the model permits an inflation outburst to be triggered for no reason at all or in response to some other shock. In our modelling exercise, we treat the jump in expectations as occurring in response to a transitory, bad supply shock. Here, we have in mind the commodity supply shocks, including the oil shock, of the early 1970s.

Now consider the Clarida et al. model. In that model, a fall in the real rate of interest stimulates the interest-sensitive components of demand. The expansion of demand raises output and employment through a standard sticky-price mechanism. In particular, firms are modelled as setting their prices in advance and then accommodating whatever demand materializes at the posted price. As output increases, the utilization of the economy's resources, particularly labour, increases. This produces a rise in costs and these are then gradually (as the sticky-price mechanism allows) passed into higher prices by firms. In this way an increase in the expected inflation rate gives rise to an increase in actual inflation, as long as  $\alpha < 1$ .



A feature of Clarida et al.'s model is that it does not have investment or money. The absence of investment reflects the assumption that only labour is used to produce output. Money could presumably be incorporated by adding a money-demand equation and then backing out the money stock using output and the interest rate. Clarida et al. do not do this and neither do we.

Evidently, the Clarida et al. model implies that a self-fulfilling outburst of inflation is associated with a rise in employment and output. If there were no other shocks in the model, then it is clear that the Clarida et al. model would have a problem, since it would be inconsistent with the phenomenon of stagflation observed in the 1970s. However, we treat the Clarida et al. model in the same way as the limited-participation model. In particular, we model the jump in inflation expectations as occurring in response to a bad supply shock. So, in principle, it might be compatible with the low output observed in the 1970s because of the bad supply shock.

### 3.3 Interpreting the Taylor rule in the two models

The various hypotheses about inflation that we discuss in this paper focus on the *motives* of policy-makers. The Taylor rule summarizes their *decisions*, and is silent on what motives produced these decisions. Still, in assessing the limited-participation and Clarida et al. models, it is useful to speculate on what sort of motives might produce a Taylor rule with  $\alpha < 1$  in these models.

In the limited-participation model, we interpret  $\alpha < 1$  as reflecting the working-capital expectations trap considerations discussed above. That is, in this model a rise in inflation expectations confronts the Fed with a dilemma because it places the goals of low inflation and stable output in direct conflict. An interpretation of  $\alpha < 1$  is that this reflects the Fed's relatively greater concern for the output goal, as in the working-capital expectations trap scenario.

By contrast, in the Clarida et al. model a rise in expected inflation does not put the low inflation, stable output goals in conflict. By simply saying *no* to high money growth and inflation, the Fed in the Clarida et al. model prevents output and inflation from simultaneously going above trend. So,  $\alpha < 1$  in the Clarida et al. model does not appear to reflect the type of central bank dilemmas that are at the heart of the expectations trap scenarios described above. Perhaps the only interpretation of  $\alpha < 1$  in the Clarida et al. model is that it reflects a mistake on the part of policy-makers. Under this interpretation, policy-makers were not aware that with  $\alpha < 1$ , a self-fulfilling inflation outburst is possible. That is, policy-makers simply did not know that they could have gotten out of the high inflation by raising the rate

of interest sharply. Our reading of the policy-making record of this period makes us deeply skeptical of this idea.<sup>23</sup>

## 4 Evaluating the Models

Neither of our models captures the events at the level of detail described earlier, nor would we want them to. The question is whether we have a model that captures the broad outlines of the takeoff in inflation in the 1970s.

We construct a simulation of the 1970s using the two models described in the previous section. We specify that the fundamental exogenous shock in this period is a shift down in the production function by 1 per cent.<sup>24</sup> That is, for each level of the inputs, output falls by 1 per cent. Inflation expectations in the wake of this shock are not pinned down. They are exogenous variables, like the technology shock.<sup>25</sup> We picked the expectations subject to two constraints. First, we required that the limited-participation model display a long-lasting, substantial response of inflation to the shock. Second, we required that the price level in the period of the production-function shock be the same between the two models.

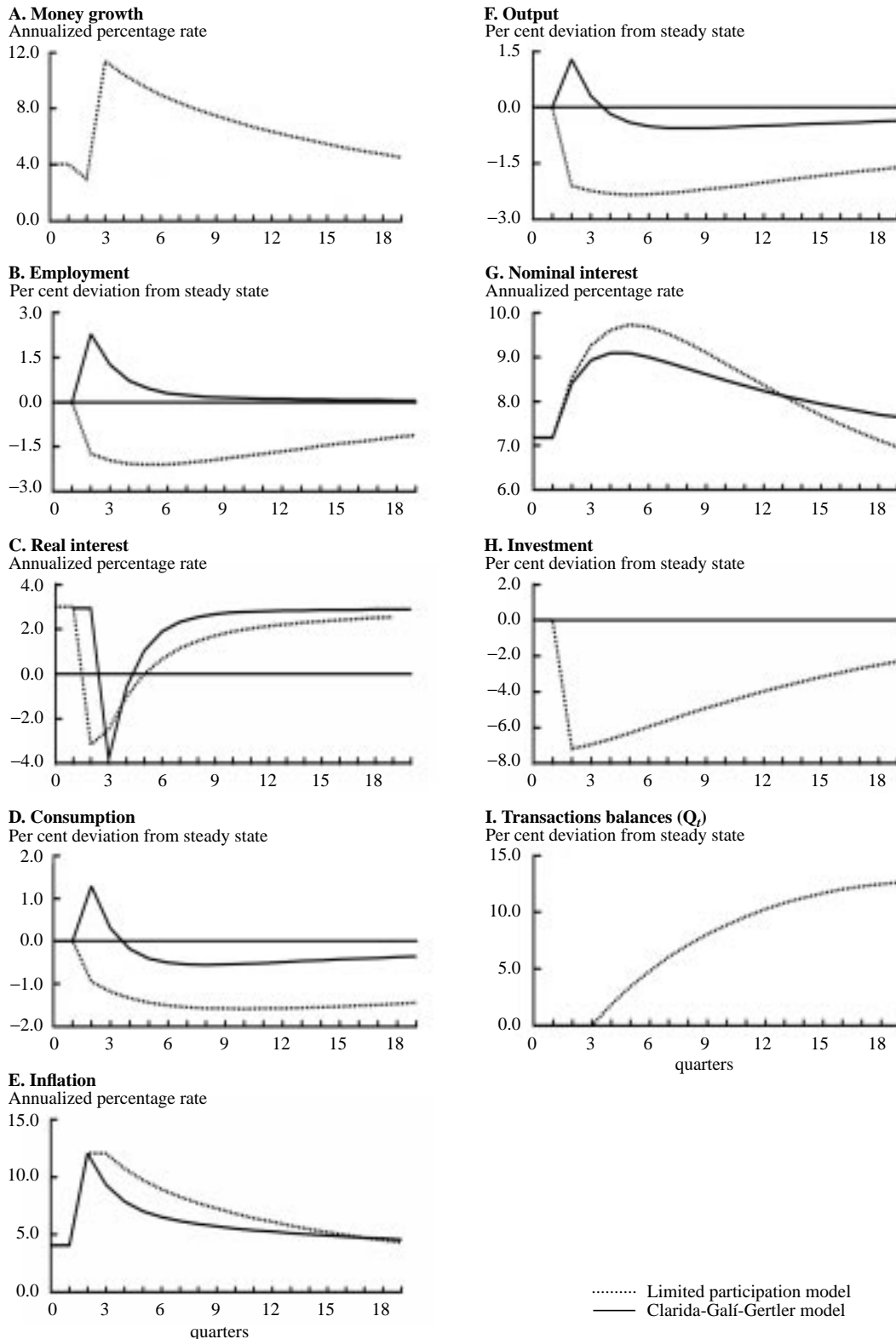
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23. Woodford (1998) develops an alternative interpretation of  $\alpha < 1$  by building on the assumption that fiscal policy (something we abstract from in our analysis) was “non-Ricardian” during the 1970s. Using the fiscal theory of the price level, he argues that with fiscal policy satisfying this condition, the Fed was forced to set  $\alpha < 1$  to avoid an even more explosive inflation than the one that actually occurred. For a simplified explanation of this argument, see Christiano and Fitzgerald (2000). The fiscal theory of the price level offers another potential explanation of the takeoff in inflation in the 1970s, one that is not based on self-fulfilling expectations and that assigns a central role to fiscal policy rather than monetary policy. While this interpretation is controversial, it deserves serious consideration. See Cochrane (1998) and Woodford (1998) for further discussion.

