The Making Of A Great Contraction With A Liquidity Trap And A Jobless Recovery

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A **jobless recovery** is a situation in which:

- Output growth recovers,

- but employment does not.

Bernanke (2009).

A **liquidity trap** is a situation in which:

- The nominal interest rate is zero; and

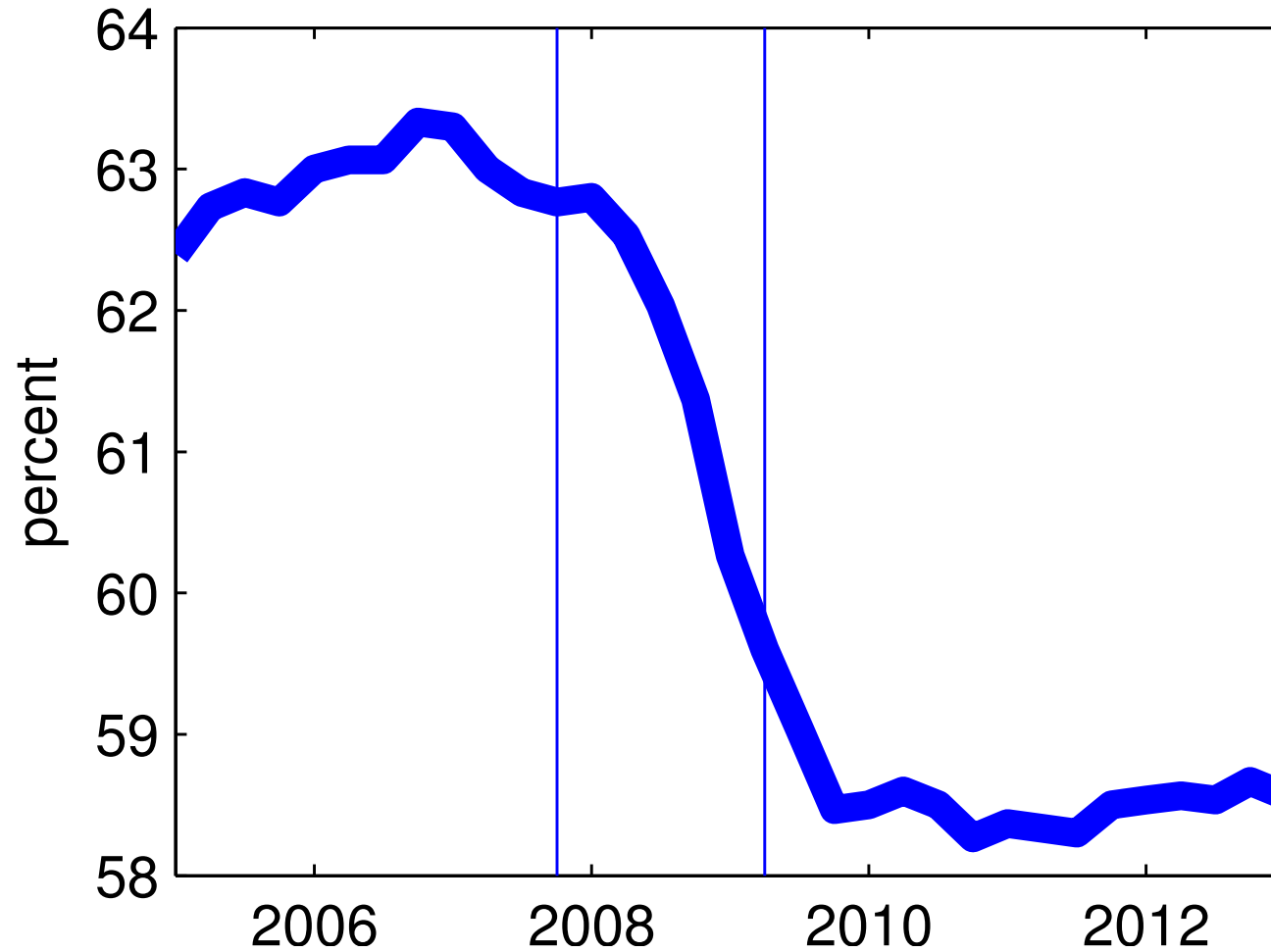- Expected inflation is below target.

