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Gauti B. Eggertsson and Benjamin Pugsley

Discussion Paper No. 2006-E-19

IMES

INSTITUTE FOR MONETARY AND ECONOMIC STUDIES

BANK OF JAPAN

C.P.O BOX 203 TOKYO
100-8630 JAPAN

IMES Discussion Paper Series 2006-E-19
August 2006

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Abstract

This paper studies a dynamic 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 US Federal Reserve, the President of the United States, and key administration officials about future price objectives were responsible for the sharp recession in the US in 1937-38, one of the sharpest recessions in US economic history. Poor communication policy is the mistake of 1937. Before committing the mistake of 1937 the US policy makers faced economic conditions that are similar in some respect to those confronted by Japanese policy makers in the first half of 2006.

Keywords: deflation; zero bound on interest rates; regime changes; Great Depression
JEL classification: E52, E65, N12

* Federal Reserve Bank of New York (E-mail: Gauti.Eggertsson@ny.frb.org)
** University of Chicago (E-mail: pugsley@uchicago.edu)

The views expressed are those of the authors and do not reflect those of the Federal Reserve Bank of New York or the Federal Reserve System. This paper was prepared for the Annual Bank of Japan Conference 2006. We thank Frederic Mishkin, Andrew Filardo, Petra Geraats, Marvin Goodfriend, Hitoshi Mio, Maurice Obstfeld, Kunio Okina, Andrea Tambalotti, Cedric Tille, Michael Woodford and seminar participants at the Bank of Japan and the Federal Reserve Bank of New York for comments and Stephen Cecchetti for data.

1 Introduction

The economic conditions can be summarized as follows: 1) There are signs that the 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 US economic history. These circumstances may sound familiar to Japanese audience. In some respects Japanese policymakers confront the same problems today. How should one manage monetary policy in a 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 US mistake as a precautionary tale for both current and future policy makers.

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 of 1937 and June of 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 communications 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 7 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.

We show that this propagation mechanism is particularly damaging at zero interest rates by constructing a stylized stochastic general equilibrium 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

[1] We use quarterly estimates of real and nominal gross national product from Barger and Klein, which are archived in the NBER Macrohistory database series q08296a q08260a respectively.

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 four percent inflation. Now assume that in response to recent coverage in the press that the public thinks that there is a five percent chance that the government will change its goals of four 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 rate 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 non-linear 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 policy maker is uncertain about the nature of the real shocks and wishes to be *conservative* he 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 (in section 5) we document several newspaper accounts that are consistent with our hypothesis. In addition we construct a new index based on newspaper records which summarizes the intensity of communication policy at a given 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, e.g. Friedman and Schwartz (1963), Romer (1992) and Meltzer (2003), have mostly focused on static changes in some measure of the money supply and static changes (or rather lack there of) in the short-term nominal interest rate which only 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,

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

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 5. 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 stochastic general equilibrium models with nominal frictions at zero interest rates. Recent paper in this vain include Krugman (1998), Jung, Terenishi, Watanabe (2005), Svensson (2001,2003), Jeanne and Svensson (2006), Eggertsson and Woodford (2003,2004), Christiano, Motto and Rostagno (2004), 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 (2004) and for a short summary see Eggertsson (2006c). The paper shares with this work its 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 a remarkable extent. The narrative approach is similar in spirit to Romer and Romer's (1989) influential study using Federal Reserve transcripts to identify policy shifts in the post war period.[3] There are some differences, however. The model of this paper suggests that the intentions of the policy makers, the focus of Romer and Romer's (1994) analysis, may not be the most natural place to look for narrative evidence for our model. Instead, it is the public's belief about future policy that matters in our analysis. While these two things may coincide (and will probably do so in most cases), they do not need to. In particular a more natural place to look for narrative evidence for our purposes is newspapers, since these reflect better public perceptions about policy 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 words are the beginning and end of policy commitments during the Great Depression. There were several actions 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, for example, were surely important in 1933 to make FDR's policy of reflating the price level credible. 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, i.e. 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

[3] See Orphaniides (2004) for an account of the discussion within the Federal Reserve during the Great Depression, based on Federal Reserve transcipts amoung other things.

changing beliefs since it was complementary to what the administration was saying about its future policy (it was deflationary in 1937 and then inflationary again in 1938).

Our modelling strategy and quantitative investigation is similar in spirit to Goodfriend and King's (2005) analysis of Volcker disinflation in early 1980's. As in Goodfriend and King (2005) 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 2-4 outline a formal general equilibrium model and investigate the effects of communications at low interest rates. Section 5 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 6 explores the extent to which the model can replicate the data by shifts in beliefs and finds that it is able to do so to a remarkable extent. Furthermore, the estimated shifts in beliefs match closely to the narrative account provided in section 5. Section 7 discusses the reasons for the mistake of 1937. The final section concludes with some speculations on what current policymakers in Japan can learn from the paper.

2 The Model

In this section we outline the model underlying our hypothesis of the mistake of 1937 and outline some general implications of the analysis which 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

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

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 ξ_t, $u(\cdot;\xi_t)$ is concave function that is increasing in consumption. Similarly, for each value of ξ_t, $q(\cdot;\xi_t)$ is increasing up to a satiation point at some finite level of real money balances as in Friedman (1969)[4]. $v(\cdot;\xi_t)$ is an increasing convex function. The vector of exogenous

[4]The idea is that real money balances enter the utility because they facilitate transactions. At some finite level of real money balances, e.g. when the representative household holds enough cash to pay for all consumption purchases in that period, holding more real money balances will not facilitate transaction any further and thereby add nothing to utility. This

disturbances ξ_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 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 $m_t \equiv \frac{M_t}{P_t}$. This equation defines money demand. Utility is weakly increasing in real money balances, but it does not increase beyond finite level of money balances $\bar{m}$ 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 100 dollar unless she expects to receive at least 100 dollars back! 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

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 $u(.)$. A satiation level in real money balances is also implied by several cash-in-advance models such as Lucas and Stokey (1987).

