# The Mistake of 1937: A General Equilibrium Analysis

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*This paper studies a dynamic stochastic general equilibrium model with sticky prices and rational expectations in an environment of low interest rates and deflationary pressures. We show that small changes in the public's beliefs about the future inflation target of the government can lead to large swings in both inflation and output. This effect is much larger at low interest rates than under regular circumstances. This highlights the importance of effective communication policy at zero interest rates. We argue that confusing communications by the U.S. Federal Reserve, the President of the United States, and key administration officials about future price objectives were responsible for the sharp recession in the United States in 1937–38, one of the sharpest recessions in U.S. economic history. Poor communication policy is the mistake of 1937. Before committing the mistake of 1937, the U.S. policymakers faced economic conditions that are similar in some respects to those confronted by Japanese policymakers in the first half of 2006.*

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## I. Introduction

The economic conditions that we will analyze can be summarized as follows. (1) Signs indicate that a depression is finally over. (2) Interest rates have been close to zero for years but are now finally expected to rise. (3) There are some concerns from both policymakers and the market participants over indications of excessive inflation. (4) This is of particular concern to some who point to a large expansion in the monetary base in the past several years as well as the current bank holdings of large excess reserves.

These four conditions characterize the economic outlook of the United States in the early months of 1937, on the verge of one of the most peculiar policy mistakes in U.S. economic history. The circumstances may also sound familiar to a Japanese audience. In some respects, Japanese policymakers confront the same problems today: how should monetary policy be managed in the transition phase from zero short-term interest rates and deflationary pressures back to more normal circumstances? We want to emphasize right from the start, however, that fortunately it seems that both the Bank of Japan and the Japanese government have not committed any mistakes of the same order as observed in 1937. Yet it is useful to understand the circumstances and mechanics of the U.S. mistake as a precautionary tale for both current and future policymakers.

This paper addresses the "mistake of 1937," which reversed the tide of the recovery from the Great Depression in 1933–37 into a short but sharp recession from 1937–38. Between May 1937 and June 1938, GNP contracted by 9 percent[1] and industrial production by 32 percent. The general price level took a tumble as well. The index of wholesale prices, for example, fell by more than 11 percent, several leading commodity prices collapsed, and the stock market lost almost half of its value.

The mistake of 1937 was in essence a poor communication policy. At the time, President Franklin Delano Roosevelt (FDR), his administration, and the Federal Reserve all offered confusing signals about the objectives of government policy, especially as it related to their goals for inflation. In the first year of his presidency, FDR had vowed to fight the drop in prices and to reflate them back to their pre-depression levels (the reference point was often understood to be the price level in 1926). By every indication, the public believed this commitment. But by 1937, the administration began expressing its alarm over excessive inflation despite the fact that prices had not yet reached their 1926 target. Vague and confusing signals about future policy created pessimistic expectations of future growth and price inflation that fed into both an expected and an actual deflation. We leave it open to question whether this communication was due to a deliberate change in policy or due to confusing signals (see the discussion in Section VII, where we propose two alternative interpretations), but we argue that regardless of the reason, the ultimate effect was a shift in beliefs about future policy. Nominal rigidities helped propagate the shift in beliefs into an output contraction and a collapse in prices.

1. We use quarterly estimates of real and nominal gross national product, which are archived in the NBER Macrohistory Database series q08296a and q08260a, respectively.

We show that this propagation mechanism is particularly damaging at zero interest rates by constructing a stylized dynamic stochastic general equilibrium (DSGE) model in which the zero bound on the short-term interest rate is binding due to temporary real shocks that make the natural rate of interest temporarily negative. We simulate this model and show that at zero interest rates, both inflation and output are extremely sensitive to signals about future policy. By "extremely," we mean that if the public's beliefs about the probability of a future regime change by only a few percentage points, there are very large effects on inflation and output. This effect is independent of any change in the current short-term interest rate, which we assume remains at zero.

In this stylized model, an example of such an effect might read as follows: suppose the public fully believes that the government is committed to targeting 4 percent inflation. Now assume that, in response to recent coverage in the press, the public thinks there is a 5 percent chance that the government will change its goals of 4 percent inflation in favor of a zero inflation goal within the next two years. This small change in beliefs in our calibrated model results in a double-digit output collapse and deflation. The large effects of shifting public beliefs about *future policy* may help explain how the vague and confusing communications in 1937, which we document in some detail, had such a large negative impact.

The large effect of communication policy is unique to an environment in which the short-term interest rate is zero. The reason is that in this environment the economy is susceptible to what we term *contractionary spirals*:[2] if the public expects a more contractionary regime in the future, this expectation creates contractionary expectations in *all* future states of the world in which interest rates are zero. Those states of the world, in turn, depend on each other, which creates a *vicious feedback effect* so that the equilibrium may not even converge to a bounded solution (for some parameter values) in our approximated model.

The reason why contractionary spirals do not occur at positive interest rates is that the central bank can react to contractionary beliefs by cutting interest rates. In contrast, when the zero bound is binding, contractionary beliefs cannot be offset by interest rate cuts. This creates the possibility of a contractionary spiral.

We find that the effect of communication policy is highly nonlinear at zero interest rates. At zero interest rates, the marginal effect of creating deflationary expectations by signaling tightening (targeting lower future inflation) is much larger than the marginal effect of signaling loosening of policy (targeting higher inflation). Our interpretation of this finding is that if a policymaker is uncertain about the nature of the real shocks and wishes to be *conservative*, he or she should err on the side of allowing some excess inflation.

Because our theory relies on shifting public beliefs about future policy, a natural place to look for evidence for the theory is within the newspapers in 1937–38. In our historical narrative (Section V) we document several newspaper accounts that are consistent with our hypothesis. In addition, we construct a new index based on newspaper records that summarizes the intensity of communication policy at a given

2. In an earlier version of the paper we termed it a deflationary spiral, but we prefer to use the term contractionary spiral, because this can refer to either deflation or output contraction. We thank Kunio Okina for drawing our attention to this.

time. We find evidence of a twofold increase in policy communication in the months we identify with the mistake of 1937.

Our theory gives a novel account of the mechanism by which monetary policy was responsible for the recession of 1937 and the recovery in 1938. Previous accounts of monetary policy during this period, such as Friedman and Schwartz (1963), Romer (1992), and Meltzer (2003), have focused mostly on static changes in some measure of the money supply and static changes (or rather, a lack thereof) in the short-term nominal interest rate, which increased temporarily in 1937 and then only by very modest amounts. The current paper differs from most studies of monetary policy during this period because according to our model the evolution of monetary aggregates is completely irrelevant at zero interest rates, except in their role in influencing the expectations about future money supply at the time at which the interest rates are expected to be positive.

Our view is that the expectation channel strengthens the argument made by the authors cited above, among others, that monetary factors were responsible for the contraction of 1937–38. Furthermore, our theory is less subject to some of the traditional Keynesian objections, which we discuss in some detail in Section V. Much of the Keynesian literature maintains that increasing the money supply, and by implication monetary policy, is irrelevant due to the zero bound on the short-term interest rate. While the current model shares the zero bound with the Keynesian literature, monetary policy still exerts a very strong effect on economic outcomes, because expectations about *future* money supply have a large effect on output and prices.

This paper builds on recent advances in the analysis of DSGE models with nominal frictions at zero interest rates. Recent papers in this vein include Krugman (1998), Jung, Teranishi, and Watanabe (2005), Svensson (2001, 2003), Jeanne and Svensson (2006), Eggertsson and Woodford (2003, 2004), Christiano, Motto, and Rostagno (2003), Auerbach and Obstfeld (2005), Eggertsson (2005, 2006a, b), Adam and Billi (2006), and Nakov (2005). For a survey of some of this literature, see Svensson (2003), and for a short summary see Eggertsson (2006c). The paper shares with this work an emphasis on the importance of expectations about future policy when interest rates are zero. It adds to this literature by modeling shifts in expectations as being due to a Markov switching process for policy regimes. This innovation allows us to simulate a model to replicate the Great Depression and gives a novel account of the recession of 1937–38 as being due to shift in beliefs about future money supply rather than due to static changes in the money supply, which this literature has shown to be irrelevant at zero interest rates.

We use narrative evidence to identify the shift in beliefs corresponding to the mistake of 1937 and the reversal in 1938. We then compare this narrative identification to the one estimated in our general equilibrium model and find that the two correspond to each other to some extent. The narrative approach is similar in spirit to Romer and Romer's (1989) influential study using Fed transcripts to identify policy shifts in the postwar period.[3] There are some differences, however. The model of this

3. See Orphanides (2004) for an account of the discussion within the Federal Reserve during the Great Depression, based on Fed transcripts, among other things.

paper suggests that the intentions of the policymakers, the focus of Romer and Romer's (1989) analysis, may not be the most natural place to look for narrative evidence for our model. Instead, it is the public's beliefs about future policy that matter in our analysis. While these two things may coincide (and will probably do so in most cases), they need not do so. In particular, a more natural place to look for narrative evidence for our purposes is newspapers, since these reflect public perceptions about policy better than confidential transcripts of policy deliberations, which were not known by the public at the time.

While our interpretation of the theoretical analysis is that beliefs were primarily moved by communications, we do *not* think that such communications are the beginning and end of policy commitments during the Great Depression. Several actions were taken during this period that can be interpreted as having made the policy communication *credible*. Fiscal policy, gold interventions, and the National Industrial Recovery Act (NIRA), for example, were surely important in 1933 to make credible FDR's policy of reflating the price level. We emphasize that these actions should be interpreted *through the effect they had on expectations* and that they reinforced the communication policy. In two closely related papers, Eggertsson (2005, 2006b), the effect of these complementary policy actions is analyzed under the extreme assumption that words carry no weight. These two papers show that a large part of the New Deal can be interpreted as actions that made FDR's announcements to inflate credible, that is, these policy actions made the reflation program incentive compatible in a Markov perfect equilibrium. Fiscal policy in 1937 and 1938 may also have played a role in changing beliefs, since it complemented what the administration was saying about its future policy (it was deflationary in 1937 and then inflationary again in 1938).

Our modeling strategy and quantitative investigation is similar in spirit to Goodfriend and King's (2005) analysis of Volcker disinflation in the early 1980s and Schaumburg and Tambalotti (2003). As in this work, the private-sector expectations depend on the beliefs about future policy regimes, and we show how a discrepancy between the current policy regime and the beliefs about future ones can explain large output movements.

The outline of the paper is as follows. Sections II–IV outline a formal general equilibrium model and investigate the effects of communications at low interest rates. Section V is an informal discussion and narrative account of the mistake of 1937 based on the historical record, guided by the principles of the model. Section VI explores the extent to which the model can replicate the data by shifts in beliefs. Furthermore, the estimated shifts in beliefs match closely the narrative account provided in Section V. Section VII discusses the reasons for the mistake of 1937. Section VIII concludes with some speculations on what current policymakers in Japan can learn from the paper.

## II. The Model

In this section, we outline the model underlying our hypothesis of the mistake of 1937 and some general implications of the analysis that could be of interest for current and future policymakers. The model abstracts from endogenous variations in the capital stock, and assumes perfectly flexible wages, monopolistic competition in goods markets, and sticky prices that are adjusted at random intervals in the way assumed by Calvo (1983). We assume there is a representative household that maximizes a utility function of the form

$$E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[ u(C_T;\ \xi_T) + q\left(\frac{M_T}{P_T};\ \xi_T\right) - \int_0^1 v(H_T(j);\ \xi_T) dj \right],$$

where $C_t$ is a Dixit-Stiglitz aggregate of consumption of each of a continuum of differentiated goods,

$$C_t \equiv \left[ \int_0^1 c_t(i)^{\frac{\theta}{\theta-1}} di \right]^{\frac{\theta-1}{\theta}},$$

with an elasticity of substitution equal to $\theta > 1$. $H_t(j)$ is the quantity of labor supplied to industry $j$, where each industry employs a specific type of labor that demands wages $w_t(j)$. $P_t$ is the Dixit-Stiglitz price index,

$$P_t \equiv \left[ \int_0^1 p_t(i)^{1-\theta} di \right]^{\frac{1}{1-\theta}}, \qquad (1)$$

where $p_t(i)$ is the price of good $i$.

For each value of the disturbances $\xi_t$, $u(\bullet;\ \xi_t)$ is a concave function that is increasing in consumption. Similarly, for each value of $\xi_t$, $q(\bullet;\ \xi_t)$ is increasing up to a satiation point at some finite level of real money balances as in Friedman (1969).[4] $v(\bullet;\ \xi_t)$ is an increasing convex function. The vector of exogenous disturbances $\xi_t$ may contain several elements, so we make no assumption about any correlation of the exogenous shifts in the functions $u$, $q$, and $v$.

For simplicity, we assume complete financial markets and no limits on borrowing against future income. As a consequence, the household faces an intertemporal budget constraint of the form

$$E_t \sum_{T=t}^{\infty} Q_{t,T} P_T C_T \leq W_t + E_t \sum_{T=t}^{\infty} Q_{t,T} \left[ \int_0^1 \Pi_T(i) di + \int_0^1 w_T(j) H_T(j) dj - T_T \right],$$

looking forward from any period $t$. Here $Q_{t,T}$ is the stochastic discount factor by which the financial markets value random nominal income at date $T$ in monetary units at date $t$, $i_t$ is the riskless nominal interest rate on one-period obligations purchased in period $t$, $W_t$ is the nominal value of the household's financial wealth at

4. The idea is that real money balances enter the utility because they facilitate transactions. At some finite level of real money balances, for example, when the representative household holds enough cash to pay for all consumption purchases in that period, holding more real money balances will not facilitate transactions any further and thereby add nothing to utility. This is at the "satiation" point of real money balances. We assume that there is no storage cost of holding money, so increasing money holding can never reduce utility directly through $u(\bullet)$. A satiation level in real money balances is also implied by several cash-in-advance models such as Lucas and Stokey (1987).

the beginning of period $t$, $\Pi_t(i)$ represents the nominal profits (revenues in excess of the wage bill) in period $t$ of the supplier of good $i$, $w_t(j)$ is the nominal wage earned by labor of type $j$ in period $t$, and $T_t$ represents the net nominal tax liabilities of each household in period $t$.

Optimizing household behavior then implies the following necessary conditions for a rational-expectations equilibrium. Optimal timing of household expenditure requires that aggregate demand $Y_t$ for the composite good[5] satisfy an Euler equation of the form

$$u_c(Y_t;\, \xi_t) = \beta E_t\left[u_c(Y_{t+1};\, \xi_{t+1})(1+i_t)\frac{P_t}{P_{t+1}}\right]. \tag{2}$$

Optimal money holding implies that

$$\frac{q_m(m_t;\, \xi_t)}{u_c(Y_t;\, \xi_t)} = \frac{i_t}{1+i_t}, \tag{3}$$

where $m_t \equiv M_t/P_t$. This equation defines money demand. Utility is weakly increasing in real money balances, but it does not increase beyond the finite level of money balances $\overline{m}$, which is called the satiation point. The left-hand side of this equation is therefore weakly positive. Thus, there is a zero bound on the short-term nominal interest rate given by

$$i_t \geq 0. \tag{4}$$

The intuition for this bound is simple. The model has no storage cost of holding money, and it can be held as an asset. The result follows that the return on bonds must be at least as good as that on money, and thus that $i_t$ cannot be a negative number. No one would lend US\$100 unless he or she expected to receive back at least US\$100! Household optimization similarly requires that the paths of aggregate real expenditure and the price index satisfy the conditions

$$\sum_{T=t}^{\infty}\beta^T E_t u_c(Y_T;\, \xi_T)Y_T < \infty, \tag{5}$$

$$\lim_{T\to\infty}\beta^T E_t[u_c(Y_T;\, \xi_T)W_T/P_T] = 0, \tag{6}$$

looking forward from any period $t$. $W_t$ measures the total nominal value of government liabilities, which are held by the household, and are the sum of $B_t$ and $M_t$. Condition (5) is required for the existence of a well-defined intertemporal budget constraint, under the assumption that there are no limitations on the household's ability to

5. For simplicity, we abstract from government purchases of goods.

borrow against future income, while the transversality condition (6) must hold if the household exhausts its intertemporal budget constraint. Conditions (2)–(6) also suffice to imply that the representative household chooses optimal consumption and portfolio plans (including its planned holdings of money balances) given its income expectations and the prices (including financial asset prices) that it faces, while making choices that are consistent with clearing financial markets. For simplicity, we assume throughout that the government issues no debt so that (6) is always satisfied.

We also find it convenient for our exposition to define the price for a one-period real bond. This bond promises its buyer to pay one unit of a consumption aggregate tomorrow, with certainty, for a price of $1 + r_t$ in terms of the consumption aggregate at time $t$. This number is the short-term real interest rate. While this price is well defined, no such bonds will be traded in equilibrium, because we assume a representative household. It follows from the household maximization problem that the real interest rate satisfies the arbitrage equation

$$u_c(Y_t;\, \xi_t) = (1 + r_t)\beta E_t u_c(Y_{t+1};\, \xi_{t+1}). \tag{7}$$

Each differentiated good $i$ is supplied by a single monopolistically competitive producer. There are assumed to be many goods in each of an infinite number of "industries"; the goods in each industry $j$ are produced using a type of labor that is specific to that industry and also change their prices at the same time. Each good is produced in accordance with a common production function[6]

$$y_t(i) = A_t h_t(i),$$

where $A_t$ is an exogenous productivity factor common to all industries, and $h_t(i)$ is the industry-specific labor hired by firm $i$. The representative household supplies all types of labor as well as consuming all types of goods.[7] It chooses its labor supply $H_t(j)$ for each type of labor $j$ so that it satisfies

$$\frac{w_t(j)}{P_t} = \frac{v_h\left(\dfrac{y_t(j)}{A_t};\, \xi_t\right)}{u_c(Y_t;\, \xi_t)}, \tag{8}$$

where we have assumed the goods market clears and substituted out hours using the production function.

The supplier of good $i$ first sets its price and then hires the labor inputs necessary to meet any demand that may be realized. Given the allocation of demand across goods by households in response to the firms' pricing decisions, period $t$ nominal profits (sales revenues in excess of labor costs) for the supplier of good $i$ are given by

6. There is no loss of generality in assuming a linear production function, because we allow for arbitrary curvature in the disutility of working.
7. We might alternatively assume specialization across households in the type of labor supplied; in the presence of perfect sharing of labor income risk across households, household decisions regarding consumption and labor supply would all be the same as is assumed here.

$$\Pi_t(i) = p_t(i)Y_t(p_t(i)/P_t)^{-\theta} - w_t(j)Y_t(p_t(i)/P_t)^{-\theta}/A_t. \tag{9}$$

If prices are fully flexible, $p_t(i)$ is chosen each period to maximize (9). This leads to the first-order condition for the firms' profit maximization

$$p_t(i) = \frac{\theta}{\theta - 1} w_t(j)/A_t, \tag{10}$$

which says that the firm will charge a markup $\theta/(\theta - 1)$ over its labor costs due to its monopolistic power. Under flexible prices, all firms face the same problem so that in equilibrium $y_t(i) = Y_t$ and $p_t(i) = P_t$. Combining (8) and (10) gives an aggregate supply equation

$$\frac{\theta - 1}{\theta} = \frac{v_h(Y_t/A_t;\, \xi_t)}{A_t u_c(Y_t;\, \xi_t)}. \tag{11}$$

We can now define equilibrium output and interest rates that take place under flexible prices. We call the real interest rate and the output in the flexible price equilibrium the natural rate of interest and natural level of output.