24. The production function is  $Y_t = \exp(z_t)K_t^\theta L_t^{1-\theta}$ , where  $Y_t$  denotes gross output,  $K_t$  denotes the stock of capital, and  $L_t$  denotes labour. The state of technology,  $z_t$ , evolves according to  $z_t = \rho_z z_{t-1} + \varepsilon_{z,t}$ , with  $\rho_z = 0.95$ . In the limited-participation model,  $\theta = 0.36$  and in Clarida et al.,  $\theta = 0$ . The simulation involves setting  $\varepsilon_{z,t} = -0.01$  for  $t = 2$  and  $\varepsilon_{z,t} = 0$  for all other  $t$ . With this value of  $\rho_z$  the state of technology remains 0.7 per cent below trend after 10 periods and 0.4 per cent below trend after 20 periods.

25. There is one important difference. Shocks to the production function can occur for any parameter values of the model. Shocks to expectations can only exist for certain parameter values.

**Figure 15**  
**Response to technology shock in two different models**



Note: Shock happens in quarter two.

Consider the limited-participation model first.<sup>26</sup> Figure 15 exhibits the response of the variables in that model to a bad technology shock. The shock occurs in period 2. Not surprisingly, in view of our earlier discussion, the shock drives output and employment down and inflation up. The monetary authority reacts immediately to the increase in inflation expectations by reducing the money supply to push up the rate of interest (recall, the coefficient on expected inflation in the Taylor rule is positive).

Notice the variable,  $Q$ , in the model. That is the part of households' financial wealth that they hold in the form of transactions balances. When inflation expectations go up and  $\alpha < 1$ , then households increase  $Q$  and correspondingly reduce the part of their financial wealth that they deposit with financial intermediaries. The increased value of  $Q$  in period 3 reflects households' higher inflation expectations. They understand that the monetary authority's policy rule implies that the nominal rate of interest will go up, but that it will go up by less than the increase in inflation expectations (that is,  $0 < \alpha < 1$ ). That is, they expect the real rate to go down. This leads them to increase the funds allocated to the goods market by raising  $Q_3$ , that is, to drain funds from the financial intermediary. To guarantee that the rate of interest only rises by a small amount ( $\alpha$  is small), the monetary authority must inject funds into the financial intermediary to make up for the loss of funds due to the rise in  $Q_3$ . The rise in the interest rate that occurs with all this produces a fall in output and employment. The stagflation persists for a long time. Money growth, inflation, and the nominal interest rate remain high for years. Output, employment, consumption, and investment are down for years. Investment is low, despite the low real rate of interest, because inflation acts like a tax on investment in this model.<sup>27</sup> Note that the effects are quite large. Output and employment remain 2 per cent below trend for a long time, and money growth, inflation, and interest rates are more than 6 percentage points above their steady state. The fall in investment is over 6 per cent. Inflation rises from 4 per cent to about 10 per cent and the interest rate rises from about 7.2 per cent to 10 per cent. These results are tentative, however, since the size of the supply shock, 1 per cent, was not based on a careful analysis of the data. Nor was the response of inflation expectations chosen carefully. Still, the results build confidence that the

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26. For details of model parameterization, see Christiano and Gust (1999). The version of the limited-participation model underlying the calculations in Figure 15 is the one in which investment is a cash good, what Christiano and Gust (1999) call the "benchmark" model. They also consider the version of the model in which investment is a credit good. The simulation of the 1970s using the Clarida et al. estimated Taylor rule resembles the results in Figure 15.

27. Feldstein (1997) has argued that high inflation hurts investment, though he emphasizes a mechanism that operates through the explicit tax system.

working-capital expectations trap hypothesis can deliver quantitatively large effects.

What is the reason for these persistent and large effects following a technology shock? Fundamentally, it is bad monetary policy. With a less-accommodating monetary policy, it would not be an equilibrium for inflation expectations to jump so much, and so the nominal interest rate would not rise so much. With a smaller interest rate rise, the negative output and employment response to a bad technology shock would be reduced. Figure 16 exhibits what happens in our benchmark limited-participation model when the policy rule estimated by Clarida et al. to have been followed in the post-Volcker period is used.<sup>28</sup> In this case, the equilibrium is (locally) unique.<sup>29</sup> Note that the fall in output and employment is smaller here. The rise in the interest rate is smaller too.

We think of a small value of  $\alpha$  in the pre-Volcker policy rule as reflecting that the rule is the decision of a policy-maker without an ability to commit to low inflation. If we interpret the inability to commit as reflecting that the policy-maker has too soft a heart for economic agents, then there is plenty of irony here. The soft-hearted policy-maker in the end does greater damage to the economy than a hard-hearted one who can commit to low inflation.<sup>30</sup>

Now consider the Clarida et al. model. Figure 15 exhibits the dynamic response of the variables in that model to a 1 per cent drop in technology. Note from the figure that in the Clarida et al. model, employment and output rise in response to the shock. After four quarters, output is down, but the employment response remains up for several years. This dynamic response pattern reflects two things. First, in sticky-price models the direct effect on output of a bad technology shock is at most very small, since output is demand determined. As a result, a bad technology shock actually has a positive effect on employment in these models

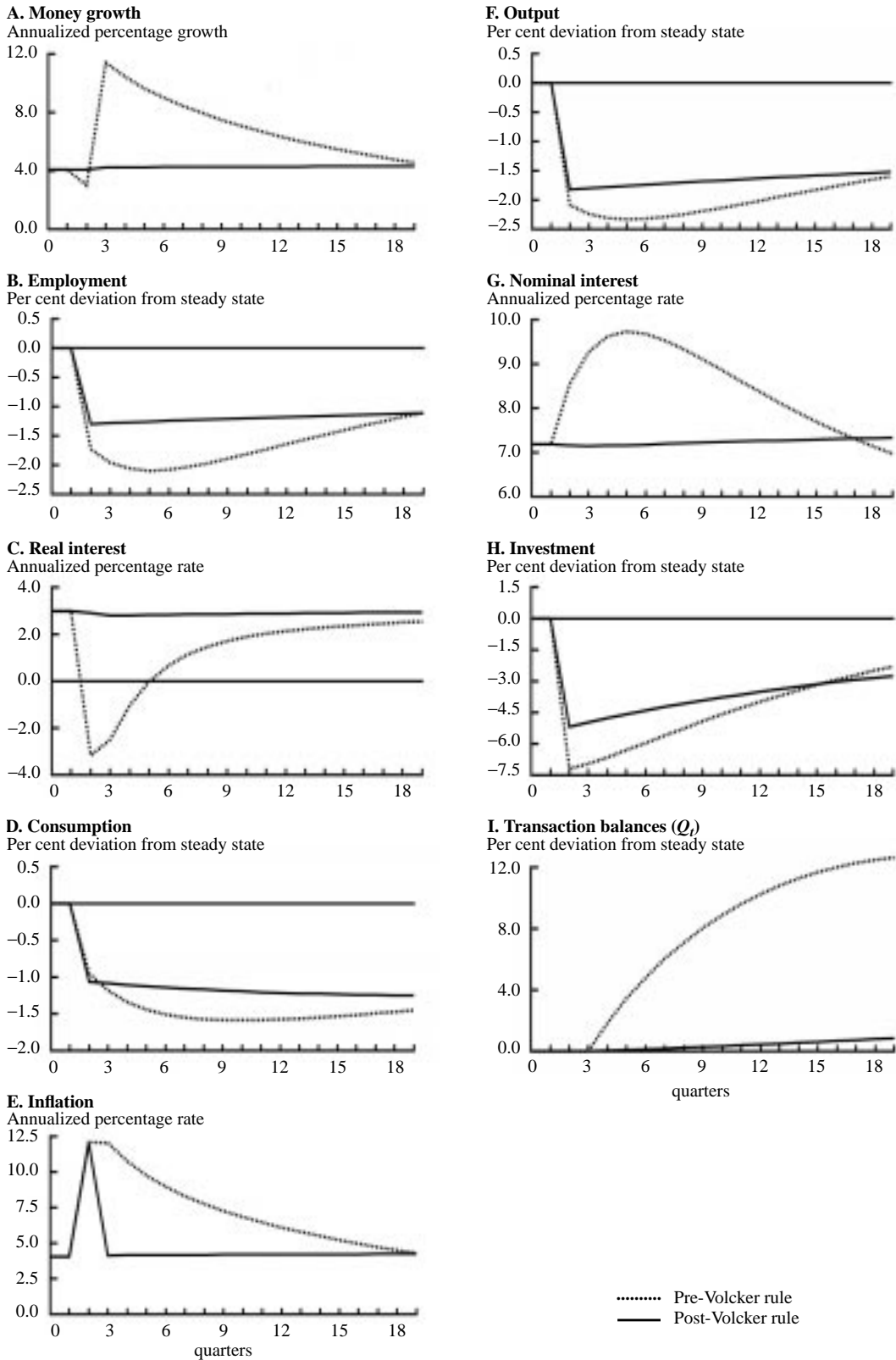
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28. This uses a larger value of  $\alpha$ .