Two historical examples of great contractions with a liquidity trap and a jobless recovery:

- Great Contraction of 2008 in the United States.

- Double Dip Recession of Japan in the 1990s.
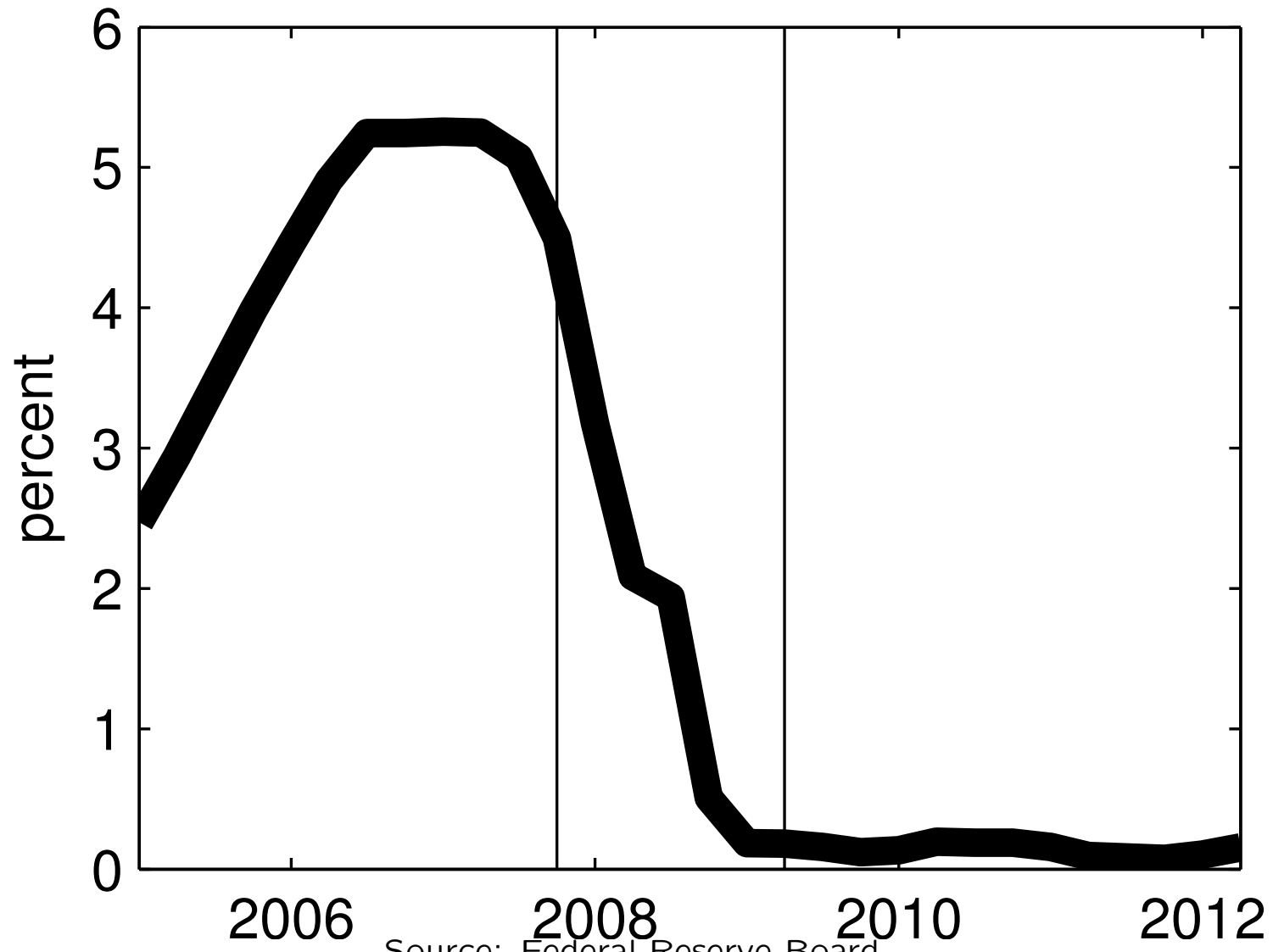
U.S. Real Per Capita GDP Growth: 2005-2012