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

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 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

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

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

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

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

[6] There is no loss of generality in assuming a linear production function because we allow for arbitary 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 assumed here.

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

which says that the firm will charge a markup $\frac{\theta}{\theta-1}$ 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 takes place under flexible price. 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), (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 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

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

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 expected discounted sum of its nominal price to a 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

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

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), (13) for a given sequence of the exogenous shocks* $\{\xi_t, A_t\}$.

3 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 ξ_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 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, i.e. $\hat{Y}_t^n \equiv \log Y_t^n/Y^n$,and the three shocks are $g_t \equiv -\frac{\bar{u}_{c\xi}}{\bar{Y}\bar{u}_{cc}}\xi_t$, $q_t \equiv -\frac{\bar{v}_{h\xi}}{\bar{H}\bar{v}_{hh}}\xi_t$, $a_t = \log A_t/\bar{A}$ where a bar denotes that the variables (or functions) are evaluated in steady state. We define the parameters $\sigma \equiv -\frac{u_c}{u_{cc}Y}$ 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 the 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 lower the real interest rate makes

[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 discussion of the approximation method.

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

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 not only depends on the current interest rate but 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

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

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, leading to a lower real wages than in a flexible price equilibrium, thus supporting an output expansion.

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

$$m_t \geq \eta_i i_t + \eta_y Y_t + \epsilon_t \tag{18}$$

$$i_t \geq 0 \tag{19}$$

$$i_t(m_t - \eta_i i_t - \eta_y Y_t - \epsilon_t) = 0 \tag{20}$$

where $\eta_i < 0$ and $\eta_y > 0$, and $\epsilon_t \equiv -\eta_i\frac{1-\beta}{\beta} + \frac{\bar{u}_{c\xi} - \bar{q}_{m\xi}}{\bar{q}_{mm}}\xi_t$ and the last condition is a complementary slackness condition that says that 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 ϵ_t we can define an approximate sticky price equilibrium as follows.

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

4 Policy Regimes, Structural Shocks and Communications

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

Recall from last 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.

[10] With the exception of ϵ_t but we do not need to take a stance on this shock.

A1: The Great Depression structural shocks $r_t^n = r_L^n < 0$ *at date* $t = 0$*. It returns back to steady state* r_H^n *with probability* α *in each period. Furthermore,* $\hat{Y}_t^n = 0 \; \forall \; t$*. The stochastic date the shock returns back to steady state is denoted* τ*. To ensure a bounded solution the probability* α *is such that* $\alpha(1-\beta(1-\alpha)) - \sigma\kappa(1-\alpha) > 0$

For a detailed discussion of the how the structural shocks q_t, g_t, a_t give rise to these shocks, see Eggertsson and Woodford (2004). The next section turns to policy. We model communication 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.

4.1 The Deflationary Regime

We first study an equilibrium under the assumption that the central bank targets a zero inflation target 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 when assuming A1 then

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

which implies by (16) that

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

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, i.e.

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

An equilibrium under Policy Regime 1 is now defined as

Definition 4 *Policy Regime 1 (The Deflationary Policy Regime). Equilibrium under Policy Regime 1 and assuming A1 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 equation (17) and (16) by using (21)-(23). The value for π_t and Y_t that solve these equation in period $t < \tau$ are the numbers π^d and $\hat{Y}^d$ (where d stands for "deflationary regime") that solve the two equations

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

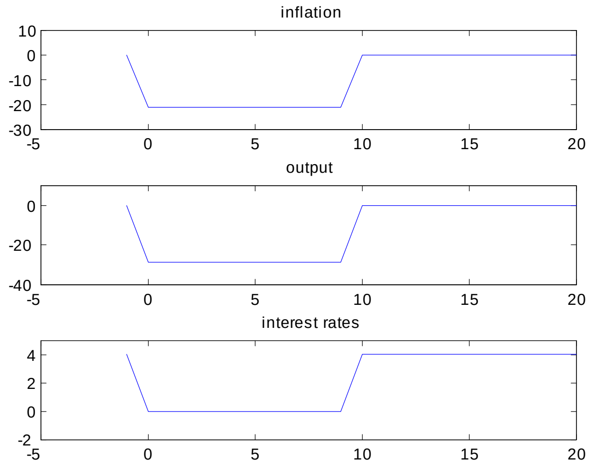

Figure 1: Output contraction at zero interest rates.

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

yielding

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

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

Table 1

parameters	calibrated values
σ	0.5
ν	2
β	0.99
θ	10
κ	0.02
α	0.1
r_L^n	-0.04

Figure 1 shows the output contraction and deflation under A1 that is predicted by the model. The parameters assumed are shown in Table 1 and are taken directly from Eggertsson and Woodford (2003) and Eggertsson (2006a). The parameter σ is the intertemporal elasticity of substitution (so that the coefficient of relative risk aversion is 2, which is in line with micro evidence), ν is the inverse of Frisch labor supply (implying a Frisch elasticity of 0.5, which is also in line with micro evidence), β is calibrated to match a steady state real interest rate of 4% per year, θ corresponds to a markup of 10 percent. The parameter κ is from the estimate by Rotemberg and Woodford (1997). The the probability of the shock reverting in the next period α is calibrated at 10 percent, which implies an expected duration of 10 periods.

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 steady state in period $\tau = 10$ (which is the expected duration of the shock). The model indicates an output collapse of 30% 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 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 α in A1 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 reflect 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 bring about the output collapse.

4.2 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, i.e. $\pi_t = \pi^* > 0$. Under A1 this implies that in Policy Regime 2

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

In addition we assume, as in Goodfriend and King (2005), that the public believes with some probability γ_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 γ_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 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 γ_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 (2006) who study a regime change model where there is a probability γ of the government reneging on its previous commitment and reoptimizing. If γ were deterministic then the expected duration of the regime would be $\frac{1}{\gamma}$ so that as γ approaches zero the regime is perfectly credible and the public believes the regime will last forever, but when it is 1 the regime has no credibility, and the public expects it to be abandoned in the next period.