29. The result that raising  $\alpha$  above unity eliminates expectations traps (at least, locally) is somewhat model specific. In some models this does not work and the central bank would have to adopt a different policy to rule out expectations traps.

30. It deserves repetition that the policy rules have not been derived from well-specified optimization problems of policy-makers and that our discussion represents an informal interpretation. For an explicit analysis based on policy-maker optimization, see Chari, Christiano, and Eichenbaum (1998).

**Figure 16**  
**Response to a negative technology shock under two different Taylor rules**



Note: Shock happens in quarter two.

(see Galí 1999, and Basu and Fernald 1999).<sup>31</sup> Second, a self-fulfilling rise in inflation by itself produces a rise in output and employment in the Clarida et al. model, as the fall in the real rate of interest stimulates the interest sensitive components of aggregate demand.

The simulation results in effect present the combined effects of both a self-fulfilling rise in inflation and a bad technology shock. In view of the observations in the previous paragraph, it is not surprising that the response of employment is positive. Output is also high for several quarters, although it eventually goes negative as the effect of the bad technology shock swamps the effect of the increase in employment. The employment response in particular puts this model in sharp conflict with the observed stagflation of the 1970s.

We conclude that the limited-participation model provides a reasonable interpretation of the takeoff in inflation in the 1970s as a working-capital expectations trap. The effects in the model are large, and qualitatively of the right type: The model predicts a stagflation. The alternative model that we examine, the one proposed in Clarida et al., provides a less-convincing explanation of the 1970s. The model predicts a boom. In addition, as discussed in the previous section, the model's explanation of why policy-makers allowed the inflation rate to take off is not very compelling.

## Conclusion

We have argued that the expectations trap hypothesis helps explain the high inflation in the early 1970s, particularly the takeoff that began in 1973. We have argued against another hypothesis, the Phillips curve hypothesis. According to that, the high inflation was an unfortunate but necessary risk that the Fed was willing to take when it decided to jump-start a weakened economy in the early 1970s. These hypotheses are in fact quite similar, and

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31. The reasoning is simple. Let  $D$  denote demand and  $P$  and  $Y$  denote price and output. Then,  $PY = D$ . In a sticky price model,  $P$  cannot change so that if  $D$  does not change then  $Y$  cannot change either, even if there is a shock to technology. Of course, if the shock is such that it takes more people to produce a given level of output, then a fall in technology results in a rise in employment. This response of employment to a bad technology shock is not robust to all specifications of monetary policy. For example, if  $\alpha$  is sufficiently large in the Clarida et al. model, then the rise in anticipated inflation produced by a bad technology shock leads the monetary authority to raise the interest rate a lot, driving down  $D$ . If the fall in  $D$  is sufficiently large, then a bad technology shock could actually lead to a fall in employment. Our results indicate that under the estimated monetary policy rule, employment rises after a bad technology shock in the Clarida et al. model.

so it may appear that we are splitting hairs in trying to differentiate between them. Is there anything at stake in the distinction?

We believe there is. Under the Phillips curve hypothesis, preventing a repeat of the high inflation of the 1970s is a relatively easy task: *just say no* to high money growth as a way to stimulate the economy. Under the expectations trap hypothesis, the problem of inflation is not solved so easily.

According to the expectations trap hypothesis, high inflation is the Fed's reaction to pressures originating in the private economy. The entire policy-making establishment, when confronted with these pressures, may truly not *want* to say no. To see this, imagine that bad supply shocks drove prices and unemployment up, and people responded by signing inflationary wage and price contracts. Certainly, the Fed would not be happy about following the path of accommodation and validating the expectations incorporated in the wage and price contracts. But, it may well choose to do so anyway. With the White House, the Congress, and the public at large bearing down on it like a great tsunami, the Fed may simply feel it has no choice.

So, the expectations trap hypothesis implies that it is not so easy to prevent a resurgence of a 1970s style inflation. According to that hypothesis, fundamental institutional change is needed to guarantee that people would never reasonably expect a takeoff in inflation in the first place. What sort of institutional change might that be?

We have not attempted to answer this question. There is a large range of possibilities. One is that the necessary changes have *already* occurred. According to that, the simple memory of what happened in the inflation of the 1970s is enough to stay the hand of a policy-maker tempted to validate the expectations incorporated in inflationary wage and price contracts. This is of course an attractive possibility, but there is reason to doubt it. When the expectations trap argument is worked out formally, it is assumed that the policy-maker has unlimited memory, a clear understanding of the consequences of alternative actions, and excellent foresight (see Chari, Christiano, and Eichenbaum 1998). The logic of expectations traps simply has nothing to do with ignorance. So, the notion that expectations traps became less likely when our eyes were opened by the experience of the 1970s does not seem compelling.

Another possibility is that changes in legislation are needed, changes that focus the legal mandate of the Fed exclusively on inflation. This would make it harder for a Congress and White House, panicked by high unemployment and inflation, to pressure the Fed into tossing inflation objectives to the wind in favour of unemployment. Understanding this in



advance, the public would be unlikely to raise inflation expectations in response to transient events, as it seems to have done in the early 1970s.

The expectations trap hypothesis does not say *what* change is needed to prevent a self-fulfilling takeoff in inflation expectations. What it does say is that *if* the government finds a way to credibly commit to not validating high inflation expectations, then costly jumps in inflation expectations will not occur in the first place.

## Appendix

### Burns and Nixon

It has been argued that, as chairman of the Federal Reserve, Arthur Burns simply did what President Nixon told him to do. Burns initially joined the Nixon administration as a special advisor to President Nixon when the latter took office in 1968. The idea is that the boss-employee nature of that relationship continued when Nixon appointed Burns to be chairman of the Federal Reserve. This impression was reinforced by Stanford Rose in a famous article in *Fortune* magazine in 1974, which suggested that Nixon was able to interrupt the policy-making committee of the Fed with a 1-hour telephone call and control the outcome of the meeting.

Nixon apparently did have *hopes* of influencing Burns when he appointed Burns chairman of the Federal Reserve. In his fascinating biography of Burns, Wells (1994, 42) quotes Nixon as having said to Burns: “You see to it: No recession.”

But, according to Wells (1994), the impression that Burns operated at the behest of Nixon is in fact completely untrue. Burns was a man with legendary self-confidence and a powerful, imposing personality. He had been an influential chairman of the CEA under Eisenhower and left a stamp on that institution that is felt even today. During that time, according to Wells (1994, 29), Burns’ relationship to Nixon was that of a

senior partner: He was older than Nixon and enjoyed more influence with Eisenhower and his lieutenants than did the vice president. Burns thought of Nixon as a protege and treated him with what one friend described as “slight condescension.” . . . After Nixon became president, Burns had trouble adjusting to a subordinate position. . . . He lectured Nixon on whatever issue was at hand, usually at great length and in considerable detail. Burns would also bluntly contradict the president or anyone else in the administration with whom he disagreed. . . .

The diaries of H.R. Haldeman (1994), Nixon’s chief of staff, confirm this impression of a self-assured Burns who expected to get his way. For example, here are a couple of entries about Burns while he was in the Nixon White House: “Huge Burns flap because he didn’t get in to see [the President]. . .”; (p. 54) “Big flap with Arthur Burns on AID. . . .” (p. 59)

Wage and price controls were a major source of friction between Burns and Nixon: Burns concluded that they were necessary, and Nixon was opposed. For example, according to Haldeman (1994, 310) Nixon told his cabinet on 29 June 1971, “Our decisions are that there will be no wage-price

controls, no wage-price board.” According to Wells (1994, 70–7), the disagreement provoked “ugly” confrontations between Burns and the White House, as Burns went public with his views. In the end, in mid-August, Nixon decided to impose wage-price controls after all. The episode shows that, as Wells (1994, 100) puts it, “The chairman was clearly no pliant tool of the chief executive but rather did whatever he thought was best.”

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## Discussion

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*Tiff Macklem*

Limited-participation (LP) models are coming of age. Having passed the test of empirical relevance at one level, LP models have matured to the point that they are now being used to examine questions that are of direct interest to monetary policy-makers. A number of recent contributions illustrate this development. Chari, Christiano, and Eichenbaum (1998) study optimal monetary policy in an LP model, Christiano and Gust (1999) examine the performance of alternative simple interest rate reaction functions in an LP model, and this latest contribution from Christiano and Gust (2000) considers the ability of an LP model to explain the pre-eminent monetary policy blunder of the post-war era—the great inflation of the 1970s.