Definition 1. *A flexible price equilibrium is a collection of stochastic processes for* $\{P_t, Y_t, r_t, i_t, m_t\}$ *that satisfy (2), (3), (4), (5), (6), (7), and (11) for a given sequence of the exogenous processes* $\{A_t, \xi_t\}$. *The output produced in this equilibrium is called the natural rate of output and is denoted* $Y_t^n$, *and the real interest rate is called the natural rate of interest and denoted* $r_t^n$.

We assume that prices remain fixed in monetary terms for a random period of time instead of being flexible. The nominal frictions make it possible for the economy to deviate from its natural level, which makes the natural rates useful in characterizing the model's shocks. Following Calvo (1983), we suppose that each industry has an equal probability of reconsidering its prices each period. Let $0 < \delta < 1$ be the fraction of industries with prices that remain unchanged each period. Any industry that revises its prices in period $t$ will chose the same new price $p_t^*$. Then we can write the maximization problem that each firm faces at the time it revises its price as

$$E_t\left\{\sum_{T=t}^{\infty}(\delta\beta)^{T-t}Q_{t,T}\{p_t^*Y_T(p_t^*/P_T)^{-\theta} - w_T(j)Y_T(p_t^*/P_T)^{-\theta}/A_T\}\right\}.$$

The price $p_t^*$ is then defined by the first-order condition

$$E_t\left\{\sum_{T=t}^{\infty}(\delta\beta)^{T-t}u_c(C_T;\, \xi_T)\left(\frac{p_t^*}{P_T}\right)^{-\theta}Y_T\left\{\frac{p_t^*}{P_T} - \frac{\theta}{\theta-1}\,\frac{v_h\left(\frac{Y_T(p_t^*/P_T)^{-\theta}}{A_T};\, \xi_T\right)}{u_c(Y_T;\, \xi_T)A_T}\right\}\right\} = 0, \tag{12}$$

where we have used (8) to substitute out for wages. We have also substituted for the stochastic discount factor that is given by

$$Q_{t,T} = \beta^{T-t} \frac{u_c(C_T; \xi_T)P_t}{u_c(C_t; \xi_t)P_T}.$$

The first-order condition (12) says that the firm will set its price to equate the expected discounted sum of its nominal price to an expected discounted sum of its markup times nominal labor costs.

Finally, the definition of the aggregate price index $P_t$ by (1) implies a law of motion of the form

$$P_t = [(1-\delta)p_t^{*1-\theta} + \delta P_{t-1}^{1-\theta}]^{\frac{1}{1-\theta}}. \tag{13}$$

With these additional conditions, we can now define a sticky price equilibrium.

DEFINITION 2. *A sticky price equilibrium is a collection of stochastic processes* $\{Y_t, P_t, p_t^*, Q_{t,T}, i_t, r_t, m_t\}$ *that satisfy (2), (3), (4), (5), (6), (7), (12), and (13) for a given sequence of the exogenous shocks* $\{\xi_t, A_t\}$.

## III. Approximate Equilibrium

We analyze the dynamics of the model by log-linearizing around a steady state in which inflation is zero.[8] The model can be separated into two blocks. On the one hand, there is a flexible price part of the model. This part of the model determines the natural rate of interest and output that we defined in the last section. These variables, output and real interest rates, will be determined completely independently of monetary policy and are only a function of the exogenous shocks $\xi_t$ and $A_t$. On the other hand, there is the sticky price block of the model. In the sticky price model, output and the real interest rate depend on the policy setting. A convenient feature of the model is that we can summarize all the shock in the sticky price model in terms of the natural rates, so that there is a direct correspondence between the two blocks of the model.

We start by log-linearizing the flexible price equilibrium. The natural level of output can be approximated by

$$\hat{Y}_t^n = \frac{\sigma^{-1}}{\sigma^{-1}+\nu} g_t + \frac{\nu}{\sigma^{-1}+\nu} q_t + \frac{1+\nu}{\sigma^{-1}+\nu} a_t, \tag{14}$$

where the hat denotes percentage deviation from steady state, that is, $\hat{Y}_t^n \equiv \log Y_t^n / Y^n$, and the three shocks are

8. This approach permits errors that are of second order or higher, and our results will be inaccurate to the extent these higher-order terms are important. See Eggertsson and Woodford (2003) for a discussion of the approximation method.

$$g_t \equiv -\frac{\bar{u}_{c\xi}}{\bar{Y}\bar{u}_{cc}}\xi_t,\ q_t \equiv -\frac{\bar{v}_{h\xi}}{\bar{H}\bar{v}_{hh}}\xi_t,\ a_t = \log A_t/\bar{A},$$

where a bar denotes that the variables (or functions) are evaluated in the steady state. We define the parameters

$$\sigma \equiv -\frac{u_c}{u_{cc}Y} \text{ and } \nu \equiv \frac{v_{hh}\bar{h}}{v_h}.$$

The natural rate of interest can similarly be log-linearized to yield

$$r_t^n = \bar{r} + \sigma^{-1}[(g_t - \hat{Y}_t^n) - E_t(g_{t+1} - \hat{Y}_{t+1}^n)], \tag{15}$$

where $\bar{r} \equiv \log \beta^{-1}$. We now turn to the sticky price equilibrium. As mentioned above, a convenient feature of the model is that all the shocks can be summarized in terms of the flexible price equilibrium variables $\hat{Y}_t^n$ and $r_t^n$ in addition to a money demand shock.

We can express the consumption Euler equation (2) as[9]

$$\hat{Y}_t - \hat{Y}_t^n = E_t\hat{Y}_{t+1} - E_t\hat{Y}_{t+1}^n - \sigma(i_t - E_t\pi_{t+1} - r_t^n), \tag{16}$$

where $\pi_t \equiv \log P_t/P_{t-1}$. This equation says that current demand depends on expectations of future output—since spending depends on expected future income—and the real interest rate, which is the difference between the nominal interest rate and expected future inflation—because the lower real interest rate makes spending today relatively cheaper than future spending. This equation can be forwarded to yield

$$\hat{Y}_t - \hat{Y}_t^n = E_t\hat{Y}_{T+1} - E_t\hat{Y}_{T+1}^n - \sigma\sum_{s=t}^{T}(i_s - E_t\pi_{s+1} - r_s^n),$$

which illustrates that the demand depends on not only the current interest rate but also the entire expected path for future interest rates and expected inflation. Because long-term interest rates depend on expectations about current and future short rates, the equation above can also be interpreted as saying that demand depends on long-term interest rates.

The Euler equation (12) of the firms' maximization problem, together with the price dynamics (13), can be approximated to yield

$$\pi_t = \kappa(\hat{Y}_t - \hat{Y}_t^n) + \beta E_t\pi_{t+1}, \tag{17}$$

9. The $i_t$ in this equation actually refers to $\log(1 + i_t)$ in the notation of the previous section, that is, the natural logarithm of the gross nominal interest yield on a one-period riskless investment, rather than the net one-period yield. Also note that this variable, unlike the others appearing in the log-linear approximate relations, is not defined as a deviation from the steady-state value. We do this to simplify notation, so that we can express the zero bound as the constraint that $i_t$ cannot be less than zero. Also note that we have defined $r_t^n$ to be the log level of the gross level of the natural rate of interest rather than a deviation from the steady-state value $\bar{r}$.

where

$$\kappa \equiv \frac{(1-\delta)(1-\delta\beta)}{\delta}\frac{\nu+\sigma^{-1}}{1+\nu\theta} > 0.$$

This equation implies that inflation can increase output because not all firms will reset their prices instantaneously.

Finally, the money demand equation along with the zero bound can be summarized as

$$m_t \geq \eta_i i_t + \eta_y Y_t + \epsilon_t, \quad (18)$$

$$i_t \geq 0, \quad (19)$$

$$i_t(m_t - \eta_i i_t - \eta_y Y_t - \epsilon_t) = 0, \quad (20)$$

where $\eta_i < 0$ and $\eta_y > 0$, and $\epsilon_t \equiv -\eta_i((1-\beta)/\beta) + ((\bar{u}_{c\xi} - \bar{q}_{m\xi})/\bar{q}_{mm})\xi_t$, and the last condition is a complementary slackness condition that says the money demand equation must hold with equality if the zero bound is slack (and similarly that the zero bound must be binding if the money demand equality is slack). Because the shocks in the sticky price equilibrium are now completely summarized by the stochastic processes of $r_t^n$ and $\hat{Y}_t^n$ and $\epsilon_t$, we can define an approximate sticky price equilibrium as follows.

DEFINITION 3. *An approximate sticky price equilibrium is a collection of stochastic processes for* $\{\hat{Y}_t, \pi_t, m_t, i_t\}$ *that satisfy (16)–(20) for a given sequence for the exogenous shocks* $\{\hat{Y}_t^n, r_t^n, \epsilon_t\}$.

## IV. Policy Regimes, Structural Shocks, and Communications

To model the effect of communications at zero interest rates, we still need to define (1) the shock processes that drive the dynamics of the model and (2) the policy regimes.

Recall from the previous section that all the shocks of the model can be summarized by the natural rates.[10] Following Eggertsson and Woodford (2004), we assume the most simple process for the exogenous shocks that give rise to zero interest rates.

ASSUMPTION 1 (The structural shocks). $r_t^n = r_L^n < 0$ *at date* $t = 0$. *It returns to steady-state* $r_H^n$ *with probability* $\alpha$ *in each period. Furthermore,* $\hat{Y}_t^n = 0\ \forall\ t$. *The stochastic date the shock returns to the steady state is denoted* $\tau$. *To ensure a bounded solution, the probability* $\alpha$ *is such that* $\alpha(1-\beta(1-\alpha)) - \sigma\kappa(1-\alpha) > 0$.

10. With the exception of $\epsilon_t$, but we do not need to take a stance on this shock.

For a detailed discussion of how the structural shocks $q_t$, $g_t$, and $a_t$ give rise to these shocks, see Eggertsson and Woodford (2004). The next section turns to policy. We model communications as corresponding to signals about the likelihood of a policy regime change. In the next two subsections, we propose two policy regimes to which these signals apply.

**A. The Deflationary Regime**

We first study an equilibrium under the assumption that the central bank targets zero inflation whenever possible. We call this Policy Regime 1 or "the deflationary regime." Zero inflation implies by (17) a zero deviation of output when there are no shocks, so under Assumption 1 then

$$\pi_t = Y_t = 0 \quad \text{if } t \geq \tau, \tag{21}$$

which implies by (16) that

$$i_t = r_t^n \quad \text{if } t \geq \tau. \tag{22}$$

A zero inflation target cannot be achieved in periods $t < \tau$, however, because this would imply negative nominal interest rates. We assume that in this case the central bank allows for maximum policy accommodation and sets the interest rate at zero, that is,

$$i_t = 0 \quad \text{for } 0 < t < \tau. \tag{23}$$

An equilibrium under Policy Regime 1 is now defined as the following.

DEFINITION 4. *Policy Regime 1 (The Deflationary Policy Regime). Equilibrium under Policy Regime 1 and under Assumption 1 is an approximate equilibrium defined in Definition 3 that satisfies equations (21)–(23).*

Observe that we do not need to specify how the money supply is set to support this policy regime. An equilibrium is fully determined without any reference to the money supply, since it does not appear in equations (21)–(23). For a given equilibrium, then, we can determine the money supply compatible with this equilibrium by (18) and (20). An observation of particular interest, especially for our historical narrative, is that *any* money supply above the satiation level is compatible with the policy regime in period $0 < t < \tau$, which indicates that the value of the money supply is irrelevant when the interest rate is zero (see Eggertsson and Woodford [2003] for a further discussion of this point).

To solve for inflation and output, we can solve equations (17) and (16) by using (21)–(23). The values for $\pi_t$ and $Y_t$ that solve these equations in period $t < \tau$ are the numbers $\pi^d$ and $\hat{Y}^d$ (where $d$ stands for "deflationary regime") that solve the two equations

$$\pi^d = \kappa \hat{Y}^d + \beta(1-\alpha)\pi^d, \tag{23b}$$

$$\hat{Y}^d = (1-\alpha)\hat{Y}^d + \sigma(1-\alpha)\pi^d + \sigma r_L^n, \tag{23c}$$

yielding

$$\hat{Y}^d = \frac{1-\beta(1-\alpha)}{\alpha(1-\beta(1-\alpha)) - \sigma\kappa(1-\alpha)} \sigma r_L^n < 0, \tag{24}$$

$$\pi^d = \frac{1}{\alpha(1-\beta(1-\alpha)) - \sigma\kappa(1-\alpha)} \kappa\sigma r_L^n < 0. \tag{25}$$

Figure 1 shows the output contraction and deflation under Assumption 1 that is predicted by the model. The parameters assumed are shown in Table 1 and are taken from Eggertsson and Woodford (2003) and Eggertsson (2006a). The parameter $\sigma$ is the intertemporal elasticity of substitution (so that the coefficient of relative risk aversion is two, which is in line with micro evidence), $\nu$ is the inverse of the Frisch labor supply (implying a Frisch elasticity of 0.5, which is also in line with micro evidence), $\beta$ is calibrated to match a steady-state real interest rate of 4 percent per year, and $\theta$ corresponds to a markup of 10 percent. The parameter $\kappa$ is from the estimate by Rotemberg and Woodford (1997). The probability of the shock reverting in the next period $\alpha$ is calibrated at 10 percent, which implies an expected duration of 10 quarters.

In the figure, it is assumed that the natural rate of interest is –4 percent in the $r_L^n$ state to match the output contraction during the Great Depression. The figure shows the case in which the natural rate of interest returns to the steady state in period $\tau = 10$ (which is the expected duration of the shock). The model indicates an output collapse of 30 percent under this calibration, and the contraction lasts as long as the duration of the shock. The contraction at any time $t$ is created by a combination of the deflationary shock in period $t < \tau$—but more importantly—the *expectation* that there will be deflation and output contraction in future periods $t + j < \tau$ for $j > 0$. The deflation in period $t + j$ in turn depends on expectations of deflation and output contraction in periods $t + j + i < \tau$ for $i > 0$. This creates *vicious feedback effects* that will not even converge unless the restriction on $\alpha$ in Assumption 1 is satisfied. The overall effect is an output collapse, what we call a contractionary spiral, as shown in Figure 1 for a relatively small shock to the natural rate of interest.[11] The duration of the contraction can be several years in the model, or as long as the shocks last.

The large collapse in output and prices reflects the strong contractionary effects brought about by nominal frictions. One observes that the flexible price output is constant throughout this period, so that it is only the interplay between the intertemporal shock $r_L^n$ and nominal frictions that brings about the output collapse.

11. The sense in which the shock is "small" is that the real rate of interest (which is equal to $\tilde{r}_t^n$ in the absence of an output slack) has been of this order several times in U.S. history, such as the 1970s (see, e.g., Summers [1991] for discussion). On those occasions, however, there has been positive inflation so that the negative real rate of interest has easily been accommodated.

**Figure 1 Output Contraction at Zero Interest Rates**

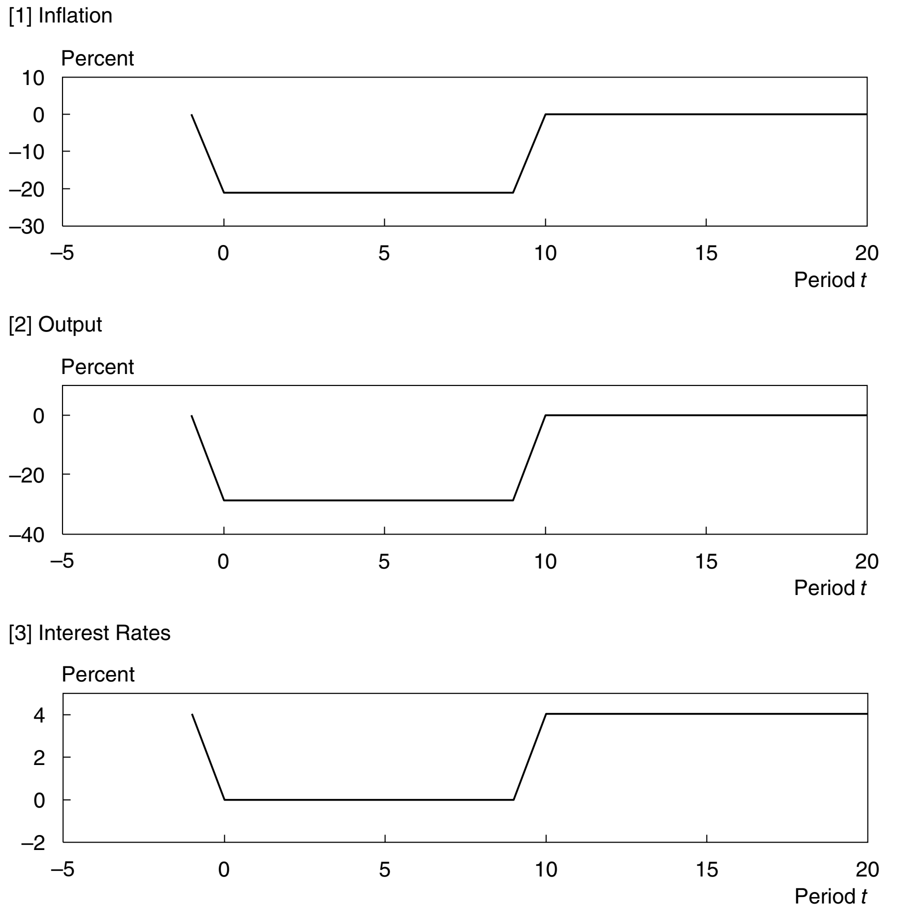



**Table 1 Parameters Assumed for Figure 1**

| Parameters | Calibrated values |
|---|---|
| $\sigma$ | 0.5 |
| $\nu$ | 2 |
| $\beta$ | 0.99 |
| $\theta$ | 10 |
| $\kappa$ | 0.02 |
| $\alpha$ | 0.1 |
| $r_L^n$ | –0.04/4 |

## B. The Reflationary Regime

We now consider the consequences of a reflationary regime, Policy Regime 2, in which the government targets an inflation rate that is higher than zero, that is, $\pi_t = \pi^* > 0$. Under Assumption 1, this implies that in Policy Regime 2

$$\pi_t = \pi^* \quad \text{for } t \geq \tau. \tag{26}$$

In addition we assume, as in Goodfriend and King (2005), that the public believes with some probability $\gamma_t$ that in the next period the government will abandon Policy Regime 2 in favor of Policy Regime 1 for all future periods. The probability $\gamma_t$ is therefore the probability of moving to Policy Regime 1 in period $t + 1$, conditional on being in Policy Regime 2 in period $t$. We assume that this probability can change over time, for example, based on new information about the administration's policy intentions. It is natural to assume that in the absence of any new information about policy, the public's beliefs will remain unchanged. This leads us to assume

$$E_t \gamma_{t+1} = \gamma_t, \tag{27}$$

which says that conditional on all information in period $t$, the public expects to apply the same probability to a regime change moving forward. One interpretation of the parameter $\gamma_t$, suggested by Goodfriend and King (2005), is that it indicates the *credibility* of the policy regime, because it is a measure of how probable the public thinks it is that the reflationary policy regime will continue. This interpretation is also consistent with the one suggested by Schaumburg and Tambalotti (2003), who study a regime change model where there is a probability $\gamma$ of the government reneging on its previous commitment and reoptimizing. If $\gamma$ were deterministic, then the expected duration of the regime would be $1/\gamma$, so that as $\gamma$ approaches zero the regime is perfectly credible and the public believes the regime will last forever, but when it is one the regime has no credibility, and the public expects it to be abandoned in the next period.