Another interesting interpretation of γ_t concerns its variations. Since this parameter is likely to change

[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 US history, such as the 70s (see e.g. Summers (1991) for discussion). On those occasions, however, there has been positive inflation so that negative real rate of interest has easily been accomodated.

in the light of new information about the policy intentions of the government, changing values of γ_t can be interpreted as reflecting communications by the government about its policy objectives.

Under A1 the solution for output, denoted Y_t^*, at time $t \geq \tau$ solves equation (17), i.e.

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

so that in the reflationary regime

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

and

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

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, i.e.

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

An equilibrium under the reflationary regime, i.e. Policy Regime 2, can now be defined as follows:

Definition 5 *Policy Regime 2 (Reflationary Policy Regime). Equilibrium under Policy Regime 2, assuming A1, 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 equation (17) and (16) with (26)-(30), along with the solutions (24) and (25). The value for π_t and Y_t that solve these equation in period $t < \tau$ are the numbers π_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

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

were 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 solution is linear in the state variable γ_t and r_t^n which implies by (27) that the expectation of π_{t+1}^r conditional on the regime being reflationary is the same as π_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 π^*. We can ignore the fourth contingency that 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 π_t^r that satisfy these four equations. Substituting (33) and (34) into (31) and (32) then π_t^r and Y_t^r solve

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

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

which yields

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

where the value of each of the functions A,B,C,D,F are given in the footnote.[12] All of these function only depend on time through γ_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 the numbers π^d and Y_t^* are given by (25) and (29).

As one would expect these equations are increasing in the inflation target π^* 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 last section.

Of even more interest to us is how the solution depends on the probability γ_t. Figure 2 shows the solution in 37 and 38 under the assumption that the shock reverts at time $\tau = 10$ and that under the assumption that Policy Regime 2 is in effect throughout. It shows the solution under four possible values

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

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

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

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

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

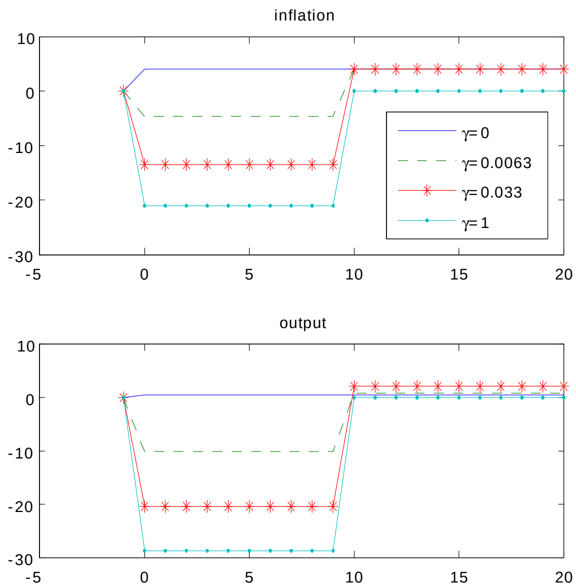

Figure 2: Output and inflation are extremely sensitive to small variations in the signal γ_t.

of γ_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 3.3 percent probability that the regime will be abandoned in the next 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 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 ρ_t. Given our assumption that $E_t\gamma_{t+1} = \gamma_t$, the probability ρ_t can be computed as

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

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

Table 2

γ_t	ρ_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

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 γ_t from 0% to 0.63% reduces output by -10.1% in the presence of large

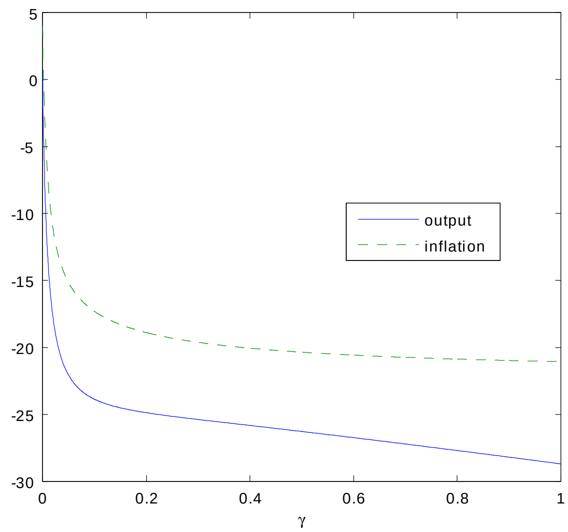

Figure 3: The response of output and inflation to changes in γ_t is non-linear and extremely sensitive at regions of high credibility.

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 the 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 γ_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, i.e. when the public strongly believes in the reflationary policies.

The nonlinearity of the inflation and output in γ_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.

To put some more structure on this argument 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% negative natural rate of interest. Consider the effect of the same regime change as considered before but now let Regime 1 now be characterized by a 8% inflation target instead of a 0 percent inflation target. In this case an increase in γ_t is a signal of high inflation instead of too low inflation. If expectations of this inflationary regime are created then, conditional being in Policy Regime 2, $\pi_t = 4\%$ and output is given by the AS equation by

$$Y_t = \{1 - \beta(1 - \gamma_t)\}\kappa^{-1} * 4\% - \gamma_t \beta \kappa^{-1} * 8\% \tag{40}$$

Figure 4 shows that local to the fully credible inflation target of 4% output is extremely sensitive to communication of a deflationary regime, while it responds by much less if the communication is about