The entry of LP models into the policy arena is a welcome development. The workhorse model of monetary policy—the sticky-price model—has been remarkably resilient, adapting to rational expectations and, to a lesser extent, optimizing agents; however, wage and price stickiness has carried a heavy load in the sense that without it, most models cannot explain the observed short-run consequences of monetary actions for real variables. While few policy-makers believe wages and prices are perfectly flexible, it is probably also fair to say that many believe this is not the only relevant rigidity. Moreover, everyone can agree that there is considerable uncertainty about how the monetary transmission mechanism works, so we should not put all our eggs in one basket. The LP model is an interesting alternative. It embodies a radically different view of the transmission mechanism—one based on rigidities in portfolio decisions between liquid and illiquid assets—and is capable of reproducing the salient

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\* I am grateful to Hope Pioro for valuable technical assistance.

stylized facts regarding the real and nominal effects of a monetary injection both qualitatively and quantitatively, provided we assume sufficient portfolio-adjustment costs.

In this the latest contribution to the LP research program, Christiano and Gust argue that not only is the LP model a credible alternative to the sticky-price (SP) model, it can actually do a better job of explaining the defining episode in post-war monetary history—the great inflation of the 1970s. This leads naturally to the conclusion that to avoid a recurrence of 1970s-style inflation, we need to take seriously the implications of LP models for the design of monetary institutions and monetary rules.

The Christiano and Gust story runs like this. They begin with the premise that the stagflation of the 1970s was caused by the combination of a negative technology shock (that was observed by policy-makers) together with an inappropriate monetary reaction function. The monetary rule they use is not any arbitrary reaction function, but one estimated on data for the 1970s by Clarida, Galí, and Gertler (1999). The key feature of this nominal interest rate rule is that the coefficient on expected inflation is less than 1, so that self-fulfilling outbursts of inflation are possible. Christiano and Gust demonstrate that when this rule is used in LP and SP models, a negative technology shock produces a sharp rise in inflation and a fall in real interest rates in both models. Thus, with respect to inflation and real interest rates, the LP and SP models do equally well in explaining the 1970s. What distinguishes the LP model is its ability to generate stagflation. In the SP model the decline in real interest rates stimulates spending and thus output, so rising inflation is associated with higher (not lower) output. In contrast the LP model generates a period of high inflation and low output—stagflation—as observed in the 1970s.

Christiano and Gust's paper is fascinating. The basic premise that the great inflation of the 1970s is the joint outcome of a negative technology shock and a destabilizing monetary rule is both interesting and provocative, and the idea of evaluating alternative models on the basis of their properties when the usual root conditions are not satisfied is intriguing. I do have one specific comment that I want to explore in some detail.

Christiano and Gust's interpretation of the 1970s is controversial. An alternative explanation of the 1970s is that the excessive monetary (and fiscal) easing was the result of policy-makers' failure to identify both the slowdown in productivity growth that occurred in the first half of the 1970s and the roughly coincident rise in the non-accelerating-inflation rate of unemployment. Although inflation was clearly rising in the first half of the 1970s, rising unemployment and weak output growth were interpreted as evidence of mounting excess supply. This, it was thought, would bring inflation down, so what was needed was not restrictive policies to control

inflation, but stimulative ones to close the growing excess-supply gap. The result of this colossal misreading of the state of the economy was sharply higher inflation and a shift from government budget surpluses to budget deficits.

This alternative to Christiano and Gust's interpretation of the 1970s is not a new story, but a recent paper by Orphanides (1999) has given it new weight. Orphanides compiles real-time estimates of the output gap as published by the Council of Economic Advisers and the Board of Governors of the Federal Reserve System from the late 1960s to the 1990s. As Figure 1 (reproduced from Orphanides) reveals, the differences between the real and the final estimates of the output gap in the 1970s are both huge and incredibly persistent. The difference between the real-time and final estimates of the output gap reaches almost 10 percentage points in 1976, and even by the end of the decade the degree of excess supply is overestimated (relative to the final estimate) by about 3 percentage points for most of the 1970s. Orphanides goes on to show that when a standard Taylor rule using real-time estimates of the output gap is simulated together with simple estimated backward-looking IS and Phillips curves, the resulting inflation profile closely matches the experience in the 1970s. The standard Taylor rule (in deviation form  $i_t = \alpha\pi_t + \gamma y_t$ ) has a coefficient on inflation ( $\alpha$ ) of 1.5, which is clearly greater than 1. Thus Orphanides' interpretation of the 1970s is very different from Christiano and Gust's. The problem was not one of a destabilizing monetary rule, but one of mismeasuring the output gap.

In my view, Orphanides' story is more believable. The Christiano and Gust story requires the monetary policy-makers to have virtual superpowers in identifying an unobserved technology shock, while at the same time possessing a complete lack of understanding of the stability conditions of simple dynamic macro models. Perhaps I am too close to the issue, but I find both these requirements difficult to swallow.

The compelling nature of Orphanides' story leads to an obvious question: How well can LP and SP models explain the 1970s, starting from the premise that the monetary rule was stable, but the level of potential output was overestimated? Since the SP model has only three equations, this is the obvious place to start in answering this question.

The three equations are an IS curve,

$$y_t = E_t y_{t+1} - \frac{1}{\sigma} (i_t - E_t \pi_{t+1}) ;$$

a Phillips curve,

$$\pi_t = \beta E_{t+1} \pi_{t+1} + \kappa y_t - \kappa z_t ;$$



**Figure 1**  
**The 1970s output-gap measurements**



Notes: The dark line indicates the final historical series for the output gap with data available at the end of 1994. Each thin solid line shows the historical series for the output gap based on data available in the first quarter of the year shown.

Source: Orphanides (1999, figure 11).

and a monetary rule. Christiano and Gust use a forward-looking Taylor rule estimated by Clarida, Galí, and Gertler, but for simplicity I replace it with a standard Taylor rule, but with output-gap mismeasurement.

The output gap ( $y$ ) is actual output ( $\tilde{y}$ ) less potential output. Let potential output be the sum of a constant (which I normalize to zero) and a mean zero technology shock ( $z$ ). Then actual output is

$$\tilde{y}_t = y_t + z_t.$$

If the technology shock  $z$  is readily observable, the monetary authority has no problem measuring the output gap, and the Taylor rule is simply

$$i_t = \alpha\pi_t + \gamma y_t.$$

However, if  $z$  is unobservable, the monetary authority must form an estimate of the output gap. For simplicity I assume that the monetary

authority does not learn about  $z$  over the horizon that is relevant for the real effects of monetary disturbances, an assumption that does not appear to be grossly at odds with experience (see Figure 1). The monetary authority therefore measures the gap by simply observing output (since unconditionally  $E(y) = E(\tilde{y} - z) = \tilde{y}$ ). The resulting Taylor rule is therefore