Another interesting interpretation of $\gamma_t$ concerns its variations. Since this parameter is likely to change in the light of new information about the policy intentions of the government, changing values of $\gamma_t$ can be interpreted as reflecting communications by the government about its policy objectives.

Under Assumption 1, the solution for output, denoted $Y_t^*$, at time $t \geq \tau$ solves equation (17), that is,

$$\pi^* = \kappa Y_t^* + (1 - \gamma_t)\beta\pi^*, \tag{28}$$

so that in the reflationary regime

$$Y_t^* = \{1 - \beta(1 - \gamma_t)\}\kappa^{-1}\pi^*, \tag{29}$$

and

$$i_t = r_t^n + (1 - \gamma_t)\pi^* - \sigma^{-1}\gamma_t Y_t^* \quad \text{at } t \geq \tau.$$

If $r_t^n \leq -\pi^*$, however, the central bank cannot achieve the inflation target in period $t < \tau$, because this may imply negative nominal interest rates. We assume that in this case the central bank allows for maximum accommodation and sets the interest rate at zero, that is,

$$i_t = 0 \quad \text{for } 0 < t < \tau. \tag{30}$$

An equilibrium under the reflationary regime, in other words, Policy Regime 2, can now be defined as follows.

DEFINITION 5. *Policy Regime 2 (Reflationary Policy Regime). Equilibrium under Policy Regime 2, under Assumption 1, is an approximate equilibrium defined in Definition 3 that satisfies equations (26)–(30).*

Again, as we observed when defining Policy Regime 1, we do not need to specify the determination of the money supply, because it is irrelevant as long as it is above the satiation level in periods $0 < t < \tau$.

To solve for equilibrium output and inflation in period $t < \tau$, we can use equations (17) and (16) with (26)–(30), along with the solutions (24) and (25). The values for $\pi_t$ and $Y_t$ that solve these equations in period $t < \tau$ are the numbers $\pi_t^r$ and $Y_t^r$ (where $r$ stands for "reflationary regime") that solve the two equations.

$$\pi_t^r = \kappa Y_t^r + \beta E_t^r \pi_{t+1}, \tag{31}$$

$$Y_t^r = E_t^r Y_{t+1} + \sigma E_t^r \pi_{t+1} + \sigma r_L^n. \tag{32}$$

The expectations are formed conditional on information at time $t$, which takes into account that the current regime is reflationary. We can express these expectations as

$$E_t^r \pi_{t+1} = (1-\alpha)(1-\gamma_t)\pi_t^r + (1-\alpha)\gamma_t \pi^d + \alpha(1-\gamma_t)\pi^*, \tag{33}$$

where the first term denotes the contingency in which the shock $r_t^n$ remains negative and the policy regime is unchanged in period $t + 1$. Here we assume that the expectation of $\pi_{t+1}^r$ conditional on the regime being reflationary is the same as $\pi_t^r$. The second term is the contingency in which the shock remains negative but the regime changes to the deflationary one (Policy Regime 1). The last term is the contingency in which the shock reverts to normal but the regime stays intact, in which case the government targets inflation of $\pi^*$. We can ignore the fourth contingency, which corresponds to the one in which the shock reverts to normal and the regime changes, because in this case the government targets zero inflation (and the term thus drops out). We can similarly write the expectation for output as

$$E_t^r Y_{t+1} = (1-\alpha)(1-\gamma_t)Y_t^r + (1-\alpha)\gamma_t Y^d + \alpha(1-\gamma_t)Y_t.^* \tag{34}$$

A solution of the model is a sequence of numbers for $Y_t^r$ and $\pi_t^r$ that satisfy these four equations. Substituting (33) and (34) into (31) and (32), then $\pi_t^r$ and $Y_t^r$ solve

$$\pi_t^r = \kappa Y_t^r + \beta(1-\alpha)(1-\gamma_t)\pi_t^r + (1-\alpha)\gamma_t\pi^d + \alpha(1-\gamma_t)\pi^*, \tag{35}$$

$$\begin{aligned} Y_t^r = {} & (1-\alpha)(1-\gamma_t)Y_t^r + (1-\alpha)\gamma_t Y^d + \alpha(1-\gamma_t)Y_t^* \\ & + \sigma(1-\alpha)(1-\gamma_t)\pi_t^r + \sigma(1-\alpha)\gamma_t\pi^d + \sigma\alpha(1-\gamma_t)\pi^* + \sigma r_L^n, \end{aligned} \tag{36}$$

which yields

$$\begin{aligned} Y_t^r = {} & A(\gamma_t)\pi^d + B(\gamma_t)\pi^* \\ & + C(\gamma_t)Y^d + D(\gamma_t)Y_t^* + F(\gamma_t)r_L, \end{aligned} \tag{37}$$

where the values of each of the functions A, B, C, D, F are given in the footnote.[12] All of these functions only depend on time through $\gamma_t$ and are positive numbers. Given this solution, one can write inflation as

$$\pi_t^\gamma = \frac{\kappa}{\Psi_t}Y_t^r + \frac{\beta(1-\alpha)\gamma_t}{\Psi_t}\pi^d + \frac{\beta\alpha(1-\gamma_t)}{\Psi_t}\pi^*, \tag{38}$$

where $1 > \Psi_t = 1 - \beta(1-\alpha)(1-\gamma_t) > 0$ and the numbers $\pi^d$ and $Y_t^*$ are given by (25) and (29).

As one would expect, these equations are increasing in the inflation target $\pi^*$ and decreasing in the shock $r_L^n$. The reason is that a higher inflation target increases expectation of future inflation and future output, which in turn stimulates demand in each period $t < \tau$. Thus, a commitment to a future reflationary policy mitigates the effects of the zero bound, as argued by Krugman (1998). In the forward-looking model used here, these effects are very large, owing to the opposite effects of the *vicious feedback effects* described in the previous subsection.

12.
$$A(\gamma_t) = \frac{\sigma(1-\alpha)\gamma_t + \dfrac{\sigma\beta(1-\alpha)^2\gamma_t(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}{1-(1-\alpha)(1-\gamma_t) - \dfrac{\kappa\sigma(1-\alpha)(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}.$$

$$B(\gamma_t) = \frac{\sigma\alpha(1-\gamma_t) + \dfrac{\sigma\beta\alpha(1-\alpha)(1-\gamma_t)^2}{1-\beta(1-\alpha)(1-\gamma_t)}}{1-(1-\alpha)(1-\gamma_t) - \dfrac{\kappa\sigma(1-\alpha)(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}.$$

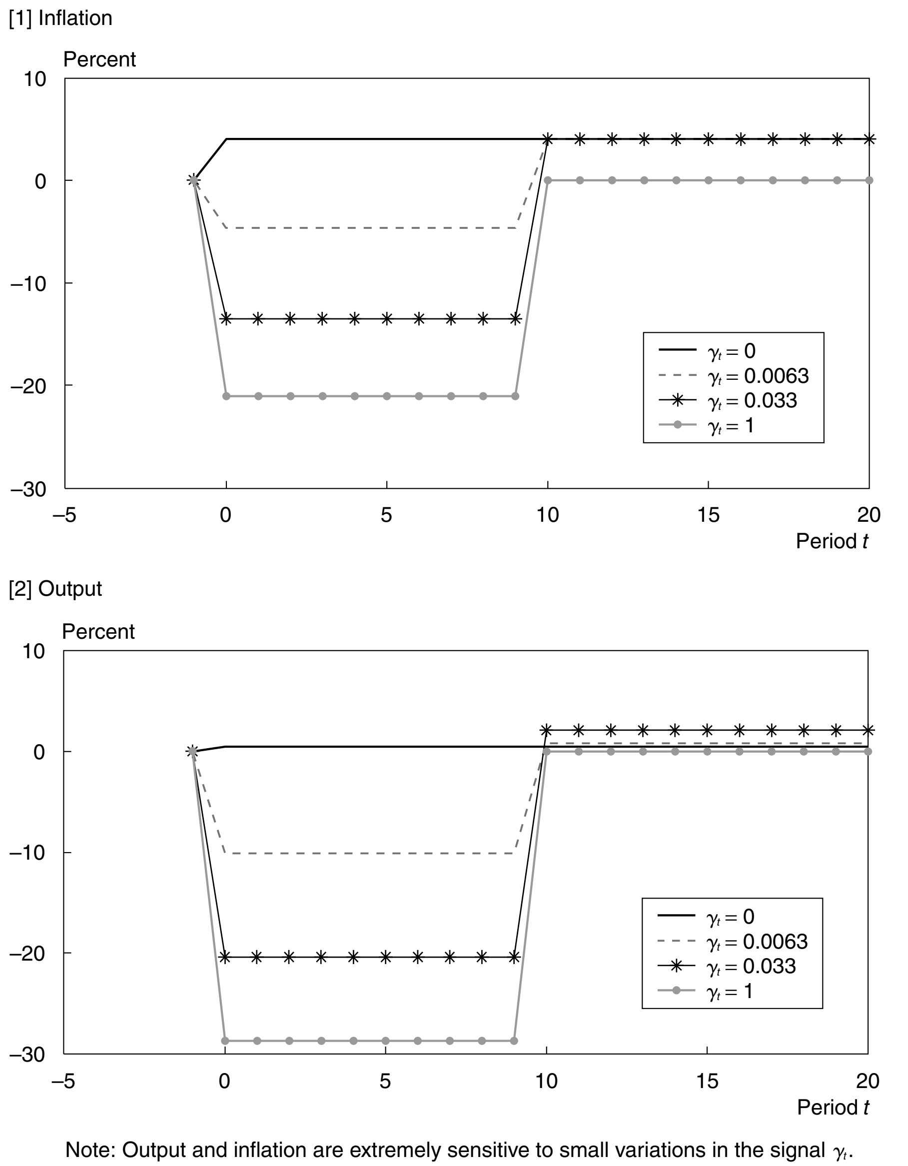
$$C(\gamma_t) = \frac{(1-\alpha)\gamma_t}{1-(1-\alpha)(1-\gamma_t) - \dfrac{\kappa\sigma(1-\alpha)(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}.$$

$$D(\gamma_t) = \frac{\alpha(1-\gamma_t)}{1-(1-\alpha)(1-\gamma_t) - \dfrac{\kappa\sigma(1-\alpha)(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}.$$

$$F(\gamma_t) = \frac{\sigma}{1-(1-\alpha)(1-\gamma_t) - \dfrac{\kappa\sigma(1-\alpha)(1-\gamma_t)}{1-\beta(1-\alpha)(1-\gamma_t)}}.$$

Of even more interest to us is how the solution depends on the probability $\gamma_t$. Figure 2 shows the solution in (37) and (38) under the assumptions that the shock reverts at time $\tau = 10$ and that Policy Regime 2 is in effect throughout. It shows the solution under four possible values of $\gamma_t$. When $\gamma_t = 0$, the inflation target is perfectly credible, and when $\gamma_t = 1$ it has no credibility, so that the solution is identical to the one in Figure 2. The intermediate cases are the ones of interest. When $\gamma_t = 0.033$, there is a 3.3 percent probability that the regime will be abandoned in the next

**Figure 2 Output and Inflation**




Note: Output and inflation are extremely sensitive to small variations in the signal $\gamma_t$.

period. This small probability has a very large effect on output and prices: output is 20 percent lower than if the inflation targeting regime is perfectly credible and there is about 15 percent deflation. Even when there is only a 0.63 percent chance of a regime change, the figure shows that the output collapse and effect on deflation are substantial.

Table 2 transforms these probabilities into another probability measure, namely, the probability that the policy regime will be abandoned within two years, denoted $\rho_t$. Given our assumption that $E_t \gamma_{t+1} = \gamma_t$, the probability $\rho_t$ can be computed as

$$\rho_t = 1 - (1 - \gamma_t)^8. \tag{39}$$

We examine $\gamma_t$ in this way because this variable has an appealing interpretation. The small number 0.0063, for example, indicates that there is a 4.3 percent chance that the regime will be abandoned within two years. Table 2 shows the effect of various values of $\gamma_t$ in terms of $\rho_t$ on output for the values given in Figure 2.

These figures also demonstrate that while changes in expectations about the future monetary regimes are extremely important at zero interest rates, they have a much smaller effect when interest rates are positive. Thus, while an increase in $\gamma_t$ from zero percent to 0.63 percent reduces output by –10.1 percent in the presence of large deflationary shocks, the same type of communication only reduces output by 1.2 percent when the interest rate is positive (i.e., when there are no deflationary shocks). The reason for this is that when there are no deflationary shocks the central bank can react to changes in beliefs about future policy by lowering the interest rate, but this is not possible when there are deflationary shocks and the central bank is constrained by the zero bound. This is what creates the fundamental asymmetry at the zero bound.

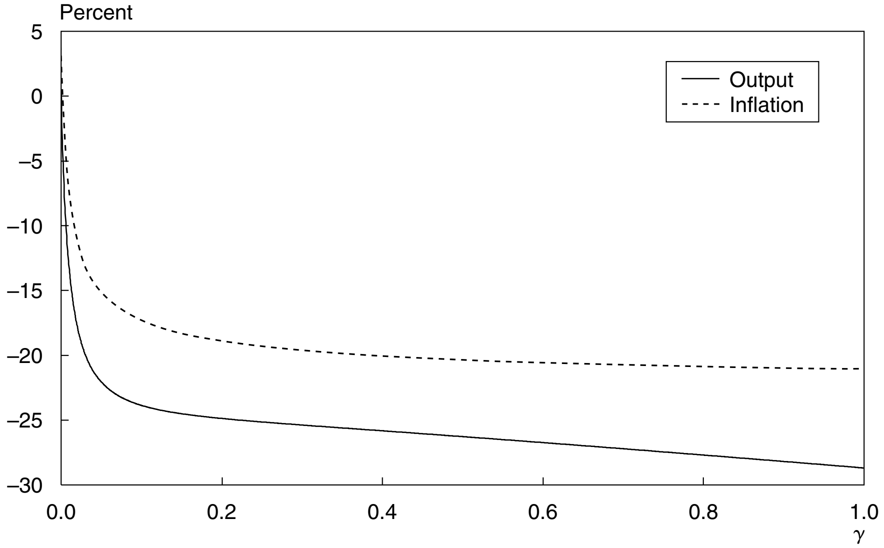
Figure 3 plots inflation and output as a function of $\gamma_t$. The figure shows the extreme sensitivity of output and inflation to small variations in $\gamma_t$. This sensitivity is particularly strong at a "high level" of credibility, in other words, when the public strongly believes in the reflationary policies.

The nonlinearity of the inflation and output in $\gamma_t$ may have some important policy implications. It suggests—although this remains a bit speculative—that a preemptive tightening (or communication of such a policy shift) has a large contractionary effect, while erring on the side of reflationary policy has a much smaller effect. This may indicate that a prudent approach to policy at a zero interest rate favors erring on the side of inflation and accepting a rather slow response to inflationary pressure.

**Table 2 The Effect of Various Values of $\gamma_t$ in Terms of $\rho_t$ on Output**

| $\gamma_t$ | $\rho_t$ | $\hat{Y}_t$ when $i_t = 0$ | $\hat{Y}_t$ when $i_t > 0$ |
|---|---|---|---|
| 0 | 0 | 0.5 | 2.1 |
| 0.0063 | 0.043 | –10.1 | 0.8 |
| 0.033 | 0.209 | –20.4 | 0.5 |
| 1 | 1 | –28.7 | 0.0 |

**Figure 3 Inflation and Output as a Function of $\gamma_t$**



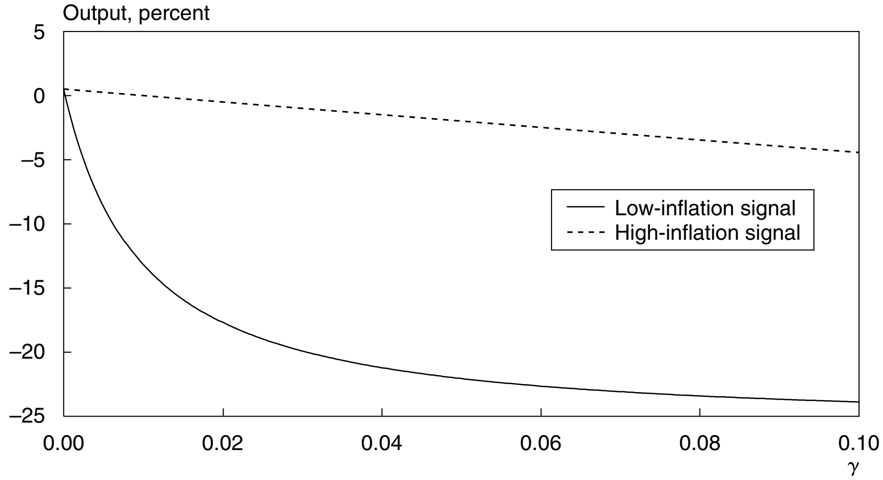

Note: The response of output and inflation to changes in $\gamma_t$ is nonlinear and extremely sensitive at regions of high credibility.

To make this argument more systematic, consider the consequences of sending a signal of "too high inflation" in the sense of a signal of an inflation target above what is required to accommodate the –4 percent negative natural rate of interest. Consider the effect of the same regime change as considered before, but now let Policy Regime 1 be characterized by an 8 percent inflation target instead of a zero percent inflation target. In this case, an increase in $\gamma_t$ is a signal of high inflation instead of too low inflation. If expectations of this inflationary regime are created then, conditional on being in Policy Regime 2, $\pi_t = 4$ percent and output is given by the AS equation by

$$Y_t = \{1 - \beta(1 - \gamma_t)\}\kappa^{-1} \times 4 \text{ percent} - \gamma_t \beta \kappa^{-1} \times 8 \text{ percent}. \tag{40}$$

Figure 4 shows that local to the fully credible inflation target of 4 percent output is extremely sensitive to communication of a deflationary regime, while it responds by much less if the communication is about excessively loose policy in the future.