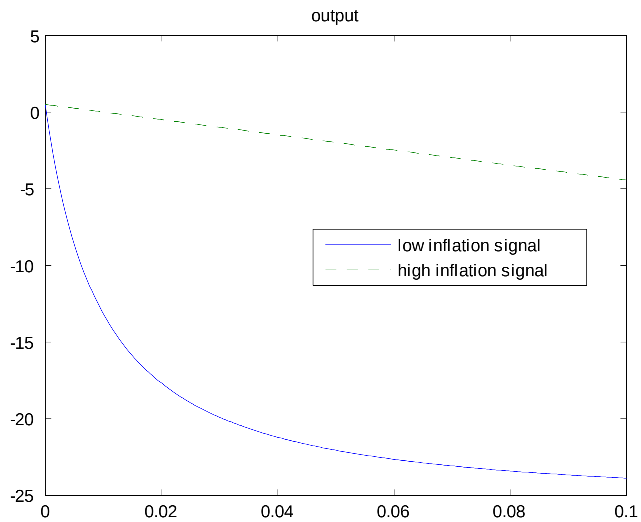

Figure 4: The nonlinearity of the zero bound indicates that output is much more sensitive to communcation that indicates excessive tightening than to communication that implies too loose an inflation policy.

excessively loose policy in the future.

5 Historical Narrative: The Great Depression in the US 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 next section estimates what pattern of beliefs could have generated the data, assuming our model is correct.

The paper's main hypothesis rests on the interpretation of the US recovery from the Great Depression 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 later expanded by 39 percent in 1933-37. The 25 percent deflation from 1929-1933 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 (IP) 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 1st, for example, he stated in the *Wall Street Journal*:

> [...] our 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.

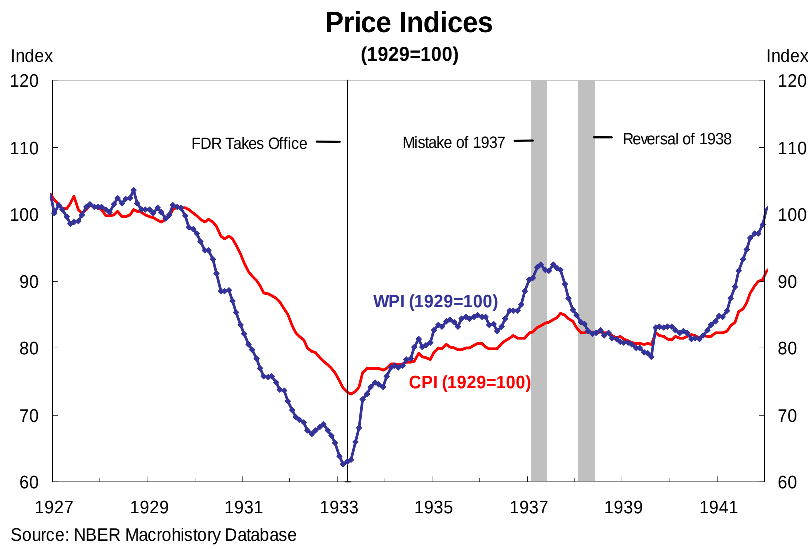

Figure 5: WPI and CPI indicate a recovery in the price level after Roosevelt's innauguration until the mistake of 1937.

FDR reiterated this in a radio address to the nation in one of his "fireside chats" on May 7th.[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 1 and 2.

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. President Roosevelt, for example, confidently claimed in his annual address to Congress on January 6th 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 still 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 history.[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 and the 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 the Board scheduled a raise in reserve requirements, to become effective on August 15th in 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 Federal Reserve generally presented the increase in the reserve requirements as having no immediate effect and because the excess reserves were "superfluous" (see e.g. discussion in Orphanides (2004)). The Federal Reserve agreed in January 1937 to a second round of

[13] See FDR (1933) "Radio Address of the President May 7".
[14] See Davis (1993) p.9.

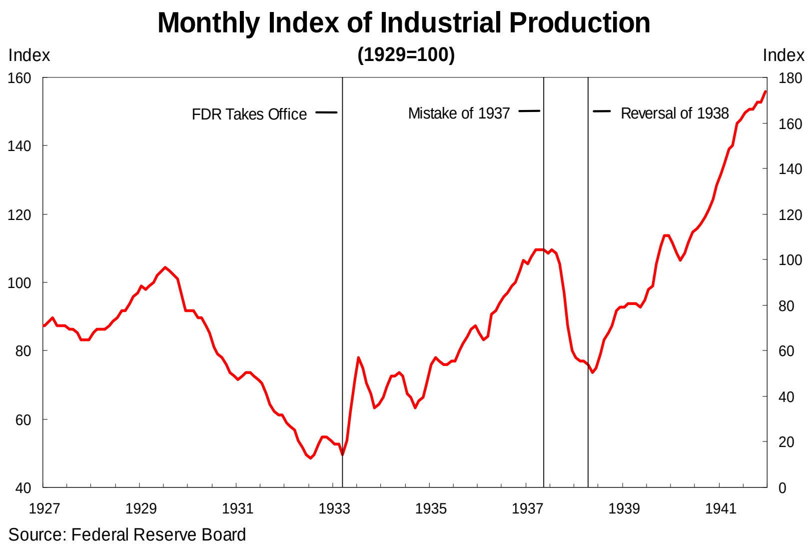

Figure 6: The reflation program in 1933 resulted in a rapid recovery in industrial production. Deflationary expectations in 1937 led to a large output contraction but the recovery resumed again in 1938 with the adminstration's renewed commitment to reflate.

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 of 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 17th, Marriner Eccles, the Chairman of the Fed, said in the Wall Street Journal, that "the short-term rates are excessively low and there may be a tendency for rates near the vanishing point to increase." Furthermore he suggested that the reserve requirements were also likely to cause an increase in long-term interest rates. The Wall Street Journal commented on this statement on the 18th of February 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 Marriner Eccles called upon 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 Federal Reserve and by other government officials. Their appetite for inflation was decreasing and they expected increases in short-term interest rate to be on the horizon. The model in this paper can explain how these communication could have such dramatic effect in a relatively short period. The next section makes this assessment concise by estimating the change in beliefs required to generate the recession.