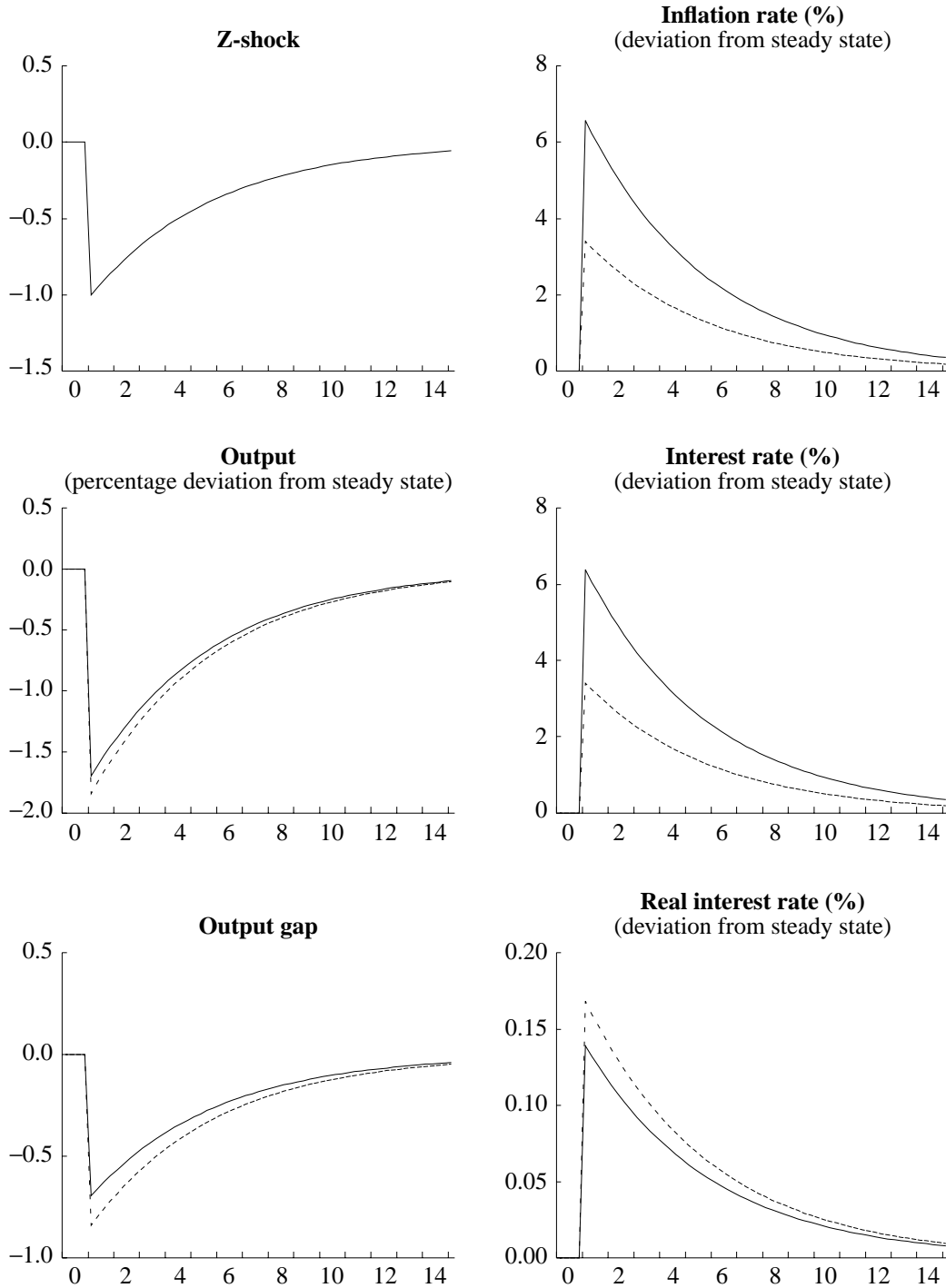
$$i_t = \alpha\pi_t + \gamma\tilde{y} = \alpha\pi_t + \gamma(y_t + z_t).$$

Figure 2 shows the dynamic response of this SP model to the same negative technology shock Christiano and Gust consider. The parameters  $\sigma$ ,  $\beta$ , and  $\kappa$  are set as they have them, and  $\alpha$  and  $\gamma$  are set to the standard Taylor values of 1.5 and 0.5. The dashed lines in the figure are the dynamic response in the standard SP model with no mismeasurement, and the solid lines are with mismeasurement. The consequences of mismeasurement are significant. In particular, inflation jumps about twice as much in the simulations with mismeasurement. Real interest rates also rise less and output falls less with mismeasurement, but the consequences of mismeasurement for these variables are small relative to those for inflation. Comparing the responses in Figure 2 to the experience of the 1970s, we see that the model with mismeasurement captures the sharp rise in inflation and the fall in output, but does not replicate the observed decline in real interest rates.

Figure 3 shows the dynamic responses to the same shock with a modified Taylor rule that shifts more weight onto the output gap, with the effect of making output-gap mismeasurement more of a problem (specifically  $\alpha = 1.1$  and  $\gamma = 1.0$ ). Without mismeasurement the real interest rate rises (as in Figure 2); however, with mismeasurement the real interest rate falls. This produces a very dramatic rise in inflation of over 25 percentage points. The stimulative effects of the negative real interest rates produce a small positive output gap that offsets some of the impact of the negative technology shock on output, but not all of the impact, so output falls, getting us closer to the 1970s in the sense that inflation rises very sharply, and real interest rates and output both fall. However, as in Christiano and Gust's analysis, the output gap goes positive in response to negative real interest rates, and the reason is exactly the same as in Christiano and Gust's analysis. In the SP model, declining real interest rates stimulate spending that, in this demand-driven model, produces excess demand for goods.

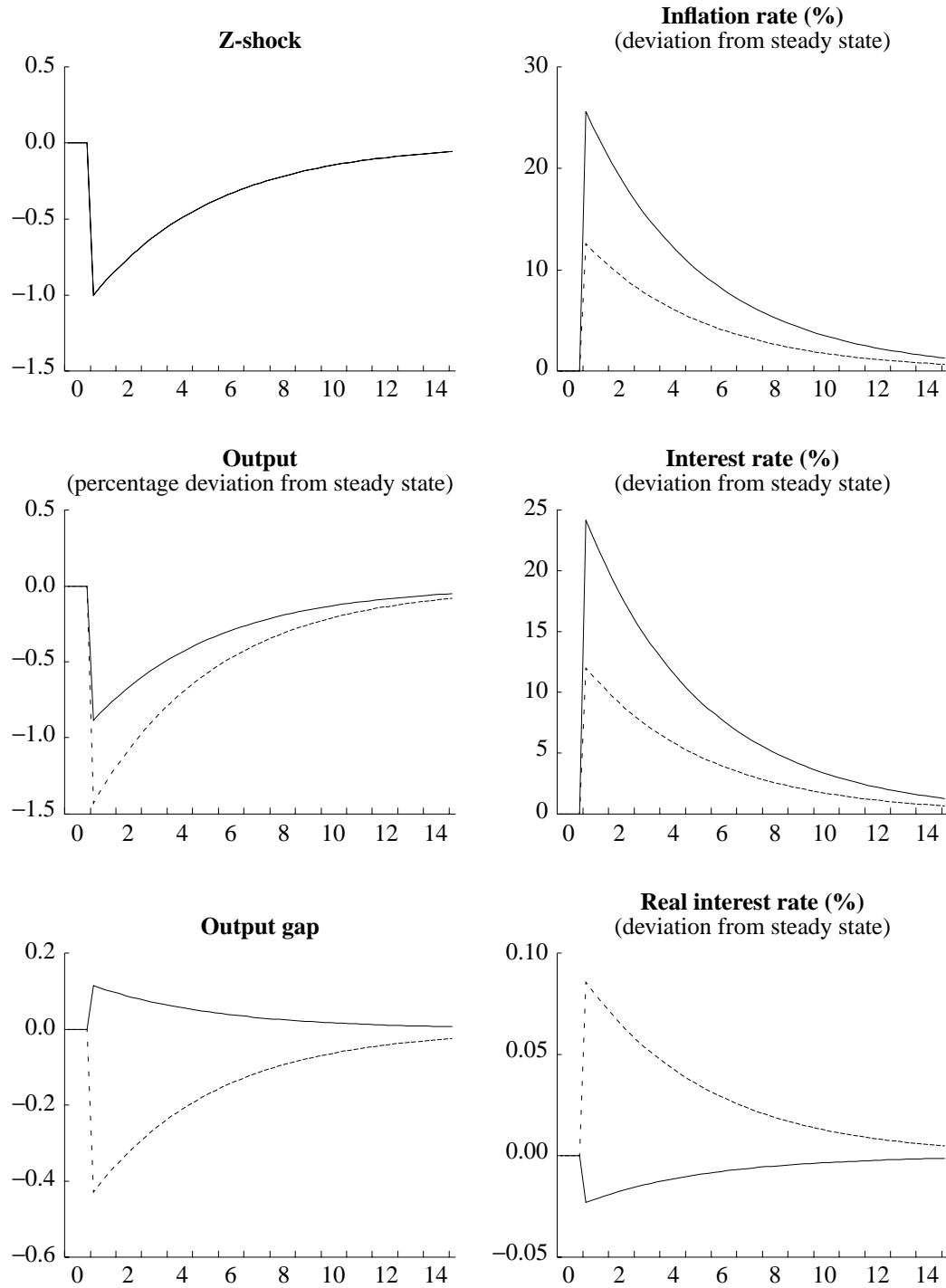
What can we learn from this exercise? Two things, I think. First, whether the 1970s are interpreted as the by-product of an observed negative technology shock and a destabilizing monetary or an *unobserved* negative technology shock with a stable rule, the SP model Christiano and Gust

**Figure 2**  
**Response to observed and unobserved negative technology shocks with a standard Taylor rule**



Note: Solid lines, with error; dash lines, no error.

**Figure 3**  
**Response to observed and unobserved negative technology shocks with a modified Taylor rule**



Note: Solid lines, with error; dash lines, no error.

consider has difficulty in simultaneously generating sharply higher inflation, negative real interest rates, and a negative output gap. The reason is much the same in both cases. This simple SP model has a very rudimentary supply side, and what supply side it does have is weakened by sticky prices. It may well be that an SP model with a richer supply side could do a better job of explaining the 1970s, but as long as sticky prices are active, demand will tend to play a leading role in the short run.

I leave it to the experts to explore whether the LP model continues to explain the 1970s under the mismeasurement story, and I encourage them to do so. If Christiano and Gust find that the LP model does better than the SP model under both interpretations of the 1970s, this would substantially strengthen their conclusion that the lessons from LP models deserve serious attention.