**Figure 4 Sensitivity to Communication**



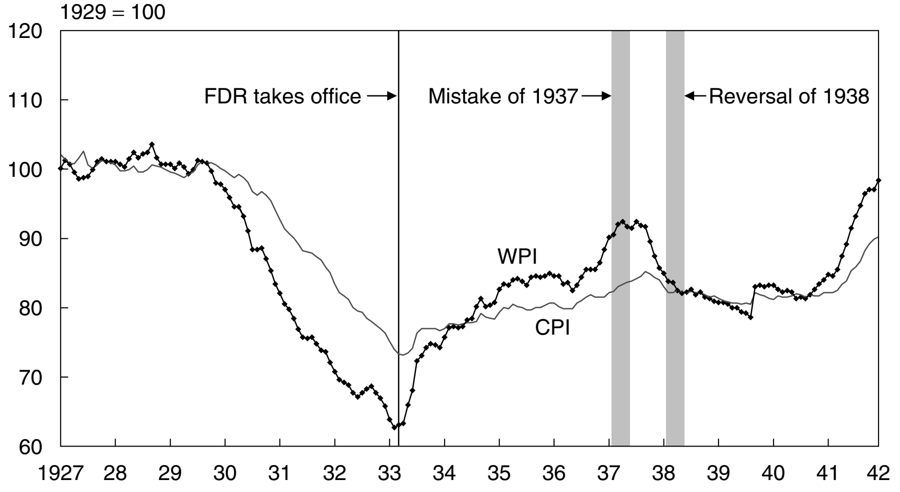

Note: The nonlinearity of the zero bound indicates that output is much more sensitive to communication that indicates excessive tightening than to communication that implies too loose an inflation policy.

## V. Historical Narrative: The Great Depression in the United States and the Mistake of 1937

This section illustrates the data and narrative accounts of the Great Depression era, and with the help of the theory outlined in the previous section, it uses them to interpret the episodes of the Great Depression and the recession of 1937–38. We also discuss how our theory of this recession differs from alternative theories of this period. The subsequent section estimates what pattern of beliefs could have generated the data, assuming that our model is correct.

This paper's main hypothesis rests on the interpretation of the U.S. recovery from the Great Depression of 1933–37 outlined in Eggertsson (2005). That paper credits the strong recovery to a shift in expectations about future policy. After a 30 percent output collapse from 1929–33, output expanded by 39 percent in 1933–37. The 25 percent deflation from 1929–33 was replaced by 11 percent inflation between 1933–37. The shifts in the wholesale price index (WPI), the consumer price index (CPI), and industrial production are shown in Figures 5 and 6, where a vertical line marks the inauguration of FDR. Eggertsson (2005) argues that FDR's commitment to inflate the price level triggered the recovery. This commitment was made credible by several government actions, such as a vigorous fiscal expansion, an end to the gold standard, and large purchases of gold abroad (today's equivalent of foreign exchange interventions). FDR made his objective to inflate clear on several occasions in the early spring of 1933. On May 1, for example, he stated in the *Wall Street Journal*:

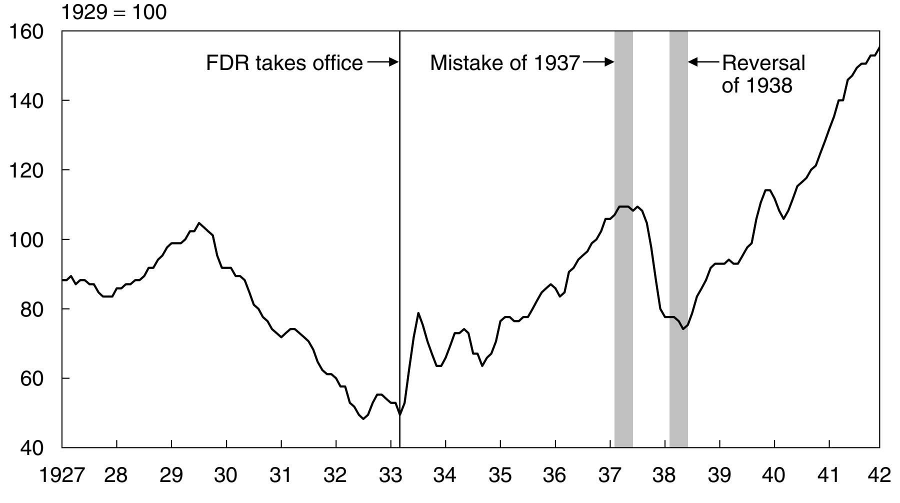
**Figure 5 Price Indices**




Note: WPI and CPI indicate a recovery in the price level after FDR's inauguration until the mistake of 1937.

Source: NBER Macrohistory Database.

**Figure 6 Monthly Index of Industrial Production**




Note: The reflation program in 1933 resulted in a rapid recovery in industrial production. Deflationary expectations in 1937 led to a large output contraction, but the recovery resumed again in 1938 with the administration's renewed commitment to reflate.

Source: Federal Reserve Board.

> [O]ur primary need is to insure an increase in the general level of commodity prices. To this end simultaneous actions must be taken both in the economic and the monetary fields.

FDR reiterated this in a radio address to the nation in one of his "fireside chats" on May 7.[13] By late spring, there could be no doubt in the minds of market participants that the administration was aiming to inflate. The effect of this policy shift is visible in both output and prices in Figures 5 and 6.

The sharp recession in 1937–38 can be interpreted through the lens of the same theory. In 1937, however, it was the administration's *abandonment of a policy of reflation* that was the driving force. In 1936, there were already discussions within the administration that suggested the depression was virtually over. FDR, for example, confidently claimed in his annual address to the U.S. Congress on January 6, 1937, "Your task and mine is not ending with the end of the depression." There was still the thorny issue of high unemployment, which had not returned to its pre-depression level, but the administration's general view was that since industrial production was reaching its potential, unemployment would soon be resolved.[14]

This sense of victory over the depression found its way into the administration's communications about inflation policy, which the market interpreted as a shift away from the reflationary commitment from the early months of 1933. One of the earliest signs of the looming policy shift occurred within the Federal Advisory Council, which on November 21, 1935 adopted a resolution recommending that the Board of Governors of the Federal Reserve System and the Federal Open Market Committee take action to cut "excess reserves" by either selling some portion of their government securities holdings or by raising member bank reserve requirements. The board ignored these recommendations until midsummer of 1936, when it scheduled a raise in reserve requirements, to become effective on August 15, 1936.

This action appears to have had a rather limited effect on markets, because it was not associated with an explicit objective to reduce inflation. Indeed, the Fed generally presented the increase in the reserve requirements as having no immediate effect because the excess reserves were "superfluous" (see, e.g., the discussion in Orphanides [2004]). The Fed agreed in January 1937 to a second round of increases to be scheduled for March and May of that year, and again the reaction of the market was muted. In the ensuing months, however, things began to change. Newspaper accounts of that period indicate that in February, March, and April there was increasing alarm within the administration about the threat of excessive inflation. Some pointed to the large increases in the monetary base over the period 1933–37 as evidence of this danger. This fear also started influencing how government officials communicated policy; in particular, they no longer presented the increase in the reserve requirement as being purely mechanical or "superfluous." On February 18, Fed Chairman Marriner Eccles said, as reported in the *Wall Street Journal*, that "the short-term rates are excessively

13. See "Radio Address of the President, May 7," in *Complete Presidential Press Conferences of Franklin D. Roosevelt* (New York: Da Capo Press, 1972).
14. See Davis (1993, p. 9).

low and there may be a tendency for rates near the vanishing point to increase." Furthermore, he suggested that the reserve requirements were likely to cause an increase in long-term interest rates. The *Wall Street Journal* commented on this statement on February 19, 1937: "This is the first time a member of the board has publicly described the reserve requirement as a device for preventing a further drop in long-term rates." About one month later, Fed Chairman Eccles called upon the U.S. Department of the Treasury to fight against "excessive" inflation by balancing the budget.[15]

This and other newspaper accounts indicate that in the early months of 1937 the public witnessed a change in the communication strategy of the Fed and by other government officials. The appetite of the Fed and the government officials for inflation was decreasing, and they expected increases in the short-term interest rate to be on the horizon. The model in this paper can explain how these communications could have such dramatic effects in a relatively short period. The next section makes this assessment concise by estimating the change in beliefs required to generate the recession.

Table 3 includes several other announcements by key administration officials. The table shows several signals about the commitment to lower inflation in the early months

**Table 3 The Mistake of 1937: Anti-Inflationary Communications**

| | |
|---|---|
| 1. July 14, 1936 | The Fed announces the first reserve requirement increase, to become effective on August 15. |
| 2. January 30, 1937 | The Fed announces the second and third reserve requirement increases, to become effective on March 1 and May 1. |
| 3. February 18, 1937 | Marriner Eccles, Chairman of the Board of Governors of the Federal Reserve System, in Senate hearings:<br>"The short-term rates are excessively low and there may be a tendency for rates near the vanishing point to increase." (*Wall Street Journal*, February 19, 1937, p. 1). |
| 4. March 15, 1937 | Marriner Eccles, Chairman of the Board of Governors of the Federal Reserve System, gives a statement:<br>"The upward spiral of wages and prices into inflationary levels can be as disastrous as the downward spiral of deflation." (*Chicago Daily Tribune*, March 16, 1937, p. 1) |
| 5. March 17, 1937 | Commerce Secretary Daniel C. Roper and Secretary of Agriculture Henry A. Wallace hold press conferences: both Secretaries warn against excessive inflation. (*Wall Street Journal*, March 18, 1937, p. 8) |
| 6. March 24, 1937 | Marriner Eccles, Chairman of the Board of Governors, on inflation:<br>"Chairman Eccles outlines five steps to avert 'dangerous inflation' in *Forbes* magazine, which are (i) reserve requirement increases 'to eliminate excess reserves,' (ii) fiscal policy that balances the budget, (iii) reduction in the gold price of the dollar, (iv) increase in the labor share of national income, and (v) antitrust legislation." (*The Christian Science Monitor*, March 25, 1937) |
| 7. April 2, 1937 | FDR holds a press conference:<br>"I am concerned—we are all concerned—over the price rise in certain materials." |
| 8. August 3, 1937 | FDR's views on price level targeting are revealed:<br>Senator Elmer Thomas publishes a letter from FDR to him rejecting his proposal that the Fed should formally target the 1926 price level. (*Wall Street Journal*, August 4, 1937, p. 6) |

15. *Chicago Daily Tribune*, March 16, 1937, p. 1.

of 1937, but that was the period during which most of the key policy announcements were made. These announcements and their effect on the public beliefs form the core of the paper. We argue that these communications are the mistake of 1937. The mistake is exemplified in FDR's press conference comments on April 2, 1937: "I am concerned—we are all concerned—over the price rise in certain materials." On the day of this announcement, the stock market fell by 6 percent. The next day, the *Wall Street Journal* reported as follows:

> There was a feeling among some bankers that the President's remarks bore a relation to the recent statement of M. Eccles, Chairman of the Board of Governors of the Federal Reserve System, advocating prompt balancing of the budget as the only means of averting monetary inflation and the other recent statements of government officials warning of the threat of inflation. All of these remarks, it was said, indicated a change in the trend of the government's recovery measures away from the emphasis which has been placed upon stimulation of industrial activity and the recovery of prices.

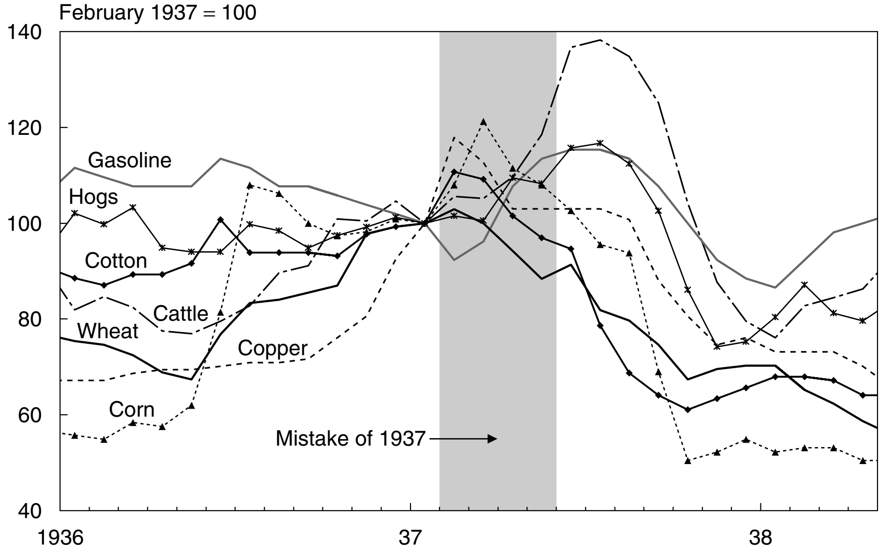
These announcements were in opposition to FDR's previous commitment to restore prices to their pre-depression levels. At the time of the mistake, prices as measured by both the WPI and CPI were still well below their previous levels. The WPI was 13 percent below its 1926 average, and the CPI was 20 percent below. With prices below their targets, the administration's very public alarm over increasing prices sent confusing signals to the public. The announcements suggested that the administration might abandon its previous goals, and these fears are reflected in the subsequent movements of the price levels.

Figure 7 shows the response of leading commodity prices in a one-year window surrounding several of the statements listed in Table 3. The period of the key announcements, that is, the ones made from February to May, is marked by a shaded region. This is the period we identify with the mistake of 1937. The monthly price indices are reindexed to 100 in February 1937 to their relative paths.[16] Since commodity prices are determined on spot markets, one would expect their prices to respond more strongly than other goods to news about changes in future policy. All of these commodity prices show a strong change in their upward trend in the early part of 1937 toward deflation. The price of corn, for example, lost more than half its value in the six months following FDR's April announcement. Figure 8 shows that the stock market also started a strong downward trend—losing almost half its value in only six months. There are no direct data on inflation expectations during this period. However, alternative estimates of inflation expectations confirm what can be grasped from these figures. Using very different estimation methodologies, Hamilton (1992), who uses data on commodity price futures, and Cecchetti (1992), who uses data on interest rates and the CPI, both find evidence of an expectations shift in 1937 from inflation to deflation.

The near-zero interest rates throughout the period have sometimes led authors to conclude that monetary policy was *not* contractionary (see, e.g., Telser [2001])

16. These data are monthly price indices of various commodities archived in the NBER Macrohistory Database.

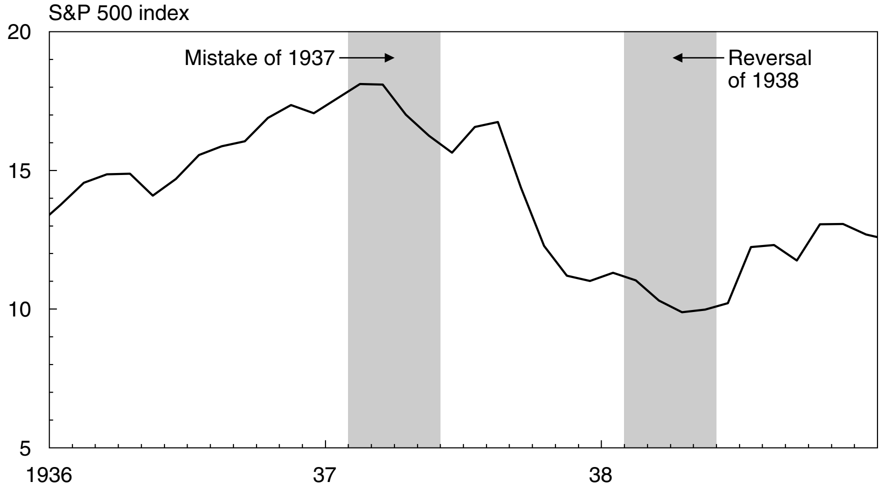
**Figure 7 Commodity Prices**




Note: Commodity prices decline after confusing signals over the administration's reinflation policy.

Source: NBER Macrohistory Database.

**Figure 8 Stock Prices**



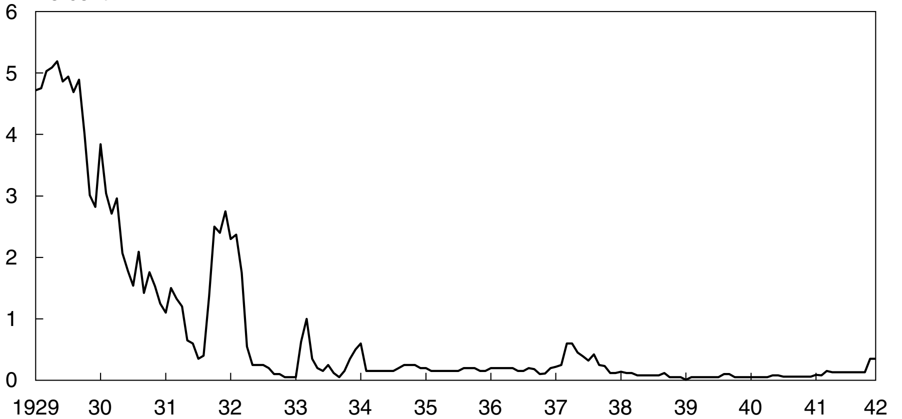

Note: Stock prices reflect the market's reaction to contractionary and then expansionary announcements.

Source: *Wall Street Journal*.

and that monetary conditions were in fact "easy." We find instead that changing expectations about future interest rates, and how in these months they depended on inflation and output, are comparatively more important than the short-term interest rate in explaining the economic collapse. Figure 9 shows the evolution of the short-term interest rate in 1929–41 as measured by estimated yields on three-month Treasuries. From late 1932 onward, the short-term interest rate remained close to zero. In the spring of 1937, it rose only slightly and then fell again. These persistently low rates stand at odds with the collapse in output and inflation in 1937. In the model we have presented in this paper, however, an increase in the current short-term interest rate is *not* required for contractionary monetary policy. All that is needed is an expectation of future policy change. Indeed, our model assumes that there is *no change* in the short-term interest rate during this period. Even with this assumption, the model delivers a large contractionary outcome only due to a change in expectations about future policy, as our estimation in the next section reveals.