[15] Chicago Daily Tribune, March 16th, pg. 1.

Table 3: The Mistake of 1937: Anti-inflationary Communcation

1. July 14, 1936	The Federal Reserve announces the first reserve requirement increase which will become effective on the 15th of August.
2. January 30, 1937	The Federal Reserve announces the second and third reserve requirement increases which will become effective the 1st of March and 1st of May.
3. February 18, 1937	Marriner Eccles, Chairman of the Board of Governors, in Senate hearings: "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, pg. 1.
4. March 15, 1937	Marriner Eccles, Chairman of the Board of Governors, gives a statement: "The upward spiral of wages and prices into inflationary levels can be as disastrous as the downwards spiral of deflation." --- Chicago Daily Tribune, March 16, pg. 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, pg. 8.
6. March 24, 1937	Marriner Eccles, Charimain of the Board of Governors, on inflation: "Chairmain 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	Franklin Delano Roosevelt holds a press conference: "I am concerned -- we are all concerned -- over the price rise in certain materials."
8. August 3, 1937	Franklin Delano Roosevelt's views on price level targeting revealed: Senator Elmer Thomas published a letter from Franklin Delano Rosevelt to him rejecting his proposal that the Federal Reserve should formally target the 1926 price level. --- Wall Street Journal, August 4, 1937, pg. 6.

Table 3 list several other announcements by key administration officials dating back to the recommendation of the Advisory Board in November 1935. The table shows several signals about the commitment to lower inflation in the early months 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 stockmarket 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 predepression levels. At the time of the mistake, prices as measured by both WPI and CPI were still well below their previous levels. WPI was 13 percent below its 1926 average and CPI was 20 percent. 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 level.

Figure 7 shows the response of leading commodity prices in a one year window surrounding several of the statements listed in table 1. The period of the key announcements, i.e. the one made from February to

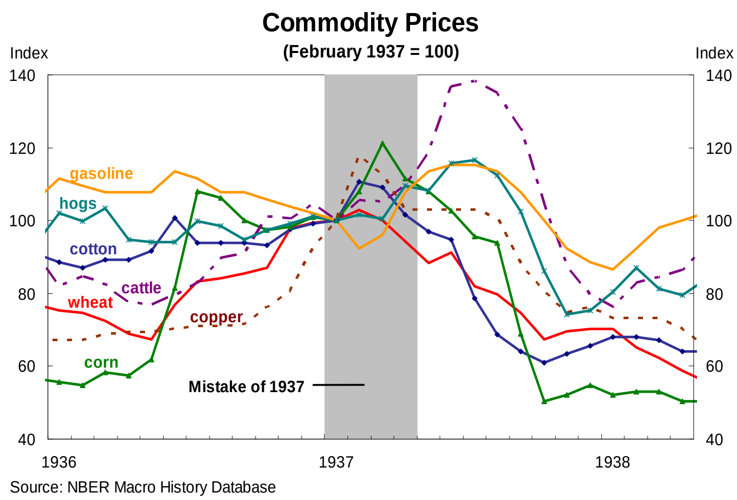

Figure 7: Commodity prices decline after confusing signals over the administration's reinflation policy.

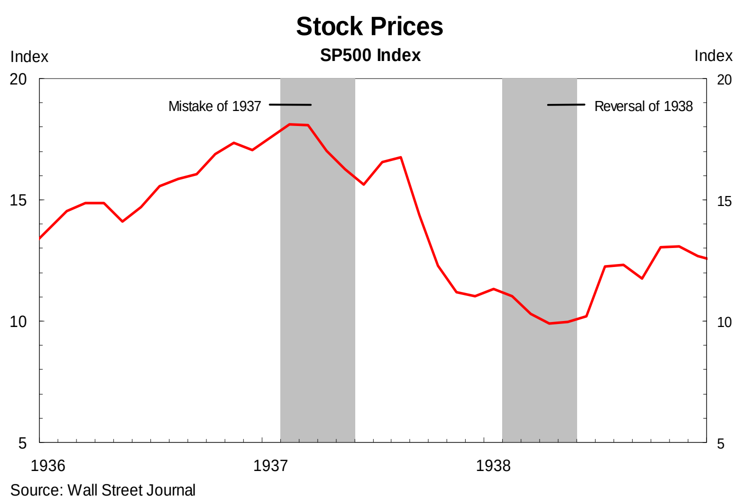

Figure 8: Stock prices reflect the market's reaction to contractionary and then expansionary announcements.

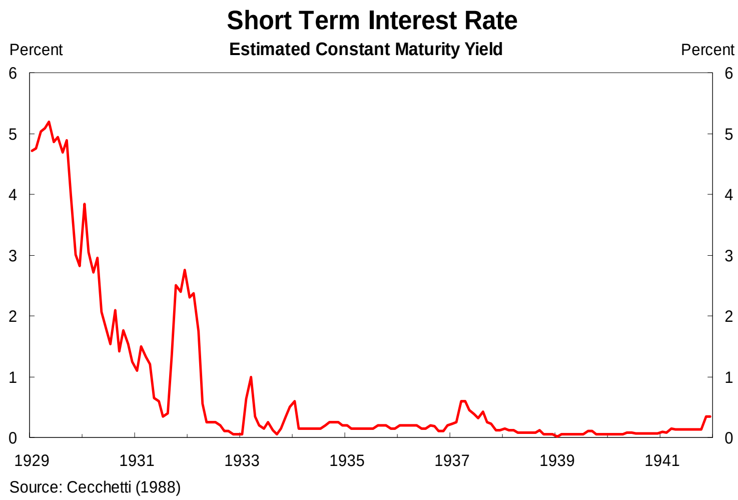

Figure 9: Interest rates as measured by the yield on three month treasuries remain close to zero througout the entire period.