Second, the obvious message from the SP model with mismeasurement is that policy-makers should not put too much weight on the output gap if they are not very confident in its measurement.<sup>1</sup> Figure 4 demonstrates this point in a particularly forceful, if somewhat exaggerated, fashion. It compares the dynamic responses using a standard Taylor rule (i.e.,  $\alpha = 1.5$  and  $\gamma = 0.5$ ) and an inflation-only rule (i.e.,  $\alpha = 1.5$  and  $\gamma = 0.0$ ), both with mismeasurement. The inflation-only rule (solid lines) does result in slightly higher real interest rates and thus marginally weaker output. But these differences are second order when compared to the improvement realized on the inflation front. With the inflation-only rule, inflation rises by only about 1/2 of a percentage point as compared to a rise of about 7 percentage points using the standard Taylor rule. The reason for this sharply different outcome is that the inflation-only rule is immune to mismeasurement of the output gap.

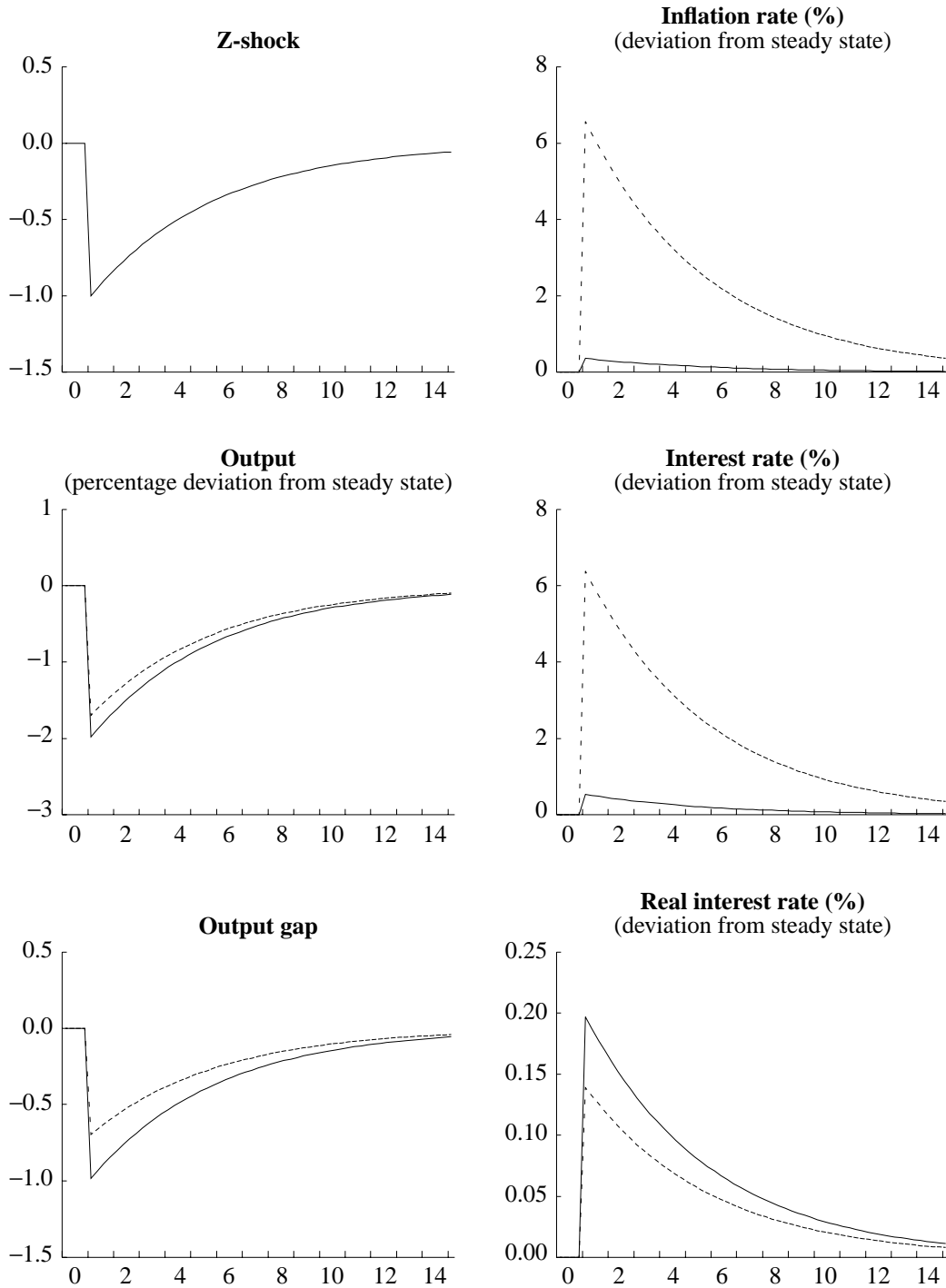
Interestingly, the message from this SP model with output-gap uncertainty is very similar to a key result in LP models. In a paper that is closely related to their conference paper, Christiano and Gust (1999) study the performance of Taylor rules in LP models. They find that equilibria in which expectations of inflation are self-fulfilling are eliminated when the Taylor rule responds *aggressively* to inflation and *very little* to output (e.g., they find  $\gamma = 1.0$  results in indeterminate solutions).

Perhaps the message for monetary policy-makers from both LP models and SP models is that if they are to avoid the recurrence of 1970s-style inflation, they should limit their ambitions with respect to output stabilization and keep the focus on inflation. The robustness of this conclusion across radically different models is both striking and reassuring.

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1. This idea is by no means original (see, for example, Smets 1998).

**Figure 4**  
**Response to unobserved negative technology shocks**  
**with inflation-only and standard Taylor rules**



Note: Solid lines, inflation only; dash lines, standard Taylor.

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## Discussion

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*David Andolfatto*

Christiano and Gust's paper is concerned with explaining the behaviour of base-money growth in the United States during the 1970s. They take as given that the Fed was responsible for the great inflation witnessed in that decade and that Fed policy-makers were very averse to the prospect of high inflation. Why, then, did the Fed do it?

Their hypothesis is that the Fed was reluctantly drawn into inflating essentially because this was what was expected of it. Given a jump in private sector expectations, the Fed perceived its choice as one of either accommodating these expectations or risking a serious recession. Given the Fed's known proclivity for accommodation, private sector inflation expectations became a self-fulfilling prophesy. The Fed got caught in an "expectations trap."

Exactly why private sector inflation forecasts jumped the way they allegedly did is not explained; Christiano and Gust view the "expectations shock" as an exogenous impulse. What is explained, however, is how particular institutional arrangements that govern the conduct of monetary policy can give rise to the logical possibility of an expectations trap. Monetary policy in the 1970s is alleged to have operated in such an institutional setting. The authors formalize these ideas within the context of a computable dynamic general-equilibrium model and demonstrate how two exogenous shocks—one to productivity and one to expectations—can lead to a 1970s-style stagflation. Their model's ability to account for the facts

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\* I would like to thank Lawrence Christiano, Ig Horstmann, David Laidler, and Ed Nosal for a number of helpful conversations.



lends some credence to their argument. They also support their interpretation of events by appealing to a number of selected statements made by Arthur Burns (Federal Reserve chairman, 1970–77).

Overall, I view their paper as an impressive piece of work; it constitutes a wonderful example of how modern macroeconomic theory can be applied to important and difficult questions concerning the conduct of monetary policy and the interpretation of monetary history. The explanation of events is original and the application of quantitative theory innovative. Even if one is, as myself, not persuaded by the argument offered here, the paper lays down a standard and invites competing explanations to do better. In all these senses their paper constitutes a valuable contribution.

## The Expectations Trap

The basic idea of an expectations trap can be presented in terms of a very simple game. Suppose that there are two players, the Fed and households. The Fed has two possible actions: It can either choose a low inflation  $\Pi_L$  or a high inflation  $\Pi_H$ . Likewise, households have two possible actions: They can expect either low inflation or high inflation. The utility payoff to each player depends not only on its own action, but also on the actions of the other player. With two players and two actions, there are four possible payoff configurations (see Figure 1).

The payoff structure displayed in Figure 1 gives rise to what is called a coordination game. Players are imagined to make their choices simultaneously (they cannot condition their behaviour on their opponent's behaviour). So two pure-strategy Nash equilibria exist for this one-shot game: one in which households and the Fed coordinate on a low-inflation equilibrium (each receiving a payoff equal to “1”), and one in which they coordinate on a high-inflation equilibrium (each receiving a payoff equal to “0”).<sup>1</sup>

A question naturally arises here as to which of the two coordinated outcomes is more likely to transpire; this is the question of equilibrium selection posed by game theorists. Unfortunately, to the best of my

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1. There is also a mixed-strategy equilibrium in which both the Fed and households expect the low-inflation regime with probability (1/3). In this case a “coordination failure” can occur with positive probability. By suitably modifying the game, one can also construct correlated (sunspot) equilibria that eliminate the possibility of coordination failure. For simplicity I will concentrate solely on pure strategies.