Figure 10 shows how longer-term interest rates responded during the periods of policy communications that we identify. Longer-term interest rates should increase in the presence of expected increases in the short rate, and the figure confirms this behavior. During the mistake of 1937, the longer-term interest rates rose beyond what is implied by the rise in the short-term rate. Even as short rates fell, long-term rates continued to increase. This is consistent with the market's anticipation of future hikes in nominal interest rates. It is important to recognize that the behavior of long rates is in general not trivial, and that their predicted path depends on how one specifies the policy regime. The observed behavior of the long rates is most consistent with a policy regime of price-level targeting, in which—if the regime is credible—the public expects the interest rate to remain at zero until the price level reaches its

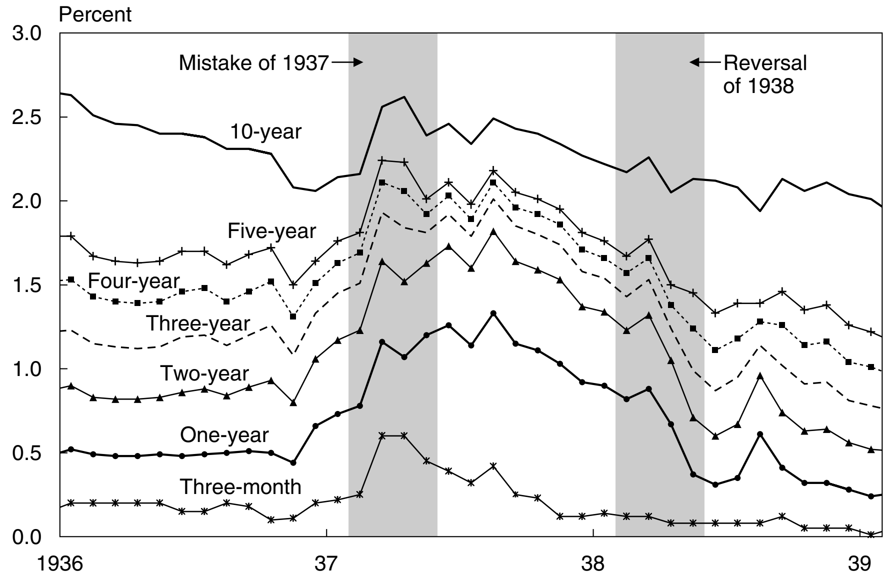
**Figure 9 Short-Term Interest Rate, Estimated Constant Maturity Yield**




Note: Interest rates as measured by the yield on three-month Treasuries remain close to zero throughout the entire period.

Source: Cecchetti (1988).

**Figure 10 Longer-Term Interest Rates, Estimated Constant Maturity Yield**




Note: Longer-term rates all show an increase in the expected short rate through the period of policy announcements.

Source: Cecchetti (1988).

target. A regime of this kind unambiguously predicts that if prices are below the target and the public expects the government to abandon its regime, then expected future short-term interest rates will increase.[17]

A leading hypothesis of the contraction of 1937–38 is suggested by Friedman and Schwartz (1963). These authors argue that the increase in the reserve requirements in August 1936 and March and May 1937 were responsible for the contraction. This hypothesis has been criticized on several grounds. The most plausible criticism of their theory is obtained by empirically evaluating their suggested transmission mechanism during this period, which Telser (2001) analyzes. The Friedman and Schwartz hypothesis, according to Telser (2001), implies that member bank lending should have declined in response to the higher reserve requirements. In fact, Telser (2001) shows that private lending actually *increased* during this period. Member banks simply satisfied the increased reserve requirements by selling their government securities, leaving little pressure to reduce private lending. He argues that this evidence disproves the hypothesis that monetary factors were responsible for the recession. His finding come as little surprise, since interest rates were close to zero during this period. Bonds and money (reserves at the Fed) were close to perfect substitutes under these conditions, and our theory suggests that the composition of government debt between money and

17. For computational simplicity, we assumed in the previous sections that the government targeted a constant inflation target rather than a price level target.

bonds was irrelevant under this condition as we discussed when defining Policy Regimes 1 and 2 in our model (see Eggertsson and Woodford [2003] for further discussion of the irrelevance of money supply at zero interest rates). Similar reasons were cited by Eccles (1951) in his autobiography. Citing the "easy" monetary condition of close to zero interest rates, he blames fiscal policy for the recession, because the Treasury tried to balance the budget in the early months of 1937.[18]

Our hypothesis is not subject to Telser's (2001) criticism, because our channel does not require any change in either the monetary base or bank lending to explain the depression in 1937, as our definition of the reflationary policy regime revealed. What was important was the expectation of future interest rates and money conditions. There were, of course, other factors outside of our model that are compatible with our explanation. Fiscal policy certainly played an important role, especially the efforts of the Treasury to balance the budget. In this sense, our theory is consistent with some aspects of both the monetarists' and the Keynesians' accounts of this recession. As argued by Eggertsson (2005), the deficit spending throughout 1933–37 gave the government a strong incentive to inflate. The later attempt of the Treasury to balance the budget in 1937, and the public's belief that these attempts would be sustained, worked in the opposite direction from the deficit spending in 1933–37, because they reduced the inflation incentive of the government and thus reinforced an expectation of deflation in 1937.

The end of the 1937–38 depression is also consistent with our hypothesis. In early 1938, the administration restored an inflationary policy. Table 4 summarizes some

**Table 4 The Reversal of 1938: Pro-Inflation Communications**

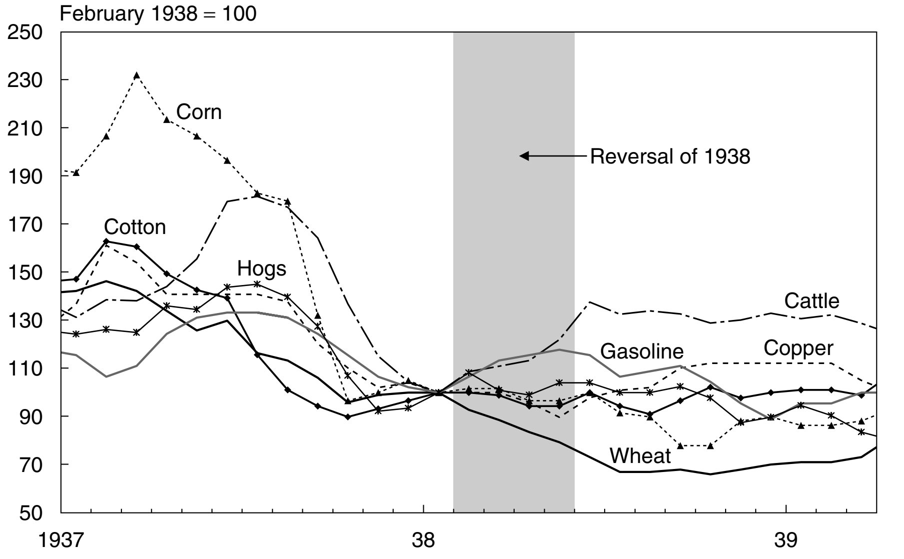
| | |
|---|---|
| 1. February 15, 1938 | FDR holds a press conference:<br>"At his press conference today, the President said that he believes now, as he did in 1933, that achievement of permanent prosperity depends on raising general price levels to those prevailing in 1926." (*Chicago Daily Tribune*, February 16, 1938, p. 1, "Hope Inflation Will Halt Depression") |
| 2. February 18, 1938 | FDR releases a written statement at a press conference that was prepared by Henry Morgenthau, Jr., Secretary of the Treasury; Henry A. Wallace, Secretary of Agriculture; Frances Perkins, Secretary of Labor; Marriner Eccles, Chairman of the Board of Governors of the Federal Reserve System; and economists of various executive departments:<br>It is clear that in the present situation a moderate rise in the general price level is desirable . . . . Our program seeks a balanced system of prices such as will promote a balanced expansion in production. Our goal is a constantly increasing national income through increasing production and employment. This is the way to increase the real income of consumers. |
| 3. April 14, 1938 | FDR addresses Congress, announcing that the reserve requirement increases will be abandoned:<br>"The measures for expanding excess reserves which were announced on Thursday by President Roosevelt will recreate the bases for a great credit inflation . . . . Monetary management, after having been directed for some time towards guarding against a possible inflationary boom, has turned, under the pressure of the business depression, toward the other extreme." (*The New York Times*, April 17, 1937) |

18. This was partly urged on by Eccles in February 1937, as mentioned above, something he does not mention in his scathing criticism of the Treasury!

key reflationary announcements. The first announcement of considerable importance was made at a February 15 press conference where FDR said that he once again believed, as he had announced in 1933, that prices should be inflated back to their pre-depression levels. Three days later, FDR called another press conference. On that occasion he read a statement that he had instructed Fed Chairman Eccles, Treasury Secretary Henry Morgenthau, and several other senior government officials to prepare. Flanked by senior administration officials, FDR announced, "It is clear that in the present situation a moderate rise in the general price level is desirable." Later that spring, the administration took several steps to support an inflationary program, such as lowering the reserve requirement back to its 1936 level, increasing deficit spending, and desterilizing government gold stocks. Figure 11 shows the rebound in commodity prices after the reversal of 1938. The period we identify with the reversal of 1938 is February–May that year. The recovery is also evident from the aggregate variables in Figures 5 and 6. The 1938–42 recovery was even stronger than in 1933–37, and by most measures the economy had fully recovered by 1942.

It is often argued that it was wartime spending which finally lifted the U.S. economy out of the Great Depression. This "conventional wisdom" is probably colored by the Keynesian view that monetary policy was impotent during this period. There is no doubt that wartime spending helped stimulate demand. According to our hypothesis, however, the turnaround from 1937–38 is more appropriately traced back to FDR's recommitment to inflation in the early months of 1938.

**Figure 11 Rebound in Commodity Prices after the Reversal of 1938**

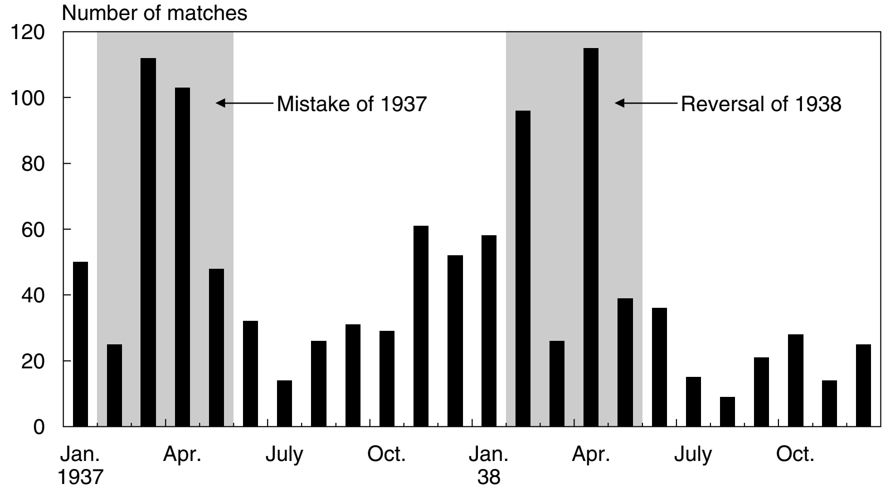



Note: Commodity prices stabilize after the administration announces a renewed commitment to price inflation.

Source: NBER Macrohistory Database.

These cited announcements are consistent with the more general trends of policy communications in the press during the period. We compute a crude index to estimate the intensity of inflation policy discussion throughout the period. Figure 12 plots the number of newspaper articles that match criteria designed to roughly identify inflation policy discussions. We search the Proquest Historical Newspapers database for front page or inner articles that mention caution of inflation, reflation, deflation, or price level and include the name of at least one key government official.[19] Beginning in January 1937, communication and press coverage over speculation about reserve requirement increases begins to intensify. During the periods we label as the "mistake of 1937" and the "reversal of 1938," the number of matching articles more than doubles. Examination of results within each month reveals that the greater part of the articles during the mistake period discusses the administration's planned response to inflationary threats, whereas during the reversal they focus on the government's renewed commitment to some price reflation. Although this measure is very rough, it does confirm that these two periods are unique in their increased levels of policy discussion.

**Figure 12 Intensity of Policy Discussion: Mentions of Inflation by Eccles, Morgenthau, FDR, or His Cabinet**




Note: Communication intensifies around the periods of the mistake of 1937 and its subsequent reversal.

Source: Proquest Historical Newspapers.

19. We search the citation and document text fields for a match on the following criteria: (inflation or "price level*" or reflation or deflation) and (fdr or roosevelt or morgenthau or eccles or roper or wallace or hopkins) and (gain* or boom or peril* or warning or fear* or danger* or conference) for each calendar month from 1937 to 1938. We only report those with a document type of article or front page. Varying the search terms does not change the overall trends.

## VI. The Data on the Great Depression through the Prism of the Model

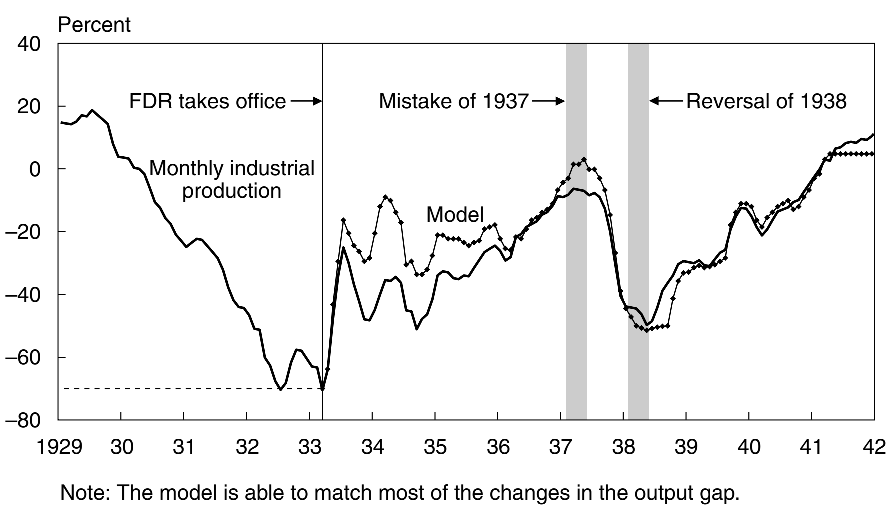
The model of this paper is quite special in several respects, and imposes stark assumptions for tractability. Keeping those limitations in mind, it is still of some interest to re-express some of the data from the Great Depression discussed in the previous section through the prism of the model. We should state from the start that we do not view this numerical exercise as a substitute for an estimation of the model. Yet we believe giving some closer connection to the data may be useful in developing the theory further. Figure 13 shows monthly data on industrial production from the Great Depression as a deviation from a linear trend estimated on the period 1921–2005. Figure 14 shows the evolution of the WPI, expressed as year-on-year inflation. We use industrial production as a proxy for output in the model and the year-on-year change in the WPI as a proxy for inflation. By studying the data at monthly frequencies, we can explore the consequences of variations in the parameter $\gamma_t$ at monthly frequencies.

To what extent can variations in $\gamma_t$ explain the evolution of output and prices? To answer this question, we recalibrate the parameters of the model to monthly frequencies. The parameters $\nu$, $\theta$ are unchanged. The parameter $\beta$ is now $0.99^{1/3}$ and $\sigma = 1$. The parameter $\kappa$ is chosen using (23b), which implies that

$$\kappa = [1 - \beta(1 - \alpha)]\frac{\pi^d}{y^d},$$

assuming that $\pi^d$ and $y^d$ correspond to inflation and output prior to the regime change in 1933 and that the regime change was unexpected.

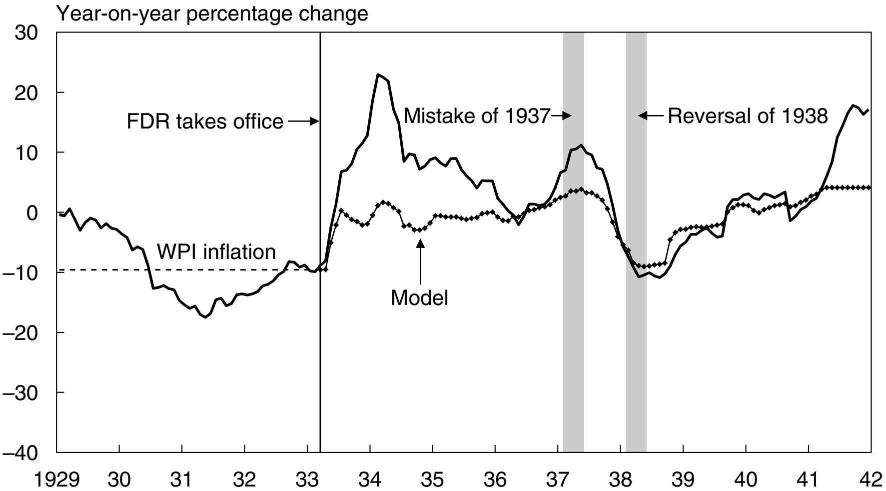
**Figure 13 Output**




Note: The model is able to match most of the changes in the output gap.

Sources: Federal Reserve Board, authors' simulated model.

**Figure 14 Inflation**




Note: The model requires a larger amount of deflation than actually occurred to match the collapse in output, especially in the earlier part of the recovery.

Sources: NBER Macrohistory Database, authors' simulated model.

We maintain the assumption from the last section that $r_L^n = -0.04/12$. We choose $\alpha = 0.0165$ to match the output decline in the beginning of the recovery in 1933. In our simulation, we condition on current policy that is set according to Policy Regime 2 and the shock in the deflationary state ($r_t^n = r_L^n$).

To extract the values of $\gamma_t$ that "best explain the data," we choose a path for this variable to minimize squared deviations of the model output from the data, that is, minimize the criterion

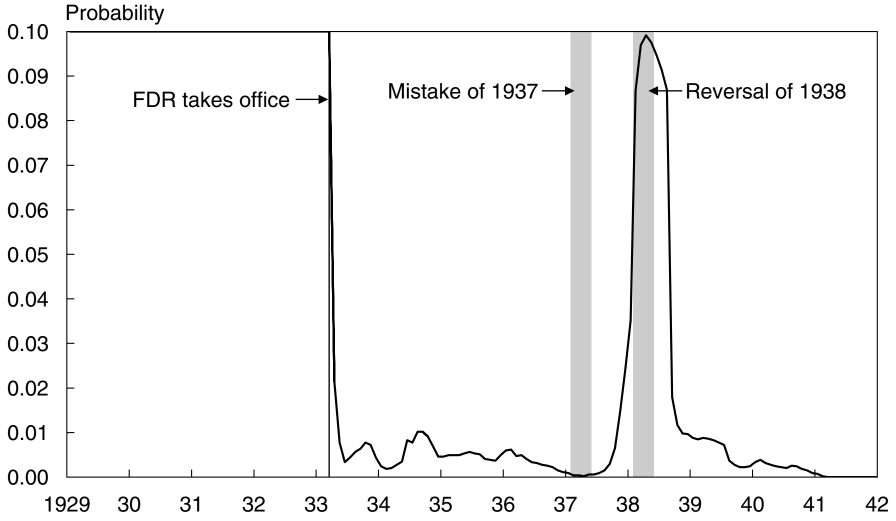
$$\min_{\gamma_t} \sum_t (\pi_t^{Model} - \pi_t^{Data})^2 + \psi(Y_t^{Model} - Y_t^{Data})^2, \tag{41}$$

where $\psi$ is an arbitrary weighting parameter set at 1/6.