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 towards deflation. The price of corn, for example, lost more than half its value in the six month period 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 future data) and Cecchetti (1992) (who uses interest rate and CPI data) both find evidence of an expectations shift in 1937 from inflationary to deflationary.

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)) and that monetary conditions were in fact "easy." We find instead that more than short-term interest rates, changing expectations about future interest rates, and how in these months they depended on inflation and output, are important to explain the economic collapse. Figure 9 shows the evolution of the short-term interest rate in 1930-1941 as measured by estimated yields in 3-month Treasuries. From late 1932 onwards 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.

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

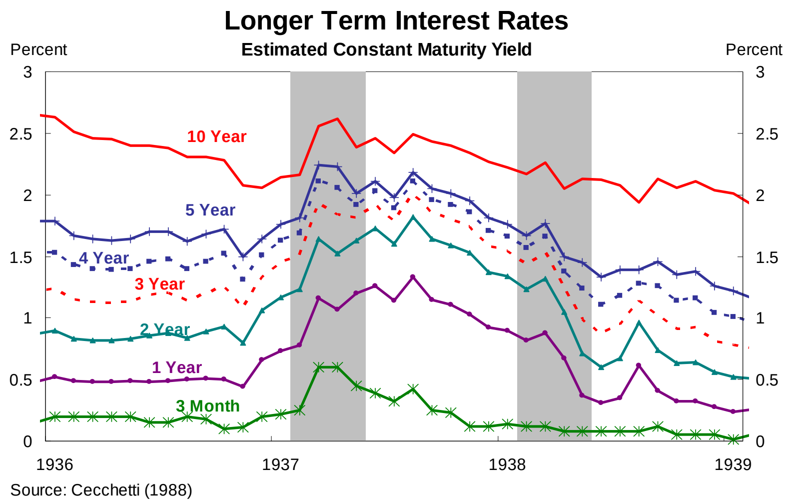

Figure 10: Longer term rates all show an increase in the expected short rate through the period of policy announcements

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 rates. 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 credible – the public expects the interest rate to remain at zero until the price level reached its 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 L.G. Telser analyzes in his (2001) article "Higher member bank reserve ratios in 1936 and 1937 did not cause the relapse into depression." The Friedman and Schwartz hypothesis, according to Telser, implies that member bank lending should have declined in response to the higher reserve requirements. In fact, Telser 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. Telser's finding come as little surprise since interest rate 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

[17] For computational simplicity we assumed the past sections that the government targeted a constant inflation target rather than a price level target.

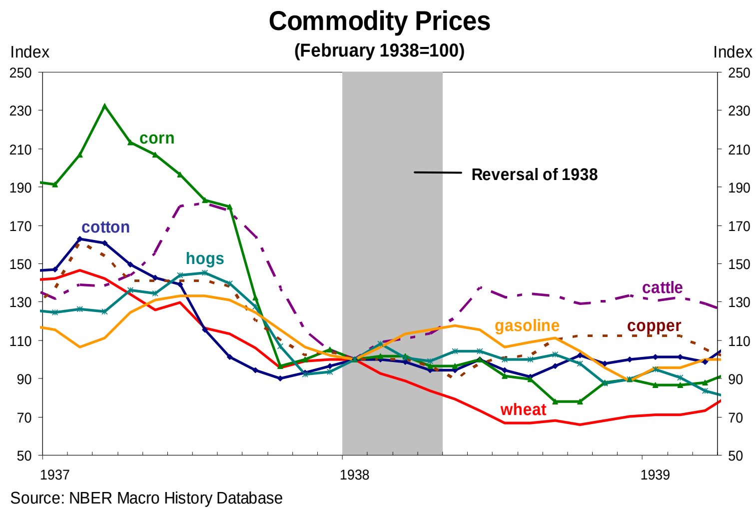

Figure 11: Commodity prices stabilize after the administration announces a renewed comittment to price inflation.

debt between money and 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 Marriner Eccles (1951), the Chairman of the Federal Reserve, 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 (partly urged on by Eccles in February, as mentioned above, something Eccles does not mention in his scathing criticism of the Treasury!).

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 rate 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.

Table 4. The Reversal of 1938: Pro-inflation Communcation

1. February 15, 1938	President Roosevelt holds a press conference: "At his press conference today, the President said that he believes now, as he did in 1933, that achivement of permanent prosperity depends on raising general price levels to those prevailing in 1926." --- Chicago Daily Tribune, February 16, 1938, pg. 1, "Hope Inflation Will Halt Depression."
2. February 18, 1938	President Roosevelt 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: 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	Franklin Delano Roosevelt, gives addresses Congress announcing that the reserve requirement increases will be abandoned: "The measures for expanding excess reserves which were announced on Thursday by President Roosevel will re-create 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.

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 key reflationary announcements. The first announcement of considerable importance was made at a February 15th 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 which he had instructed Federal Reserve 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 1938-1942 recovery was even stronger than in 1933-1937 and by most measures the economy had fully recovered by 1942.

It is often argued that it was wartime spending that finally lifted the US 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 Roosevelt's recommitment to inflation in the early months of 1938.