Source: Bureau of Economic Activity.
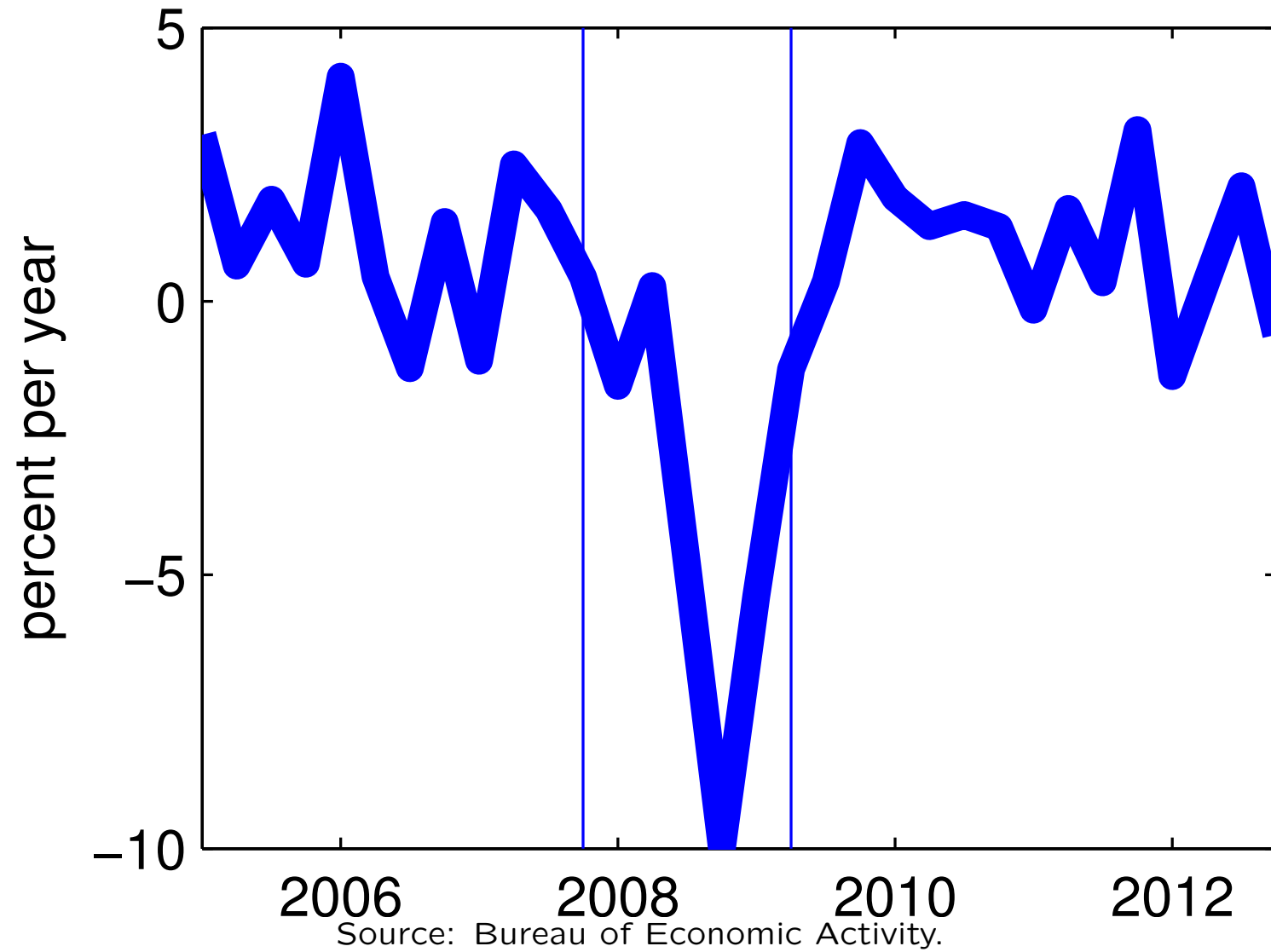
U.S. Civilian Employment-Population Ratio: 2005-2013Q1

Source: Bureau of Labor Statistics.