Figure 13 compares the values for output from the model, given our estimated sequence of $\gamma_t$, against the data. Figure 14 repeats this exercise for model-predicted and actual inflation. Figure 15 shows the estimated sequence of $\gamma_t$, re-expressed as $\rho_t$, using formula (39) (but raising to the power of 24 to reflect the shift from quarterly to monthly frequency). Under this calibration, the model generates a large depression in output of roughly the same order as seen in the data.

It is worth considering how the model fit can be improved, especially in the period 1933–36, since the inflation predicted then by the model deviates substantially from the data. We conjecture that the main feature which could improve the fit of the model would be to incorporate the evolution of marginal costs in more detail. In the current model only prices are sticky, but wages are perfectly flexible. To the extent that movements in marginal costs due to sticky wages were limited, our conjecture is that the gap

**Figure 15 Probability of a Regime Change within Two Years**




Note: The shaded periods of policy announcements predict changes in the credibility parameter.

between the model's predicted inflation and the data can be reduced. More importantly, several policy initiatives at the early stages of the New Deal directly impacted marginal cost and markups in a way that is not modeled. The NIRA, as described in Eggertsson (2006b), is especially relevant. It may have had considerable effects on wage costs and on the monopoly pricing of industries. These factors are likely to have increased inflation well beyond what is predicted by the model, which assumes that variation in $\gamma_t$ is the only factor affecting inflation. It is interesting to observe that the U.S. Supreme Court struck down large parts of the NIRA in 1935 that it deemed unconstitutional.[20] Together, these may help explain why the gap between the model-predicted inflation and the data is larger in 1933–36 than in 1937–41.

While there is a difference in the level of inflation between the model and the data—especially between 1933–36—the model does generate the correct change in inflation over this period. In particular, the model predicts a sharp increase in inflation following the regime change in 1933 and also during the mistake of 1937 as well as during the reversal in 1938. The driving force of the simulation is the estimated values for $\gamma_t$, which are shown in Figure 15 re-expressed in terms of $\rho_t$. High values of $\rho_t$ indicate a small degree of credibility of the reflationary regime and suggest that the public believed the regime would be abandoned with high probability in favor of the deflationary regime. Note when $\rho_t = 1$, the reflationary regime is identical to the deflationary regime and the estimated path for $\rho_t = 1$ implies this to be the case prior to FDR's inauguration. The figure shows that $\rho_t$ declined substantially in 1933 with FDR's inauguration and—while showing some variation—gradually declined until

20. See, for example, Davis (1986).

during 1937, when there was a clear shift in belief toward a deflationary regime, consistent with our maintained hypothesis. That trend was only reversed in the early months of 1938. These broad patterns of belief, estimated by the minimization of (41), are consistent with the narrative accounts we reviewed in Section V. As the figures reveal, there appears to be a slight lag, of one or two months, between our narrative account of the relevant policy communication and the change in the path for $\gamma_t$. The policy announcement thus predicts changes in $\gamma_t$. The most likely reason for this lag is that our model is completely forward looking so that any effect of policy has an immediate effect on output and prices. Realistically, however, firms and consumers make some decisions in advance, at least one or two months earlier. Many authors (see, e.g., Rotemberg and Woodford [1997]) introduce decision lags of several quarters to account for some delay in monetary policy on output and prices. The estimated path for $\gamma_t$, when considered in light of the timing of policy communications, indicates that relatively small decision lags (of less that one quarter) would be needed to explain a delayed effect of policy surprises on output and prices during the Great Depression.

## VII. What Was the Reason for the Mistake of 1937?

In the model, the mistake of 1937 is treated as an exogenous shift in beliefs, captured by the parameter $\gamma_t$, which we interpret as a change in the communication about future policy by policymakers, a conjecture supported by the narrative accounts from newspapers of this period. Left open, however, is *why* policymakers chose to send the signals that had such a dramatic effect on beliefs and shifted $\gamma_t$. Broadly speaking, one can hypothesize that either the mistake was (1) an unintentional communication of confusing signals or (2) a deliberate (but mistaken) change in policy. Both possibilities can be supported by some evidence, and we discuss each in turn. While this should be a subject for further study, we believe that in the final analysis the most likely explanation is some combination of the two.

The first explanation, that the policy communication was more unintentional than a deliberate change of course, is more convincing if applied only to FDR than to Fed policymakers. In the early months of 1937, FDR was engaged in one of the toughest fights of his career—the "court-packing fiasco." It was one of the few political battles he would lose during his presidency. He was deeply frustrated with the Supreme Court, because it had been a major obstacle to his reforms, striking down several New Deal programs as unconstitutional. In response, he tried to stack the court in 1937 by proposing legislation which mandated that several of the justices retire due to their advanced age. This caused a furor, both publicly and within Congress, and had a substantial negative impact on FDR's credibility. In the midst of this battle, which started in February 1937, it could be argued that FDR had difficulty paying close attention to monetary policy. Indeed, his offhand remarks on April 2 about inflationary dangers, which led to a large market reaction and that some newspapers would later blame for the depression of 1937–38,[21] appear to have been made without

21. See, for example, "Fall Elections Seen as Motive in Gold Action," *Chicago Daily Tribune*, February 16, 1938.

much thought or discussion within the administration. Indeed, in 1938, FDR tried to claim that he had wanted to inflate the price level to pre-depression levels all along, as he had promised in 1933, despite his explicit warning in April 1937 against too much inflation. Hence, it is possible to argue that whatever comments FDR made about inflationary pressures in the spring of 1937, they were an example of confusing signals rather than a genuine change in his thinking about policy.

What is more certain is that in February 1938 FDR put all his weight and credibility behind a renewed commitment to reflate. In contrast to his warnings against excessive inflation, this commitment seemed to have been well thought out within the administration. His formal announcement in a press conference on February 19 was in fact prepared through the joint efforts of the Chairman of the Fed and the Secretary of the Treasury, along with several other senior advisors.

While one may argue that FDR may have been less than deliberate about the change in the course of policy in the spring of 1937, there appears to be less reason to doubt that the Fed abruptly and deliberately changed course during that period (as we document in Section V). The question is why? The most likely reason is that the Fed misread the economic situation and focused on a rather narrow objective for social welfare in a "discretionary way" (in the sense of Kydland and Prescott [1977]). Furthermore, with the passage of the Banking Act of 1935, the Fed may have seen itself as no longer bound by FDR's commitment to inflate the price level to pre-depression levels. To see why an excessive tightening may have been rational for the Fed, let us suppose that the Fed was maximizing social welfare. Under certain conditions (see, e.g., Eggertsson [2006a]), the social welfare function can be approximated by a second-order Taylor expansion of the utility of the representative household yielding

$$E_t \sum_{T=t}^{\infty} \beta^{T-t} \{\pi_T^2 + \lambda Y_T^2\}.$$

Consider now the optimal solution from time $t$ onward under the assumption that the central bank believes that the natural rate of interest $r_t^n$ is positive. In this case, the Fed could minimize the output and inflation at their social optimum, in other words, at $\pi_t = Y_t = 0$, by setting $i_t = r_t^n > 0$. Thus, by reneging on FDR's 1933 commitment to reflate the price level to pre-depression levels, the Fed could achieve a better economic outcome. While this outcome is *ex post* optimal, it is not optimal *ex ante* because it was optimal for the government in 1933 to create expectations about reflation. This *ex post* incentive to renege on a previous inflation promise is what Eggertsson (2006a) coins the "deflation bias of discretionary policy." The snag in 1937, of course, is that there is every indication that the Fed misjudged the natural rate of interest, believing that the depression was over and that the battle with deflation had been won. This was a serious misjudgment. Thus, according to this interpretation, the mistake of 1937, as far as the Fed was concerned, was a bad miscalculation of economic conditions.

## VIII. Conclusion

A key question is whether or not Japan in recent years has been subject to contractionary spirals of the kind described in this paper. To make this assessment, and then compare the results to those during the Great Depression in the United States, it is helpful to observe that an economy subject to the forces described here does not need to experience excessive deflation of the order observed during the U.S. Great Depression. In a model that has a higher degree of price rigidities, the contractionary spiral will mostly be reflected in output instead of prices. In the very extreme when prices are perfectly rigid, for example, the contractionary spiral will only show up in an output contraction without any change in prices. The key condition for a contractionary spiral is a series of shocks so that the natural rate of interest is temporarily negative, because these kinds of shocks cannot be fully accommodated due to the zero bound.

As always, it is difficult to draw strong comparisons between different countries at different times. Japan today certainly looks very different from the United States in 1937. Yet there are some similarities and some lessons that Japanese policymakers may wish to keep in mind. The most obvious similarity is that Japan is also contemplating a transition from zero interest rates to positive ones. The U.S. experience indicates that economic outcomes can be extremely sensitive to expectations given those circumstances. It appears that Japan might be vulnerable to contractionary spirals. This highlights the importance of clear communication by the Bank of Japan about its future inflationary goals as argued by Eggertsson and Ostry (2005). In particular, the market is very sensitive to signals about the future policy regime. Given the asymmetries documented in the paper, it seems to us more prudent to err on the side of inflation, rather than deflation.

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# Comment

**ANDREW FILARDO**[22]
**Bank for International Settlements**

## I. Introduction

It is always a pleasure to discuss such a high-quality paper, especially when it is from a pioneer in the field of monetary policy modeling such as Gauti B. Eggertsson. What he and his co-author Benjamin Pugsley offer here is a superb effort to improve our understanding of how new modeling techniques can be brought to bear on critical policy issues. This time, it is accomplished through the lens of history. By taking a fresh perspective on a well-studied historical episode—the sharp U.S. recession in 1937–38 and the subsequent expansion—we are not only challenged to reexamine our beliefs about the key forces dominating that complex policy environment but also shown a nice application of state-of-the-art monetary policy modeling.

The authors develop a dynamic stochastic general equilibrium (DSGE) model that they believe sheds considerable light on explaining the past. In this commentary, I first discuss several modeling issues in the paper. I will then raise some doubts about the robustness of their provocative conclusion that poor communication policy was the key source of the "mistake of 1937." This line of argumentation, however, should not be taken as a criticism of the quality of the modeling, the importance of pursuing this line of research, or the eventual policy implications that might be uncovered with this approach. Rather, my arguments simply raise a cautionary flag to policymakers and their staffs about the immediate usefulness of these models in a practical policy context. In other words, I am suggesting that these models, while academically sound and well developed, still might not yet be ready for "prime time." Finally, I look at the authors' approach from the perspective of a more conventional view of the historical record and draw some policy conclusions. It will become increasingly clear that I see this class of DSGE models as still being quite narrowly focused and highly stylized. Indeed, one might say that these models might still require fundamental reorientations if they are to explain the wide range of past monetary policy experiences seen in the cross-country historical record.

22. The views expressed are those of the author and not necessarily those of the Bank for International Settlements. I would like to thank Magdalena Jurecka for research assistance.

## II. Modeling Issues

Many aspects of the model are worthy of praise, but let me just highlight a few key ones. The authors provide a nice, succinct description of the policy environment in the 1930s. In addition to the traditional approach of sifting through historical databases, they meticulously collect statements made at the time in the popular press by policymakers that could bear on the formation of inflation expectations. This narrative offers new insights about the policy environment that have the potential to help us better understand what the government and other economic actors were thinking at the time. Using this information together with their model that emphasizes the role of inflation expectations, the authors challenge traditional accounts of the historical record. The historical analyses suggest that the increasingly restrictive monetary conditions and tight fiscal policies were the key factors driving the story. The authors, however, identify inflation expectations management—or, more appropriately, mismanagement—by policymakers as the main culprit in leading to one of the deepest recessions in the post-World War I period.

There is little doubt that expectations played some role in the recession and recovery. But the key question is whether expectations about inflation derived from statements in the popular press played a dominant role.

The answer depends in large part on how inflation expectations are formed and how they affect output and inflation dynamics of the economy. The authors construct a model where such expectations are allowed to play a major role in the macroeconomic dynamics. Indeed, the real strengths of this paper are the construction of a state-of-the-art monetary policy model and the adaptation of it to the question at hand. The model is derivative of the type of models that Eggertsson, his co-authors, and others have pioneered in recent years. The clever and novel feature of this paper is the inclusion of Markovian inflation dynamics, which allow hypothetical policymakers in the model to engineer a shift in the mean inflation rate from a low to high level. The solution methods, equilibrium concepts, and type of dynamics strike me as being quite useful for thinking about various monetary policy regimes that are focused on inflation control. Moreover, what I find most intriguing is the possibility that one could imagine central banks in the current policy environment using the model to calibrate the effectiveness of central bank communication. In particular, the equations in the paper could be used to infer and track $\gamma_t$, the transition probability that captures the changing public perceptions of the inflation objectives of the policymakers. This type of information might be particularly helpful to policymakers, especially when survey and financial market assessments of inflation expectations might be biased or misleading for various reasons.

## III. Robustness of the Paper's Conclusions

While it is an interesting model and perspective on the role of expectations, the applicability to the interwar period in the United States is not without considerable question. First, during the 1920s and 1930s, for example, major questions for the

United States—as well as many other countries—were whether or not to reinstitute the gold standard and, if so, at what parity. The notion of two steady-state *inflation* rates might have seemed to the public to have been a strange set of policy options. A more realistic set of options might have been a choice between two *price level* objectives. Even though the conclusions of the paper are likely to carry over to a model of price level targeting, the fit of the calibration may or may not be tighter.

Second, the Markovian dynamics raise questions about whether there is a tendency in the model to attribute too much of the variation in inflation and output to the inferred role of expectations. For instance, one could imagine that some of the statements in the popular press at the time only influenced the perceived variance of price outcomes, with the mean being little changed. In the extreme case of a mean-preserving spread, the extra "noise" from public statements would not generally elicit such a large output effect, as indicated by the equations in the paper. Being able to distinguish the noise hypothesis from the regime-switching hypothesis would seem to be an absolute prerequisite of the analysis.

Third, one could also imagine that statements in the popular press would not have had such a powerful output effect as suggested in the model, because of doubts that policymakers and politicians could actually deliver on their intentions. As the equations in the paper illustrate, an upward shift in expected inflation necessarily leads to a boost in economic activity, presumably through the incentives for some of the forward-looking firms to produce more while relative prices are temporarily high. The link in the paper appears to be nearly mechanical. In reality, such links might be rather tenuous and state dependent, not least owing to issues of credibility and of policymakers having effective policy tools. Can central banks simply utter phrases about higher inflation as a means to generate an economic revival? Does the public respond to statements in a way consistent with this expectational channel? Would this occur even if monetary authorities found themselves at the zero lower bound for short-term policy rates?

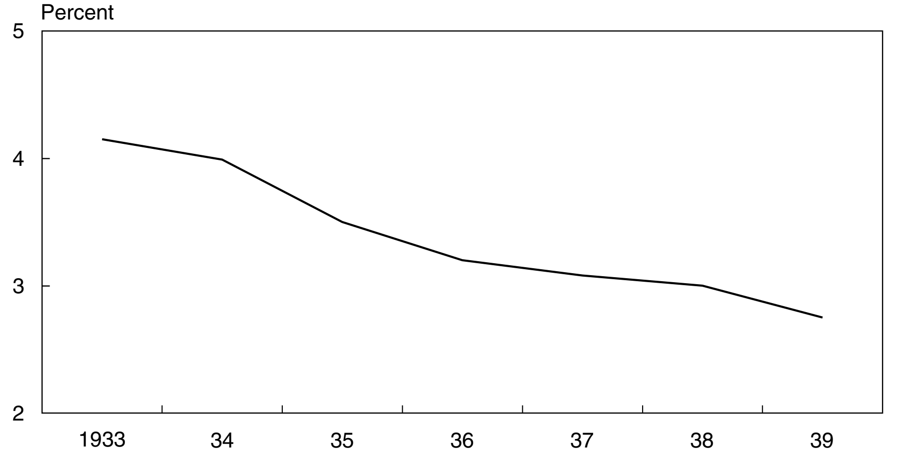
The main difference between this model and traditional models of animal spirits seems to be that in this model the central bank has the ability to initiate and manage animal spirits. As recent history suggests, this feature of the model seems to be much too simplistic to capture the complex trade-offs that central banks face. Credibility, both earning it and knowing how to use it, is a critical issue that is largely ignored in the paper. In the 1930s, was a relatively obscure institution called the Federal Reserve really so powerful that when it made a few utterances consumers, workers, investors, and firms would immediately react—on the downside to create one of the worst recessions on record as well as on the upside to cause a rapid recovery? Having policymakers utter the phrase "prosperity is just around the corner" seems like an approach that has been tried again and again over time with very little success. Moreover, when we look at recent history in Japan, transparency alone has not been sufficient to empower "open-mouth policies." Indeed, the Bank of Japan (BOJ) has consistently expressed clearly that it wanted to end deflation, not least by making unambiguous statements about its inflation preferences and by taking actions consistent with these statements under its unconventional quantitative monetary easing policy (QMEP). But the financial headwinds and the zero lower bound, among other factors, proved to be formidable constraints. In this light, one must question whether some important aspects of the monetary policy transmission mechanism in the authors' model are either missing or largely suppressed.

Fourth, the simulation results in the paper also raise questions about the appropriateness of the calibration. For example, the inflation simulation compares a path for consumer price inflation that is at odds with the historical record. In a recent paper, Bordo and Filardo (2005) published relevant cross-country statistics about the magnitude and duration of deflations over the past two centuries. Of the 87 episodes of sustained deflation that we examined, only a few were close to being as extreme as the simulation in the authors' paper, and those tended to be in the first half of the 19th century. This suggests that the authors, in subsequent research, should base their simulations, in general, on data much more consistent with the historical record and, in particular, to match the model inflation rate to consumer prices rather than to the much more extreme movements of wholesale prices. Another recommendation is to calibrate the model to a more realistic steady-state inflation rate. For the reasons mentioned above, 4 percent seems unrealistically high for a steady-state inflation rate that would be believable at the time. It would also be informative if the choice of the high inflation rate were motivated by a more thorough discussion of what a credible inflation (or price level) target in this period would resemble. For a model-consistent approach, consideration of optimal inflation rates would be one way to proceed, say, in the vein of Kahn, King, and Wolman (2003).