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 Newspaper database

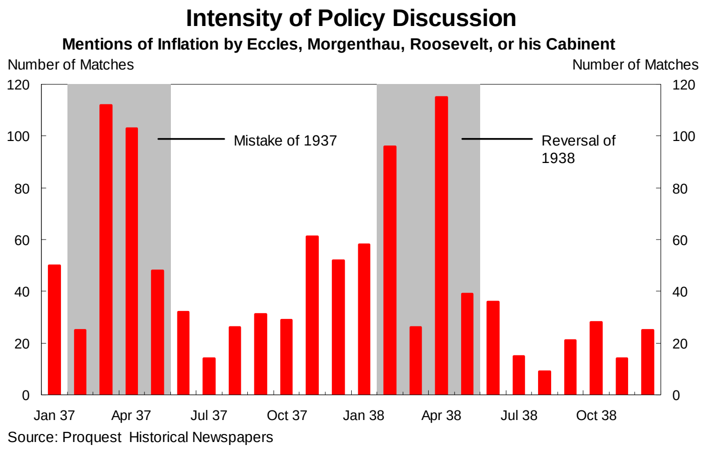

Figure 12: Communication intensifies around the periods of the mistake of 1937 and its subsequent reversal.

for front page or inner articles that mention caution of inflation, reflation, deflation, or price level and include the names of at least one key government official[18]. 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 preponderance of articles during the mistake period discuss 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.

6 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 last 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 a full scale 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 wholesale price index, 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 WPI as proxy for inflation. By studying the data at monthly frequencies we can explore the consequences of variations in the parameter γ_t at monthly frequencies.

To what extent can variations in γ_t explain the evolution of output and prices? To answer this questions

[18] 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.

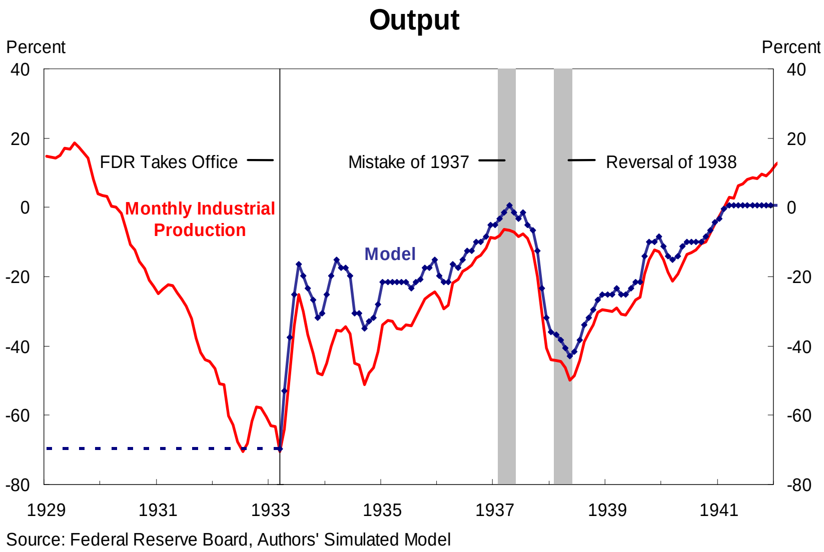

Figure 13: The model is able to match most of the changes in the output gap.

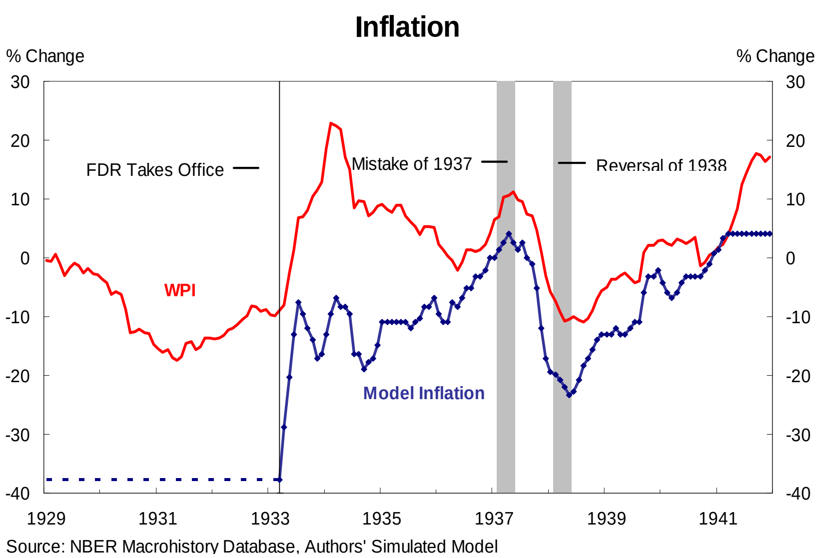

Figure 14: The model requires a larger amount of deflation than actually occured to match the collapse in output, especially in the earlier part of the recovery.

we recalibrate the parameters of the model to monthly frequencies. The parameters σ, ν, θ are unchanged. The parameter β is now 0.99ˆ(1/3). The parameter κ is a function of the "deep" parameters of the model and is given by.

$$\kappa = \frac{(1-\delta)(1-\delta\beta)}{\delta}\frac{\omega+\sigma^{-1}}{1+\omega\theta}$$

Assuming the same degree of price rigidities as (i.e. choosing the parameter δ for the monthly model so that the expected duration of a given price is unchanged) as in the quarterly model yields $\kappa = 0.0018$. We maintain the assumption from the last section that $r_L^n = -0.04/12$. Finally we choose $\alpha = 0.0284$ to match the output decline in the beginning of the recovery in 1933. The number indicates that at that time people expected the exogenous shocks to last for $1/\alpha$ months or about three years. In our simulation we condition on current policy set according to Regime 2 and the shock in the deflationary state ($r_t^n = r_L^n$).

To extract the values of γ_t that "best explain the data" we choose a path for this variable to minimize squared deviations of the model output from the data, i.e. minimize the criterion

$$min_{\gamma_t} \sum(\pi_t^{Model} - \pi_t^{Data})^2 + (Y_t^{Model} - Y_t^{Data})^2. \tag{41}$$

Figure 13 compares the values for output from the model, given our estimated sequence of γ_t, against the data. Figure 14 repeats this exercise for model-predicted and actual inflation. Figure 15 shows the estimated sequence of γ_t, re-expressed as ρ_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. The model, however, overpredicts the extent of the deflation needed to generate this output collapse. This feature is most prominent at the onset of the recovery in 1933. This may reflect the presence of other non-modelled factors that were important in explaining the contraction. The model does a better job capturing the size of the deflation and output contraction in the depression of 1937-38 than in 1933, which suggests that this recession is better explained by the propagation mechanism outlined here, recalling that there was no banking or financial crisis in 1937-38.