**Figure 1**  
**The game**

		Households	
		$\Pi_L$	$\Pi_H$
The Fed	$\Pi_L$	1	-1
	$\Pi_H$	-1	0

knowledge there is still no good answer to this question.<sup>2</sup> So we see here that the prevailing institutional structure (the rules and structure of the game) gives rise to a fundamental indeterminacy: Either outcome constitutes a logical possibility. In the game, if households expect (for whatever reason) that inflation is to be high, then the Fed, anticipating this expectation, will have an irresistible incentive to accommodate these expectations. To do otherwise would invite coordination failure. But if the Fed plans to generate a high inflation, then households are perfectly rational in expecting it. In this way, high expectations of inflation can be self-fulfilling. Christiano and Gust exploit exactly this type of indeterminacy in their explanation of the great inflation.

In applying their theory they invoke the assumption that household inflation expectations are subject to exogenous shocks.<sup>3</sup> By specifying such a process the theorist is in effect selecting an equilibrium. For example, in the context of the game, suppose that I simply assume that households choose  $\Pi_L$  (or that households choose  $\Pi_L$  on the basis of some extraneous information).<sup>4</sup> Conditional on this assumed behaviour, the only equilibrium is the low-inflation outcome. It would appear that the theorist is now free to choose any desired outcome simply by specifying the appropriate exogenous process for inflation expectations. One way to impose discipline on the exogenous expectations process is to estimate its parameters by fitting the model to the data. Obviously this exercise is not going to answer the question of why inflation expectations bounce around the way they do, but the estimated model can be used to answer the question of why the economy

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2. There are some axiomatic approaches to selecting among equilibria for coordination problems. Some are simple (choose the Pareto dominant one, if there is one), while others are more complicated (see Myerson 1991). The literature on learning and on evolutionary games also attempts to address this issue.

3. Alternatively, one might hypothesize that it is Fed behaviour that is subject to exogenous shocks. Technically, I do not believe anything would change aside from the interpretation of events.

4. Technically, by allowing individuals to condition their strategies on some external shock or information, I have implicitly modified the one-shot game described above.

behaves the way it does given that inflation expectations bounce around the way they do. Methodologically this is no different than, say, a real business cycle theorist estimating the parameters of an exogenous process for technological change and then offering an explanation of the business cycle conditional on this estimated exogenous process.

The exact procedure Christiano and Gust employ in explaining the great inflation is to assume that over the relevant sample period there was one exogenous upward shift in inflation expectations *and* that this shift occurred coincidentally in the period of an adverse technology shock. (The model provides absolutely no theoretical rationale for why expectations move the way they do in response to the supply shock, however plausible the argument may sound on other grounds.) The quantitative magnitude of the shift in expectations seems to have been calibrated to match some unspecified price-level response in the period of the technology shock.

The model provides an intriguing interpretation of economic events in the early 1970s. The choice of a modelling framework that features an equilibrium indeterminacy, exogenous expectations shocks, and accommodative monetary policy seems to fit well with a number of recorded statements made by policy-makers in that era. For example, we know that Burns did not view monetary policy as the ultimate driving force behind inflation; at the same time, he recognized that inflation could not be sustained without money growth. In his view, monetary policy was severely constrained by a host of political and economic factors that compelled the monetary authority to behave the way it did (see Hetzel 1998). The game described above reflects this point of view; the monetary authority can do little aside from adopting the “accommodative” Taylor rule Christiano and Gust employ in their quantitative investigation. This view also explains why Burns fought so hard to have a system of wage and price controls put into place. To the extent that wage and price controls can be made credible, the public would be compelled to form low expectations of inflation, and the monetary authority could therefore avoid being pushed into inflating.

## Criticism

In any theory or explanation a theorist must take a stand on what might appropriately be treated as exogenous for the purpose at hand. The tradition in monetary economics has been to hypothesize the existence of exogenous shocks to monetary policy (with expectations accommodating the structure of monetary policy). Christiano and Gust hypothesize the existence of exogenous shocks to expectations (with monetary policy accommodating the structure of expectations). I have no problem with exploring the implications of reversing the direction of causality in such a manner;

however, in emphasizing the role of an exogenous variable, it would seem desirable for the researcher to first take some measurements of the variable in question (e.g., see Prescott 1986).

There are, in fact, many independent measures of inflation expectations for the time period Christiano and Gust study. For example, Thomas (1999) reviews three popular survey measures of inflation expectations for the United States beginning in 1960. Interestingly, regardless of how they are measured, year-to-year forecasts of inflation since 1960 consistently display an “inertial” tendency. In particular, over the period of generally rising inflation (1965–80), inflation expectations typically lagged (underestimated) the actual inflation rate. Likewise, since the disinflation of the early 1980s, inflation expectations have generally lagged (overestimated) the actual inflation rate.<sup>5</sup>

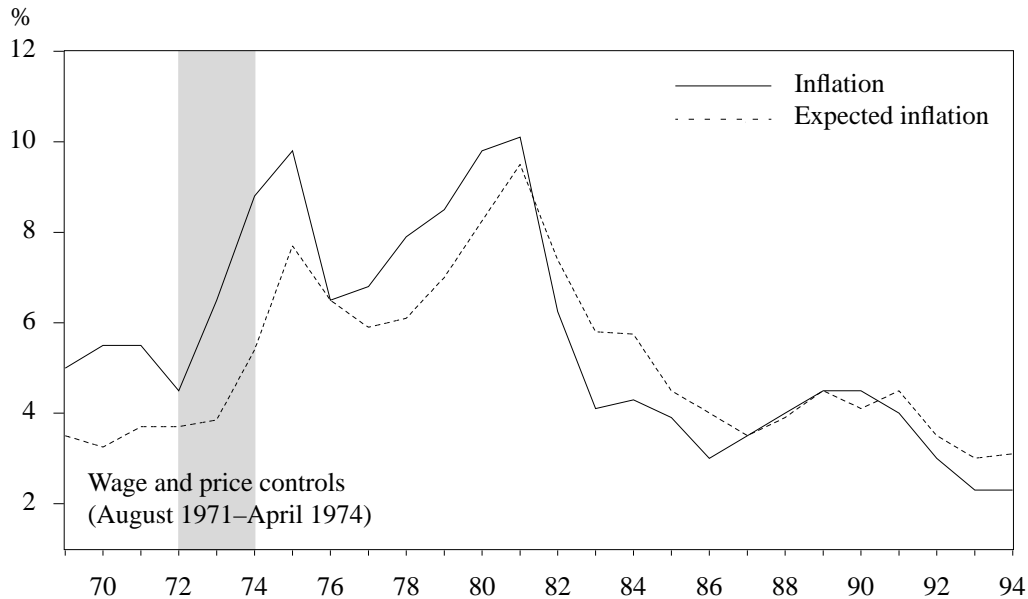
To give the reader a feel for these data, Figure 2 reproduces the actual GDP deflator inflation and the previous year’s forecast of inflation in the United States over the 1969–94 sample period. The inflation forecast is based on a survey of professional forecasters; the data are taken from Figure 6.9 in De Long (1997). A striking feature of these data is how expectations of inflation consistently underestimated the actual inflation rate through most of the 1970s; however, what is even more striking is how, in virtually each and every year, private forecasters were expecting a *disinflation*. Consider, for example, the inflation “takeoff” of 1973 and 1974, when inflation rose from 4.5 per cent to 6.5 per cent and 8.8 per cent. In December 1972, with inflation at 4.5 per cent, forecasters were predicting for 1973 an inflation rate of 3.9 per cent. In December 1973, with inflation running at 6.5 per cent, forecasters were predicting for 1974 an inflation rate of 5.4 per cent. My reading of De Long (1997) is that policy-makers of this era generally shared in these “optimistic” forecasts.

So my question to Christiano and Gust is: Where is the evidence for this alleged expectations shock? In my view their argument’s plausibility requires evidence of a sharp increase in inflation expectations, an increase that either precedes or is at least coincident with an increase in money growth. In the data, however, money growth leads inflation and hence leads inflation expectations by even a greater extent. One could try to argue that the sharp rise in base-money creation beginning in 1970 (see Christiano and Gust’s Figure 2) was engineered by the Fed in order to accommodate the rise in inflation expectations expected to occur around 1974–75, but I think that this is stretching things. A more plausible interpretation of these data is that inflation expectations are not subject to unaccountable shocks but rather

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5. Dotsey and DeVaro (1995) also find that their measure of inflation expectations shows a persistent tendency to overestimate the actual inflation rate during the 1980s disinflation.