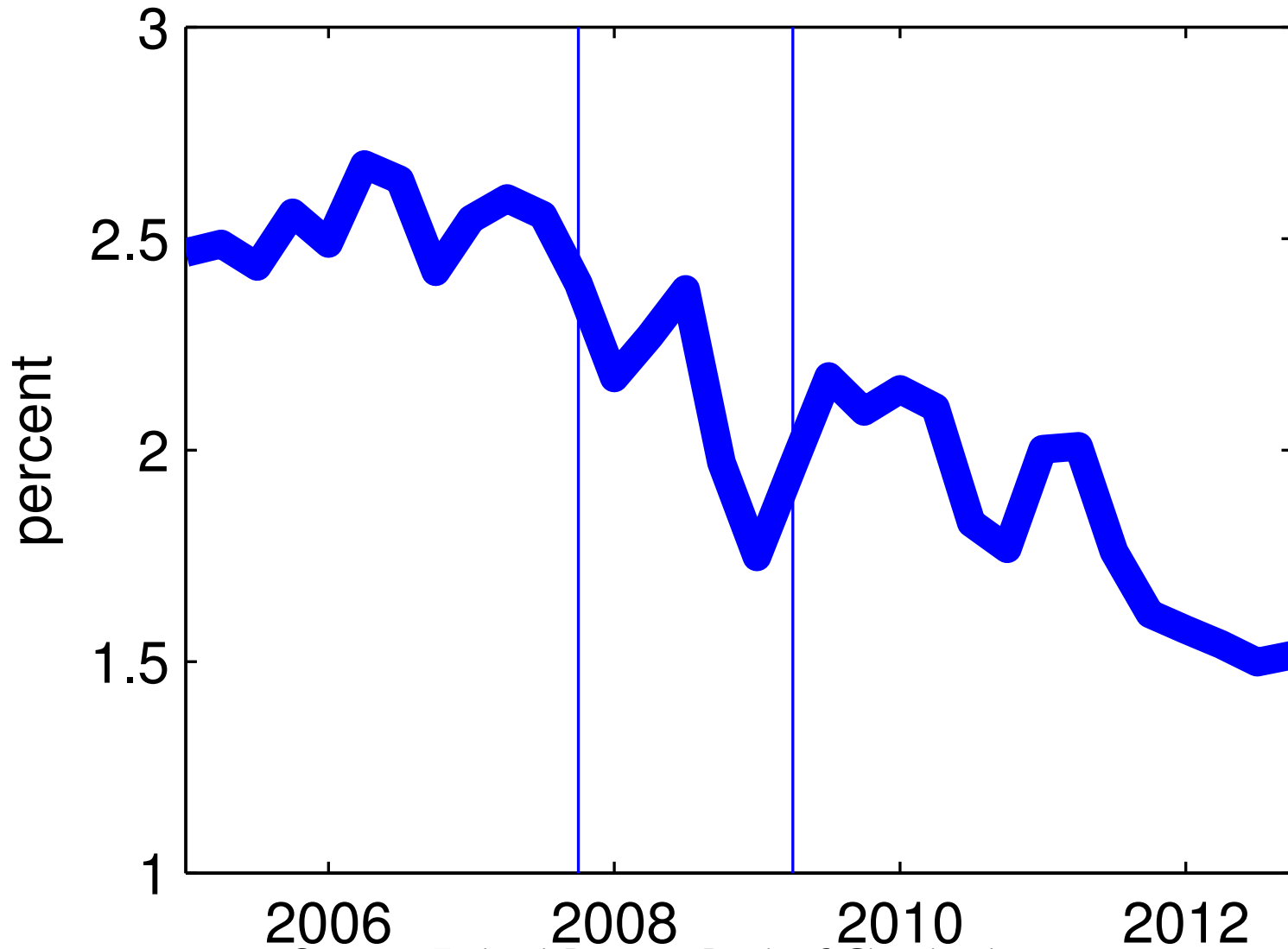$\Rightarrow$ The U.S. recovery from the Great Contraction of 2008 was **jobless**.