It is worth considering how the model fit can be improved, especially in the period 1933-1936, since then the inflation predicted by the model deviates substantially from the data. We conjecture that the main feature that could improve the fit of the model would be incorporating 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 between the model's predicted inflation and the data can be reduced. More importantly, there were several policy initiatives at the early stages of the New Deal that directly impacted marginal cost and markups in a way that is not modelled. The National Industrial Recovery Act (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 γ_t is the only factor affecting inflation. It is interesting to observe that the Supreme Court struck down large parts of the NIRA in 1935 that it deemed unconstitutional.[19] Together, these may help explain why the gap between the model predicted inflation and the data is larger 1933-36 than in 1937-41.

[19] See e.g. Davis (1986).

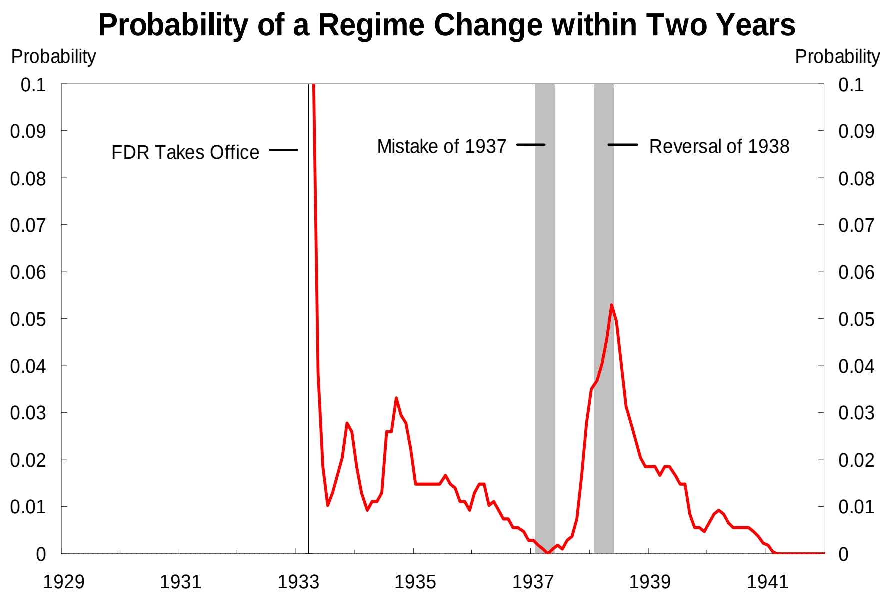

Figure 15: The shaded periods of policy announcements predict changes in the credibility parameter.

While there is a difference in the level of inflation between the model and the data - especially between 1933-1936 – 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 γ_t, which are shown in figure 15 re-expressed in terms of ρ_t. High values of ρ_t indicate a small degree of credibility of the reflationary regime and suggest that the public believes that the regime will 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 ρ_t declined substantially in 1933 with FDR's inauguration and – while showing some variation – it gradually declines until in 1937 when there is a clear shift in beliefs towards a deflationary regime, consistent with our maintained hypothesis. That trend is only reversed in the early months of 1938. These broad patterns of beliefs, estimated by the minimization of (41), are consistent with the narrative accounts we reviewed in section 2. As the figures reveal there appears to be slight lag, of one or two months, between our narrative account of the relevant policy communication and the change in the path for γ_t. The policy announcement thus predict changes in γ_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 makes some decisions in advance, of at least one or two months. 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 γ_t, when considered in light of the timing of policy communications, indicate 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.

7 What was the reason for the mistake of 1937?

In the model the mistake of 1937 is treated as an exogenous shifts in beliefs, captured by the parameter γ_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* policy makers choose to send the signals which had this dramatic effects on beliefs and shifted γ_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 of 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 President Roosevelt than to Federal Reserve policy makers. 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. FDR 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 FDR tried to stack the court in 1937 by proposing legislation that mandated several of the justices to retire due to age. This caused a great 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, FDR would have had difficulty paying close attention to monetary policy. Indeed, FDR's offhand remarks of inflationary dangers on April 2nd, which led to a large market reaction and that some newspapers would later blame for the depression of 1937-38,[20] appear to have been made without 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 against too much inflation in April of 1937 . Hence, it is possible to argue that whatever comments FDR made about inflationary pressures in the spring 1937, they were an example of confusing signals rather than a genuine change in his thoughts 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 and deliberated within the administration. His formal announcement in a press conference on February 19th was in fact prepared by the joint efforts of the Chairman of the Federal Reserve and the Secretary of the Treasury, along with several senior advisors.

While one may argue that FDR may have been less than deliberate about the change in course of policy in the spring of 1937, there appears to be less reason to doubt that the Federal Reserve abruptly and deliberately changed course during that period (as we document in section 5) The question is why? The most likely reason is that the Federal Reserve 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 Federal Reserve 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 Federal Reserve let us suppose that the Federal Reserve 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

[20] "Fall Elections Seen as Motive in Gold Action," *Chicago Daily Tribune,* Feb 16, 1938.

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 onwards under the assumption that the central bank believes that the natural rate of interest r_t^n is positive. In this case the Federal Reserve could minimize the output and inflation at their social optimum, i.e. 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 Federal Reserve could get 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 expectation 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 Federal Reserve 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 Federal Reserve was concerned, was a bad miscalculation of economic conditions.

8 Conclusion

A key question is whether or not Japan has been subject to contractionary spirals of the kind described in this paper in recent years. To make this assessment, and then compare the result to those during the Great Depression in the US, 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 Great Depression in the US. 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 kind 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 policy makers 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 US 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 BoJ 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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