**Figure 2**  
**Inflation and expected inflation in the United States, 1969–94**



are fully endogenous, responding optimally in an adaptive manner (Muth 1960) to new information as it becomes available.<sup>6</sup>

### An Alternative Hypothesis

When I view the historical evidence over the last century, this is what I see. There were three (possibly four, depending on how you measure things) inflationary episodes: 1916–20, 1940–46, and 1965–80. (Here I take issue with Christiano and Gust’s dating of the “inflation takeoff”; to my eye the takeoff seems to have occurred in 1965, with the 1969–70 disinflation representing a cyclical deviation from the general trend of rising inflation.) Each episode is characterized by three things: (1) a major shift in government expenditure and/or outlays, (2) pressure to finance these outlays with paper (new debt or new money), and (3) a breakdown of a prevailing international monetary institution.

In the first great inflation we had the First World War and the breakdown of the gold standard. In the second great inflation we had the Second World War and a breakdown in the gold standard (admittedly this gold standard was abandoned in the 1930s, so the timing is not quite right here). In the third great inflation there was the Vietnam War in addition to the “war on poverty” and a breakdown of the Bretton Woods fixed exchange

6. See, for example, Andolfatto and Gomme (2000).

rate system, which formally ended in 1971 when Nixon abandoned the dollar's peg to gold.

The appropriate exogenous event would seem to be whatever caused the major shift in government expenditure. In the case of a war, this might be modelled as an exogenous (and transitory) shift in the general public's preferences for output that is to be consumed in the enforcement of national property rights. People know what comes with war: an increased scarcity of goods for private use, mounting fiscal deficits (nominally denominated, for that matter), a weakening of peacetime institutions, and an irresistible temptation to resort to new money creation.

The Vietnam War was peaking in the late 1960s and early 1970s. Military expenditures were placing great strain on the American economy as real resources were being consumed in unproductive ways. Presidents Johnson and Nixon were naturally reluctant to raise taxes in order to finance the outlays required to meet the growing demands of the war effort and the growing demands for social spending. The arithmetic of the government budget constraint implies that there must have been a growing reliance on other forms of finance, in particular the issuance of new paper (new money and debt) and/or the default on existing paper (monetizing the debt).<sup>7</sup>

Seigniorage revenue is often dismissed as "small potatoes," but it is likely that reported statistics greatly understate seigniorage as a revenue source under a system of fixed exchange rates. When the United States rapidly increased the rate of base-money creation beginning in 1965, the relevant "tax base" under Bretton Woods was the world money supply; foreigners were conceivably contributing significant resources to the United States as inflation around the world soared owing to the proliferation of U.S. dollars. As foreign countries struggled to maintain control over their domestic monetary policies through a series of currency re-evaluations, the fixed exchange rate system began to come apart. The inflation also made it increasingly painful to maintain the value of American currency at \$35 per ounce of gold; in 1971, the gold standard was abandoned and Bretton Woods ceased to exist.

It was the fiscal authority (Nixon) that abandoned the gold standard. Why? One argument is that by doing so, the Fed (Burns) was relieved of an important constraint on the rate of money creation (it was no longer compelled to maintain the nominal anchor to gold). This institutional change implied that the Fed was more susceptible to political pressure for accommodative behaviour. This political pressure took the form of demands for more spending (on both Vietnam and the Great Society), demands not to

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7. The unanticipated inflation of the early 1970s implied a significant implicit default on outstanding nominal debt (see Auerbach and Kotlikoff 1995, 300).

increase taxes (for fear of crippling consumer demand in the weak 1970s economy), and demands not to increase the rate of government debt issue (bad for business psychology). What was the Fed to do in such a situation? One answer is that the Fed could do what it did: reluctantly accommodate these demands by increasing (or not decreasing) the rate of money creation. The narrative I provide here is not inconsistent with Burns's own views. For example, according to Burns's testimony to the U.S. Congress in August 1974 (Hetzel 1998, 35):

The current inflationary problem emerged in the middle 1960s when our government was pursuing a dangerously expansive fiscal policy. Massive tax reductions occurred in 1964 and the first half of 1965, and they were immediately followed by an explosion of Federal spending. . . . Our underlying inflationary problem, I believe, stems in very large part from loose fiscal policies.

In 1979 he gave a speech called "The Anguish of Central Banking" in which he stated (Hetzel 1998, 34):

Once it was established that the key function of government was to solve problems and relieve hardships—not only for society at large but also for troubled industries, regions, occupations, or social groups—a great and growing body of problems and hardships became candidates for government solution. . . . Their [government programs'] cumulative effect . . . was to impart a strong inflationary bias to the American economy. . . . My conclusion that it is illusory to expect central banks to put an end to the inflation that now afflicts the industrial economies does not mean that central banks are incapable of stabilizing actions; it simply means that their practical capacity for curbing inflation that is driven by political forces is very limited.

According to my interpretation, while general expectations were important, they simply reflected the nature of a fundamental fiscal shock. Expectations were not an indeterminate entity, as Christiano and Gust argue. In fact, I will go so far as to argue that inflation expectations were likely a very important factor in curtailing the rate of inflation. Imagine, for example, what might have happened if Americans (for some unexplained reason) always expected zero inflation. I conjecture that the political demands for new money would have been even easier to accommodate. In contrast, the Christiano and Gust model would suggest the absence of inflation.

## Conclusion

Christiano and Gust's interpretation of the most recent great inflation is to treat the general rise in inflation over the late 1960s and early 1970s as two separate episodes. The first episode is explained in terms of their Phillips curve hypothesis, the second by an expectations trap. The monetary authority at that time is described as being weak in the sense of operating in an institutional environment that encouraged it to accommodate possibly whimsical private sector expectations (as opposed to being weak in the sense of readily capitulating to the demands of the fiscal authority or other political forces). They hypothesize the arrival of an adverse technology shock that temporarily increased the inflation rate and the arrival of an expectations shock that propagated the higher inflation forward in time (as the monetary authority accommodated the higher inflation expectations, thereby making them self-fulfilling).

As usual, many different interpretations of history are possible. The best way in which to understand the causes of the 1970s inflation is still an open question. However, it is encouraging to note that while the explanations offered above may differ, they share a common policy implication. In particular, one way to prevent inflationary outbursts is to endow the monetary authority with a credible commitment mechanism (possibly through legislation) that prevents it from ever capitulating to the incessant demands for new money.

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## General Discussion

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David Laidler commented that the study of Fed behaviour and motives in the 1970s should take into account the state of informed opinion, or economic knowledge, attained in those years. This state was such that expectations of inflation and, in general, forward-looking behaviour, as well as the levels of money stocks, were thought to have little bearing in determining the actual level of inflation at a point in time.

Jean-Pierre Aubry agreed with Laidler and also agreed with David Andolfatto's comment that inflation expectations were not relatively high and leading indicators of ever higher inflation, but were relatively low and lagging indicators of inflation during the seventies.

Marvin Goodfriend wondered how much the present economic system is susceptible to such positive shocks in inflation expectations and whether there is a danger of such an inflation spiral appearing once again. He also agreed with Andolfatto's opinion that it didn't seem that inflation expectations were relatively high in the seventies. Goodfriend offered a possible rationalization of the Fed's incentive to accommodate inflation expectations and not strongly intervene to contain inflation: Political pressures on the Fed's independence were growing in the sixties, so maybe it could not afford to disregard contractionary policy's effect on economic activity. The undermining of the Bretton Woods system also meant that the Fed was left with neither a clear nominal anchor nor a clear fundamental objective for most of that decade.

Charles Freedman asserted that economists deserved some of the responsibility for the increase in inflation in the seventies. Many did not recognize that high inflation had substantial costs, or they concluded that

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\* Prepared by Kevin Moran.

these costs were small compared to the benefits of moving up the Phillips curve (Harberger triangles were small and Okun's gaps large).

Christopher Gust commented that he liked Tiff Macklem's comment and the simulation included in it and would have liked to have seen the results of Macklem's simulation done with the limited-participation model.

Lawrence Christiano thanked the commenters. He put into doubt Andolfatto's assertion that high fiscal pressure had most often been the underlying cause of (eventual) high inflation by pointing to the eighties, when the American fiscal position continuously deteriorated while inflation was brought into control. He also welcomed Andolfatto's suggestion to try to identify and quantify the exogenous shocks to inflation expectations in their model. Christiano also mentioned that their model and the story derived from it could also be interpreted in a monetarist framework.