Notwithstanding the above comments, this paper is a success in the sense that it made me reconsider the role of expectations during this interwar period. Often, historical studies ignore the actual information that economic agents had at the time from the popular press, in large part owing to the difficulties associated with collecting such information. In our current period of transparent monetary policymaking, insights on this dimension from historical experiences could be quite valuable. However, the more I thought about the potential channels through which expectations could work in the late 1930s, the greater sense of unease I felt. Who exactly was reading these newspapers and, more importantly, who was reacting by changing their wage and price-setting behavior? The 1930s were a very tough and tumultuous period in United States. One would have thought that consumers and workers would be more interested in the basic necessities of life than the myriad public statements about prices from policymakers and politicians. One group that might be particularly sensitive to such statements, though, would have presumably been investors on Wall Street. These were the individuals and companies that had just experienced massive volatility and, in many cases, huge losses at the hands of policymakers and politicians. Moreover, just a few years earlier in the decade, the U.S. Supreme Court had nullified the gold clauses in nominal bond contracts, which represented a large transfer of wealth from lenders to borrowers (Kroszner [2003]).

Given this backdrop, one would imagine that lenders would be particularly sensitive to anything which might compromise their inflation-adjusted yields. Then such evidence, if truly important, would have shown up in pricing and, hence, yields in bond markets. So, do yields on long-term bonds exhibit a pattern consistent with the published news that the authors collect? No. I am struck by the movement, or rather

**Figure 1 Yield on U.S. 10-Year Treasury Notes, 1933–39**

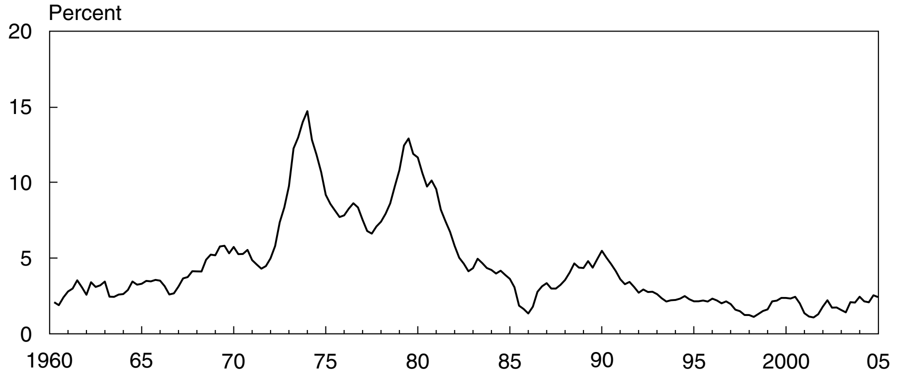



Source: National data.

lack of movement, in market interest rates during this period. Figure 1 illustrates the behavior of the yield on 10-year U.S. Treasury notes during 1933–39. Yes, the yield fell during the initial months of the downturn, and was consistent with the view that inflation expectations were falling. However, the yield kept falling even in the period during which the authors conjecture that inflation expectations were rising sharply. At the very least, the evidence from the bond markets indicates that the expectation story in the paper might be more complicated than suggested.

One might also question the description of the expectations mechanism in the authors' paper as being too simplistic, even in the more highly transparent policy regimes of recent decades. For instance, Figure 2 shows the long march of inflation in the G-10 economies down from the peaks in the 1970s and early 1980s to the current low and stable inflation environment. It was quite clear in many countries during the 1970s that lower inflation was the goal of monetary policy, as the costs of high and variable inflation were amply felt (Bank for International Settlements [2005]). Yet the slow evolution of inflation expectations seemed to be the norm rather than the exception in the G-10 economies, a pattern in sharp contrast to what the authors suggest was operative in the 1930s. Other examples of this phenomenon come to mind, especially the inertial deflationary expectations that remained entrenched in Japan over the past decade despite many clear statements by the BOJ about its inflation objectives. These episodes raise serious doubts that expectations and policy statements alone are sufficient to adequately explain the past, or the present.

**Figure 2 G-10 Inflation Rate, 1960–2005**




Note: Annual change in consumer prices, in percent; weighted average based on 2000 GDP and purchasing power parity exchange rates.

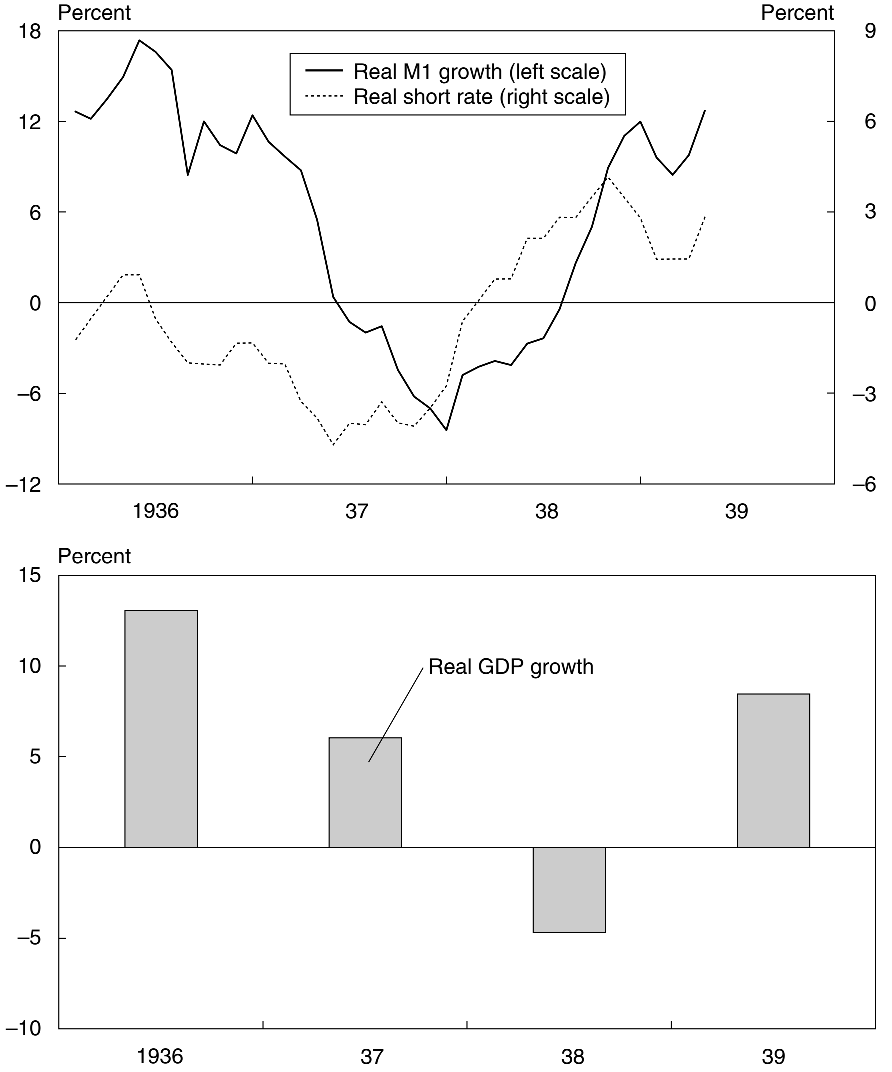
Source: National data.

## IV. An Alternative Perspective and Policy Implications

So if the expectation channel were not the dominant force during the period, then what channels were? Since it is one of the most studied periods in economic history, there is no shortage of candidates. My reading of the evidence suggests that traditional explanations apply rather well. This seems especially to be the case in the 1936–38 period. For instance, Figure 3 illustrates the close match between real M1 growth and real GDP growth. This procyclical relationship is particularly interesting to students of monetary history because of the counterintuitive movements, from a monetary policy perspective, in real interest rates. Real rates fell as the economy slowed and achieved a relatively high level during the recovery, an insightful correlation discussed by Meltzer (1999). The movement in the monetary aggregates in this episode appears to have been a good predictor of economic activity, while the real interest rates sent misleading signals. Even though more complicated stories might be able to explain these correlations in the late 1930s, the straightforward interpretation points convincingly to a traditional monetarist transmission mechanism.

It is also instructive to look to other episodes of deflation and recovery in the historical record. One can look to the Japanese experience in the 1920s and early 1930s (Nakamura [1994]). During the 1920s, aggregate consumer prices were generally falling and real interest rates were high. The postwar recovery was complicated by the Great Kanto Earthquake of 1923, the banking crisis in 1927 (attributed in part to ill-advised statements by Finance Minister Naoharu Kataoka in the Diet), and the resumption of the gold standard in 1929 at the prewar parity. By way of contrast, the successful recovery plan of Finance Minister Korekiyo Takahashi was what we would now consider a classical prescription (and it predates the publication of Keynes' *General*

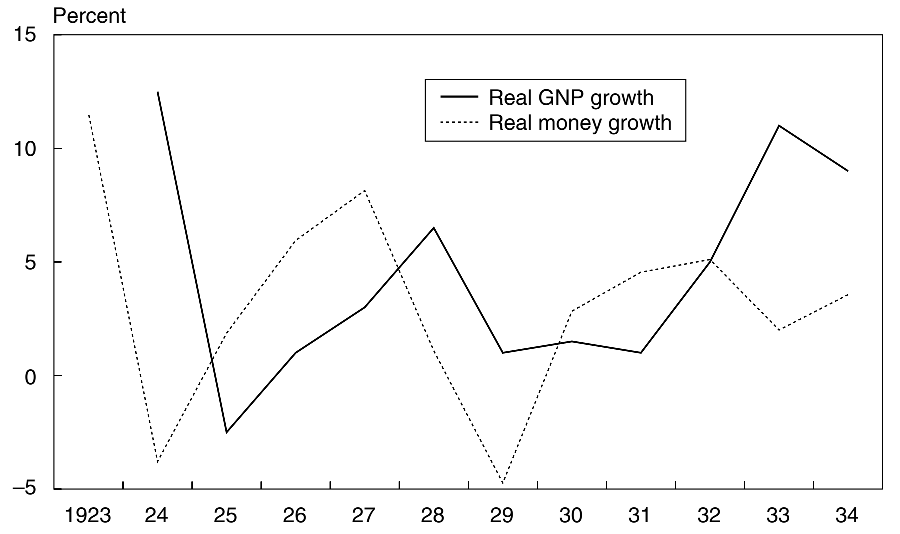
**Figure 3 U.S. Money Growth, the Real Interest Rate, and Real GDP Growth, 1936–39**




Source: National data.

*Theory of Employment, Interest and Money*!). The gold standard was abandoned in 1931, the official lending rate was lowered significantly in 1932 and, possibly most important, the central bank monetized vast quantities of the government debt. The consequence of these actions can be best seen in the strong link between money growth and economic activity in this period. Figure 4 illustrates that real money growth tended to lead real GNP growth by a year or so.

**Figure 4 Japanese Money Growth and Real GNP Growth, 1923–34**




Source: Historical statistics of Japan.

Despite the apparent limitations of the model vis-à-vis the historical record, the efforts are still important and informative in at least two ways. First, methodologically, the authors deserve praise for their ambitiousness. They take a state-of-the-art DSGE model, which they believe is a good approach to analyze contemporary policy trade-offs, and test it with "out-of-sample" data—that is, data from a period which were not used to calibrate the model. There are good reasons to believe that the much simpler financial environment during the past could make it somewhat easier to identify the role of the key factors driving the monetary policy transmission mechanism. If the basic channels of this mechanism have not radically changed over time, this laboratory of the past might therefore help us to understand the factors relevant today. One way to interpret the nature of this thought experiment is in terms of the Bayesian scientific method. In other words, they begin with the hypothesis, $H$, that their DSGE model is appropriate. Then they draw inferences about its probability by looking at these historical data: $P(H, data) = P(H) \times P(data | H)$. Despite the difficulties that they face—not least being data quality and familiarity with the way expectations might have been updated—they are nevertheless able to shed some new light on the episode.

Second, the authors also show us how to adapt this class of models to a less familiar policy environment. The applicability of this model goes well beyond the interwar period. An obvious extension would be to study the past decade or so of Japanese economic history, where the measurement of expectations and other features might be easier to assess.

These methodological strengths also suggest additional avenues in which future research might fruitfully proceed. As regards the interwar period, a more careful assessment of the relative role of all the factors—monetary, fiscal, credibility, expectational, and so on—in the context of a general equilibrium model remains a reasonable goal for this literature. This would mean, at a minimum, including more realistic specifications of the trade-offs faced by fiscal and central bank authorities. More difficult for this class of DSGE models is the potential role for the monetary aggregates, owing to the fact that these models often subjugate the monetary aggregate channel to a sideshow. While this particular modeling simplification might be convenient in some circumstances, such as in an economy with elaborate globalized financial systems, it seems much harder to maintain in the case of the early 20th century.

Indeed, a more comprehensive historical study of inflation behavior and central banking might suggest that these other factors are not only contributing ones but, in fact, dominating factors. Bordo and Filardo (2004) consider the economic histories of 17 countries over the past few hundred years to detect broad characterizations of monetary policy frameworks and their influence on inflation determination. The historical record suggests that the appropriate monetary policy frameworks depend on the inflation zone in which a central bank finds itself. These inflation zones span the spectrum from hyperinflation to deep deflation.

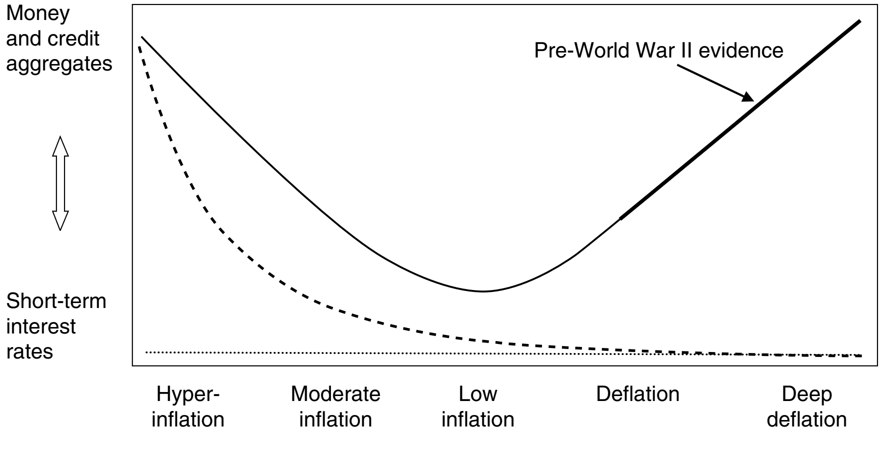
In particular, the usefulness of the monetary aggregates in signaling the stance of monetary policy is strongest during hyperinflations, when monetary aggregate growth rates are much more reliable measures of the thrust of monetary policy than interest rate settings, and during deep deflations, when policy interest rate movements are significantly constrained by the zero lower bound for nominal interest rates. In the intermediate inflation zones, policy interest rates often appear relatively more informative about the stance of monetary policy, in large part because of the uncertainties associated with velocity over short horizons in these inflation zones.

As for policy prescriptions, the historical record is generally supportive of the notion that, if in a high inflation zone, central banks have tended to establish a credible monetary commitment mechanism with a sharp reduction in the growth of the monetary aggregates, while at the same time regulatory and fiscal authorities take actions to strengthen the prudential frameworks and to pursue more balanced fiscal regimes, respectively. In the moderate inflation zone, velocity instabilities may call for monetary policy frameworks that rely increasingly on interest rate targeting and the Wicksellian approach. In a price stability zone, the Wicksellian approach may dominate; but complications may nonetheless arise from the zero lower bound for nominal interest rates and hence justify putting additional weight on the monetary aggregates as a guide for the stance of monetary policy. In a low-to-moderate deflation zone, the problems associated with the zero lower bound for nominal interest rates would indicate even greater weight on the monetary aggregates as well as consideration of such unconventional measures as open market operations in longer-term, less-liquid assets and "helicopter drops." Finally, deep deflations such as those seen in the Great Depression may require the aggressive use of monetary aggregate expansion; most cases of this type of deflation had been accompanied by financial/banking crises that required resolution, usually with some range of fiscal measures.

This reading of the historical record generally leads to a rather different set of policy implications than those suggested in the authors' paper. In particular, this reading suggests that quantitative measures of monetary policy (i.e., monetary and credit aggregates) play a more central role and their importance might best characterized as exhibiting a U-shaped pattern (Figure 5). To be sure, expectations matter. But, expectations about the regime (e.g., the gold standard versus fiat currency regimes) and the policy setting (e.g., financial stability conditions and the extent of fiscal dominance) matter much more than statements from policymakers about cyclical conditions. Moreover, I think it is reasonable to conclude that, in contrast to the views of the authors, the expectational channel associated with cyclical developments is likely to be weak and uncertain, especially in crisis times when "talk is cheap."

Figure 5 also illustrates the type of patterns that might be implied by the class of DSGE models used in this paper. In one case, the relationship is flat at zero owing to the assumed irrelevance of the monetary aggregates; in an alternative case, it is declining to zero owing to the generally accepted view that excessive growth in the monetary aggregates causes hyperinflation. It is also important to keep in mind that this graphical analysis does not assume that monetary policy can solve all problems. The historical record does not suggest that monetary policy can easily ameliorate problems that have non-monetary origins. For example, financial stress

**Figure 5 Indicators of the Stance of Monetary Policy: The Inflation Zone View**




Note: For a more detailed description of the U-shaped relationship, see Bordo and Filardo (2004). The dotted line denotes implications from models, such as the type in Eggertsson and Pugsley (2006), where the money and credit aggregates play little role as a measure of the stance of monetary policy; the dashed line denotes the implications from a similar model, except that it allows money and credit growth to largely determine high-inflation environments.

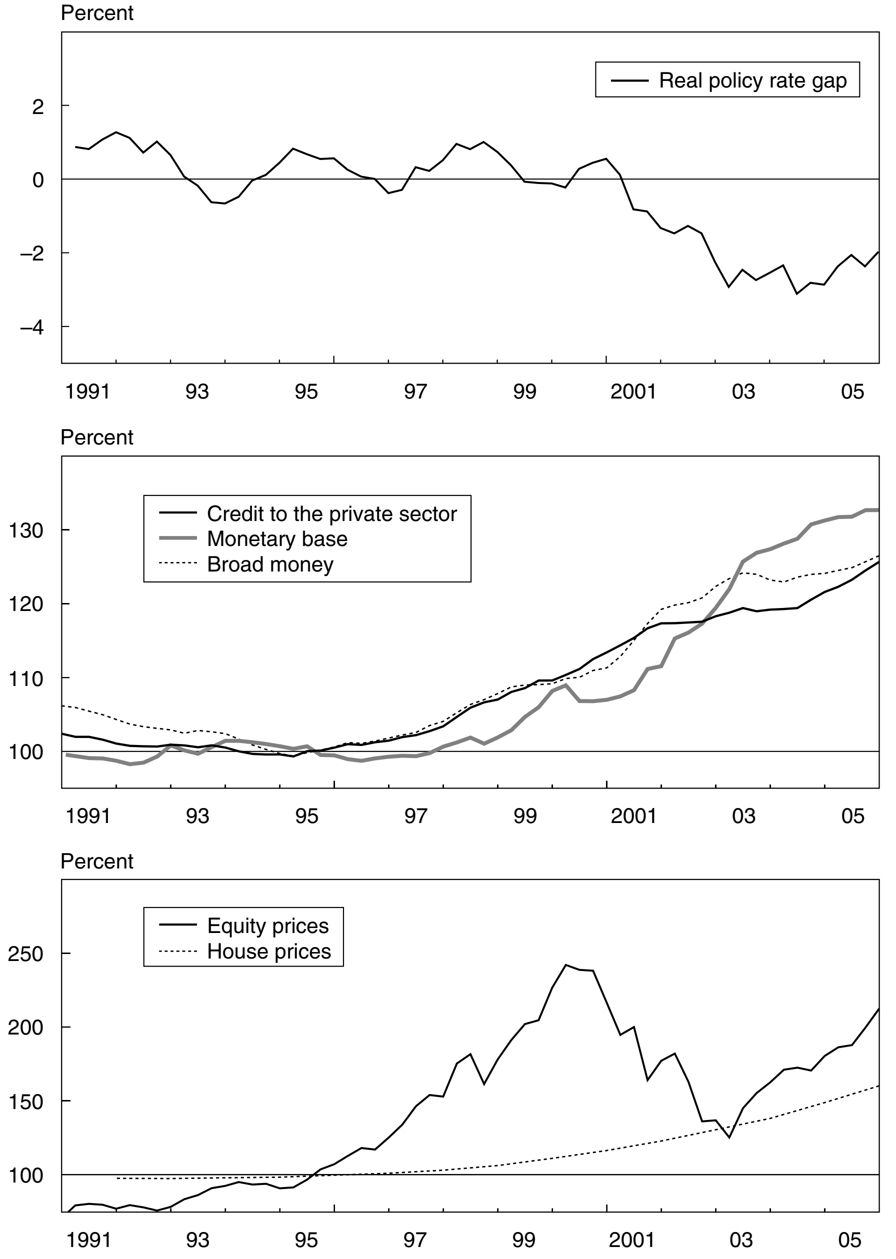
may require prudential and fiscal solutions before the force of the monetary channel can be fully realized. But the potential role of the monetary channel should not be underestimated either, even when the zero lower bound for the policy rate is approached. The general lesson we have learned from the historical record is that central banks may need, at times, to go beyond interest rates alone as measures of the stance of monetary policy to a broader set of policy indicators. As a consequence, models without a significant role for money and credit are likely to be incomplete and too narrowly focused to capture the full range of policy challenges faced by central banks. This might be especially important when central banks are targeting price stability. In this respect, the two-pillar approach of the European Central Bank and the new two-perspective approach of the BOJ appear to be consistent with the broad historical narrative.

In addition to the implications for policy frameworks, the above analysis has implications for the current policy juncture. In particular, the quantitative measures of the stance of monetary policy currently may be underscoring important risks to medium-term price stability. Figure 6 illustrates such risks. The top panel shows that real policy rates in the G-10 economies have been relatively low for a fairly long period. On the one hand, inflation pressures have remained subdued and inflation expectations have appeared to be well anchored. All this might simply suggest that the short-run natural rate of interest has been temporarily low. On the other hand, the other two panels suggest that the inflation risks may be more worrisome. The low real rates have been associated with a significant surge in global liquidity as measured by the narrow monetary aggregates, the broad monetary aggregates, and credit growth. Moreover, this pattern has been associated with a rapid run-up in asset prices that, when taken together, is reminiscent of boom-bust conditions of the type seen in the past (see, e.g., Borio and Lowe [2004] and White [2006]).

## V. Conclusion

Taking together all the points raised in this commentary, it seems reasonable to conclude that mistakes were made in 1937. Yes, some statements from policymakers may have influenced the situation in a detrimental way. And the authors have made a nice contribution to our understanding of the period by sifting through historical sources of statements by policymakers. Yet consideration of the broader policy environment in the interwar period calls attention to monetary and fiscal factors that might have played a more dominant role. This suggests that further study of the period and further modeling refinements may still be fruitful as a means to better understanding of the period. Ultimately, a key test of the model's flexibility and robustness will be its ability to describe not only the past but also the current policy environment. In this way, such studies can help us to assess more accurately what the past has to teach us about present, and future, challenges facing central banks.

**Figure 6 G-10 Real Interest Rate Gap, Money Growth, and Asset Prices, 1991–2005**




Note: Real policy rate in percent; money and credit aggregates as a share of nominal GDP; share and house prices in levels, 1995 = 100.

Sources: National data, share and house prices from the Bank for International Settlements. The real policy gap is defined as the real policy rate less the average real rate from 1985–2005 (for Japan, 1985–95; for Switzerland, 2000–05) plus the four-quarter growth in potential output less its long-run average.

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# Comment

**KUNIO OKINA**[23]

**Bank of Japan**

It is my pleasure to comment on the authors' interesting and stimulating paper. Based on the expectation-oriented theoretical models and the experience of the United States in the 1937, they offer useful advice to the Bank of Japan (BOJ).

In their paper, the authors define two policy regimes: the deflationary regime R1, and the reflationary regime R2. The authors define R1 as targeting zero inflation whenever possible, and if a zero inflation target cannot be achieved, the central bank allows for maximum policy accommodation and sets the interest rate at zero. On the other hand, the authors define R2 as a reflationary regime, when targeting an inflation rate higher than zero. And in their framework, the public believes with some probability $\gamma$ that in the next period the government will abandon R2 in favor of R1 for all future periods.

Although the authors' analysis focuses mainly on the reflationary regime R2, I think the deflationary regime—that is, R1—is interesting, especially when we consider Japanese monetary policy. This is because the R1 regime seems to describe the Japanese policy regime quite well until very recently. Therefore, in the rest of my comment, I would like to concentrate mainly on the R1 regime.

23. Currently, Chuo University. Views expressed in this comment are those of the author and do not necessarily reflect the official views of the Bank of Japan.

According to the authors, under the R1 regime, given price rigidity, the model predicts immediate, large output collapse when a relatively small shock hits the natural rate of interest in the economy. Therefore, the authors suggest that the deflationary regime R1 is risky and sometimes disastrous. The claims come from the calibration results obtained in Figure 1 of their paper under the R1 regime, which shows an immediate and very large output collapse after the negative shock hits the economy, and the contraction lasts as long as the duration of the shock.

Therefore, the authors' message is as follows. First, under the R1 regime, the outcome would be disastrous. Second, even under the R2 regime, if policymakers conduct poor communication policy, that may lead to a situation similar to what occurred in 1937 in the United States. Third, the economic condition of 1937 in the United States is similar to that of Japan in the first half of 2006. Therefore, clear communication by the BOJ about its future inflationary goals is important.

Although hypothetical, the authors' story is impressive and their advice to the BOJ is straightforward. I have two comments, however. First, as already discussed by Andrew Filardo, other factors outside of the model may better explain what happened in the 1930s in the United States. Second, although the authors suggest that the BOJ is facing a situation similar to that of the United States in 1937, one must not forget that the BOJ had once before experienced an exit from the zero interest rate policy (ZIRP), in 2000. As a case study, I think comparing the BOJ's experience in 2000 with the prediction of the model in the paper may deepen our understanding of the major driving force of the economy in a deflationary environment.

Let me first briefly review the Japanese experience of August 2000. The BOJ adopted the ZIRP in February 1999 and abandoned it in August 2000. This exit decision was unpopular with economists, because deflation was not over at the time of exit, and the Japanese economy experienced another recession in 2001 after the exit. Should we consider this episode as the "mistake of 2000"? If so, how serious was it?

To prepare this comment, I looked at various speeches by policymakers at the BOJ to determine the main views of the BOJ at that time, and decided to select Deputy Governor Yutaka Yamaguchi's speech of August 4 (Yamaguchi [2000])—one week before the exit from the ZIRP. In his remarks, Yamaguchi first pointed out the overall recovery of the Japanese economy at that time:

> A variety of economic indicators suggest that Japan's economy is on a recovery path, albeit moderate . . . For example, the year-on-year growth rate of real GDP increased from minus 0.4 percent in the first quarter of 1999 to plus 0.7 percent in the same quarter of 2000, and industrial production growth rose from minus 3.8 percent in the first quarter of 1999 to plus 7 percent in the second quarter of 2000 . . . Moreover, [the June 2000] *Tankan* survey showed that corporate profits were expected to mark a double-digit increase for two consecutive years in fiscal 1999 and 2000.

Behind this recovery, there was a boom in the high-tech and IT-related business areas; a number of them had been expanding their investment.

In the meantime, however, while inflation in terms of the wholesale price index (WPI) was slightly above the previous year's level, that in terms of the consumer price index (CPI) was slightly below. In other words, deflation was not over. Did the BOJ recognize the risk of a deflationary spiral? Of course it did. Because of high corporate profits at that time, however, the risk was not considered very high. If the BOJ had perceived the risk of collapse of the boom in high-tech and IT-related areas and the resultant deflationary pressure, it would have been much more cautious. But the major central banks at that time seemed to pay less attention to them. Unfortunately, the BOJ was not an exception.

Still, one may wonder why the BOJ did not wait until the risk of inflation became evident. Again, Yamaguchi (2000) seems to provide an answer to this question:

> We often hear the argument that monetary policy should be changed only when the risk of inflation becomes evident. At first glance this argument appears reasonable since the target for monetary policy is price stability. As a matter of fact, in the bubble period of the late 1980s, the conduct of monetary policy was based on this argument. From 1986 through 1988, the economy grew at an annual rate of 5 percent, asset prices soared, and the general price level was extremely stable. Under such circumstances, the Bank of Japan could not find an opportunity to preemptively correct the low interest rate policy at the time . . . we should ask ourselves what are the lessons learned from the experience of the late 1980s in today's context? Let me mention two points.
>
> First, the policy change in response to a clear and present risk of inflation would inevitably be monetary tightening, and, moreover, cumulative interest rate hikes would probably be needed as was the case in 1989 and 1990. In view of the very high amount of government bonds outstanding, for example compared with the late 1980s, the capital loss on these government bonds caused by higher interest rates would, other things being equal, pose much larger problems for the economy. We must thus avoid, to the extent possible, monetary policy that forces the central bank to raise interest rates rapidly and substantially at a later stage because it could destabilize the economy and the financial system.
>
> Second, if the zero interest rate policy continues for a long period even after the economy clearly recovers, more economic agents will tend to conduct activities based on the expectation that current extremely low interest rates will be sustained indefinitely. This is what happened in the bubble period, leading to an enormous waste of resources which continues to inflict pain on us today.

Based on Yamaguchi (2000), let me compare the Japanese economy in August 2000 with the four conditions indicated in the authors' paper, which describes the U.S. economy in 1937. First, there was a sign that the "depression" was finally over, although the signs were not so strong. Second, interest rates had been close to zero for years, but there were no strong expectations of a rise. Third, deflation was very mild but not yet over; therefore, there was no concern about excessive inflation. Fourth, there were no large excess reserves to enhance concern about excessive inflation. In sum, the Japanese economy in August 2000 was on a recovery path, but the recovery was not robust. Also, there was no concern about inflation in the near future. This means that the economic situation in August 2000 in Japan was less inflationary than that in 1937 in the United States described by the authors. In addition, the policy regime in Japan, in principle, was closer to that of R1. In this environment, the collapse of the IT bubble did actually hit the economy, just as a negative shock hit the economy in the authors' simulation.

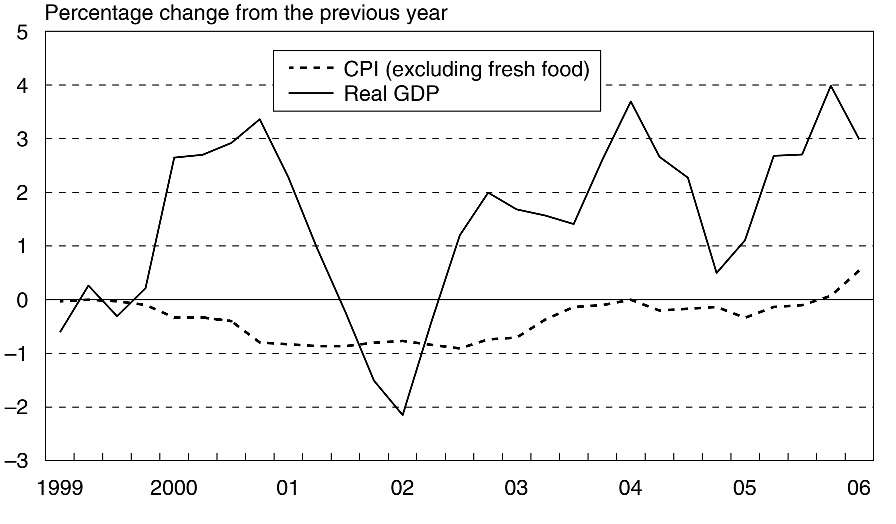
Thus, based on the authors' model prediction as shown in Figure 1 in their paper, Japan's situation at that time should have become disastrous, and the "mistake of 2000" should indeed have been a serious one. But did their model predict exactly the deflationary spiral of Japanese economy after 2000? The answer seems to be quite negative. In spite of the disastrous outcome predicted in their paper, no deflation spiral was observed and the decline of real GDP was temporary (see the Figure below).

It must be mentioned that in the meantime, the BOJ adopted a new policy regime—that is, the quantitative monetary easing policy (QMEP)—in March 2001, after the Japanese economy fell back into recession. It seems to me, however, that this new policy regime should still be regarded as R1 from the authors' viewpoint.

Then, one may wonder, why did the deflationary spiral not occur in Japan? There are several possible explanations. However, since Masaaki Shirakawa of the BOJ will take up this issue in the concluding panel discussion, I will leave it for the panel.

Instead, since the authors compare the current Japanese conditions and the U.S. conditions in 1937, let me add a few points regarding conditions in 2006. Compared to 2000, conditions in 2006 seem to be much closer to those in the United States

**Figure The Situation in Japan**




Sources: Ministry of Internal Affairs and Communications, "Consumer Price Index"; Cabinet Office, "National Accounts."

in 1937 described by the authors, but some differences remain. For example, despite large excess reserves, we have no concern about immediate excessive inflation. In addition, the BOJ Policy Board members' forecasts for fiscal 2006 and 2007 are much brighter than the consensus forecast in fiscal 2000. And the BOJ was very cautious about communicating with market participants when it abandoned the QMEP. For example, it introduced a new framework for the conduct of monetary policy.

Under the new framework, the BOJ explicitly indicates a range of 0–2 percent in the CPI inflation to show a distribution of each Policy Board member's current view of price stability. My personal view is that if we were to pick a policy regime described by the authors, the new framework might be interpreted as R2 with very small and stable $\gamma_t$.

In conclusion, the authors show an interesting example of the importance of communication and expectations management. However, it is worth examining why the model failed to explain the Japanese case in 2000. The relevance of the authors' advice to the BOJ may hinge on the results of such a case study. Needless to say, there is no doubt that expectation management is important.

## Reference

Yamaguchi, Yutaka, "Thinking behind Current Monetary Policy," remarks at the Japan National Press Club on August 4, 2000 (available at www.boj.or.jp/en/type/press/koen/ko0008a.htm).

# General Discussion

In his response to the discussants, Gauti B. Eggertsson first insisted that announcing a certain inflation target would not be a panacea unless the central bank had credibility with the public. Nevertheless, communication was important, especially when it was done in conjunction with other policy measures, such as government spending. He showed some evidence from newspapers that the expectation channel was effective in the mistake of 1937. Regarding the model's specifications, he explained that the assumption of a regime switch with exogenous credibility was just a modeling device, and the results would not change very much even if he modified this assumption. Responding to Kunio Okina's comment as to whether the model could explain the experience of Japan around 2000, he pointed out that the shocks were presumably much larger during the Great Depression than the one observed in Japan, and that the conditions of other measures, such as fiscal measures, were different between the two cases. He stated that he evaluated the communication strategy implemented by the Bank of Japan highly, especially during the exit phase of the quantitative monetary easing policy (QMEP).

In the general discussion, David Longworth (Bank of Canada) argued that the effectiveness of communication depended on which monetary policy regime was currently adopted. Stefan Ingves (Sveriges Riksbank) further pointed out that the effectiveness of communication depended on the degree of credibility, but the credibility ultimately depended on how the central bank used its own balance sheet. Glenn D.

Rudebusch (Federal Reserve Bank of San Francisco) expressed a doubt on the assumption that central banks had strong ability to control inflation expectations through communication. Eggertsson agreed with them, saying that his analysis crucially depended on the degree of credibility (that is, the controllability of inflation expectations), because without it, the miscommunication would not yield any disastrous results to the real economy. He stressed, however, that in 1937 people quite strongly believed in the reflationary program of the administration, not only because of what they said but also because of what they did. Hiroshi Fujiki (Bank of Japan) claimed that the policy effect through the expectation channel should depend on the credibility in the financial market, not among the general public. Masaaki Shirakawa (Bank of Japan) commented that it was sometimes difficult to identify policy mistakes because economic downturns were occasionally brought about by exogenous shocks, not by pure policy actions. He stated that if this was the case, it might be somewhat harsh to blame the central bank for it as a "mistake," although central banks had to be reasonably capable to predict such events.

With respect to the model specifications, Maurice Obstfeld (University of California at Berkeley) questioned the sensitivity of the results to the specific nature of the Calvo contracts. To check the sensitivity of the model, Isamu Yamamoto (Bank of Japan) suggested changing the Calvo contracts to Taylor contracts and also to put wage stickiness into the model. Yamamoto also argued that the parameter values based on the empirical evidence of the United States might not be appropriate in analyzing the Japanese economy. Rudebusch expressed a doubt regarding the assumption that the inflation expectations were extremely flexible. Fabrizio Perri (New York University) questioned how the model would change if investment was added to the model. Eggertsson responded that the model was not sensitive to the exact nature of price rigidities. The key driving force in the model was really the Euler equation of the representative household, in which output depended on the real interest rates and expectations of future real interest rates. He stressed that any sensible model of the macroeconomy had this feature and, therefore, how the central bank communicated was always going to be extremely important.

Tao Wu (Federal Reserve Bank of Dallas) insisted that credibility should be endogenously determined. He also pointed out that the expectation for future credibility did not necessarily coincide with the current credibility. Eggertsson responded that in his other paper, credibility was created by issuing nominal debt, which made the reflationary program credible. Fujiki pointed out that the problem of miscommunication at that time should emphasize the commodity price rather than the price level in general. Ryuzo Miyao (Kobe University) cast doubt on the plausibility of the assumption about a negative 4 percent real interest rate since the early 1930s. William Cox (Federal Reserve Bank of Dallas) argued that in comparison to the United States around 1937, the issue of the zero lower bound might not be so critical at present because international capital markets were now quite open and the exchange rate could move a lot. Junggun Oh (The Bank of Korea) stated that the effectiveness of interest rate policy might have decreased recently, so the central banks should consider again the role of money and credit.