U.S. Federal Funds Rate: 2005-2012

Source: Federal Reserve Board.

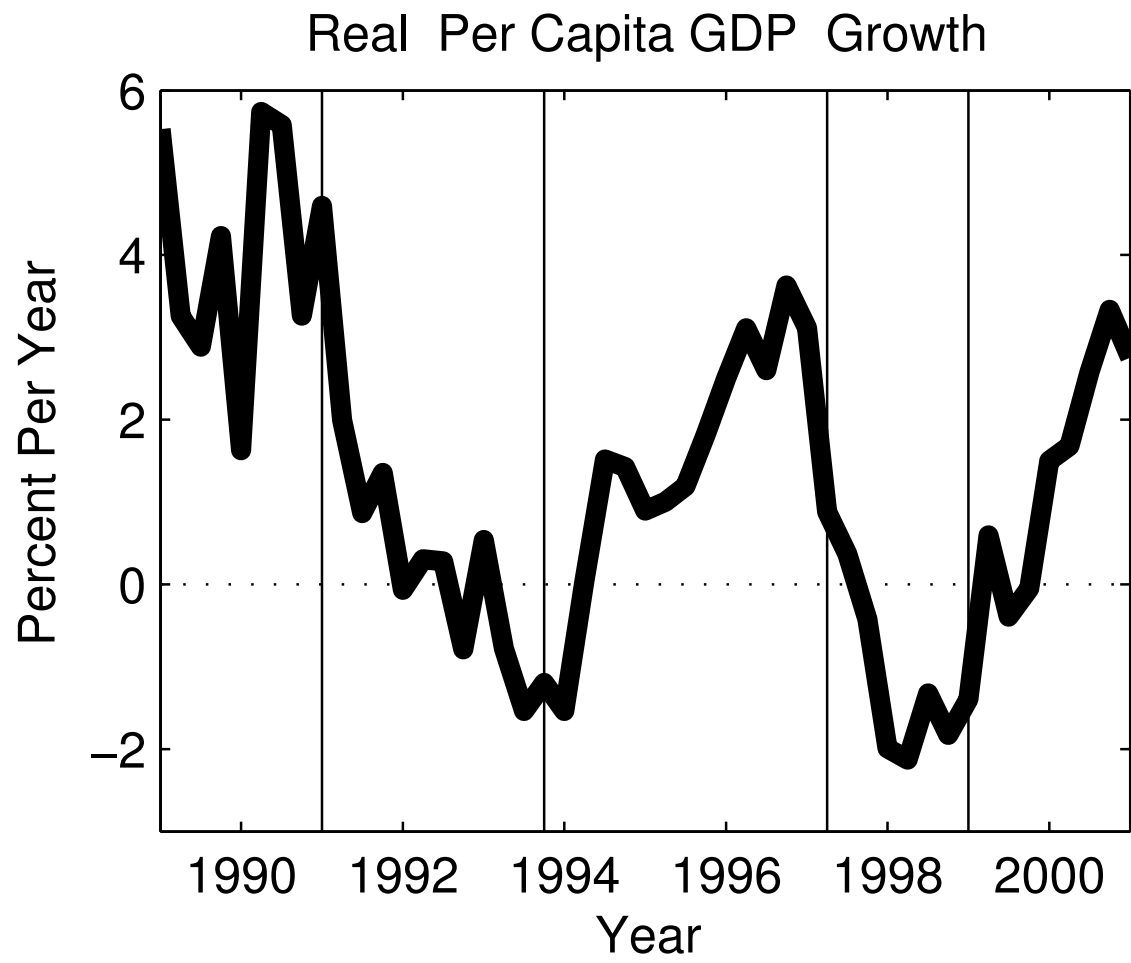# U.S. 10-Year Expected Inflation: 2005Q1-2012Q4

Source: Federal Reserve Bank of Cleveland.

$\Rightarrow$ The Great Contraction of 2008 pushed the U.S. economy into a **liquidity trap**.

Japan

The Double-Dip Recession

1989 – 2001

Real Per Capita GDP Growth 4qtr, Japan, 1989-2001
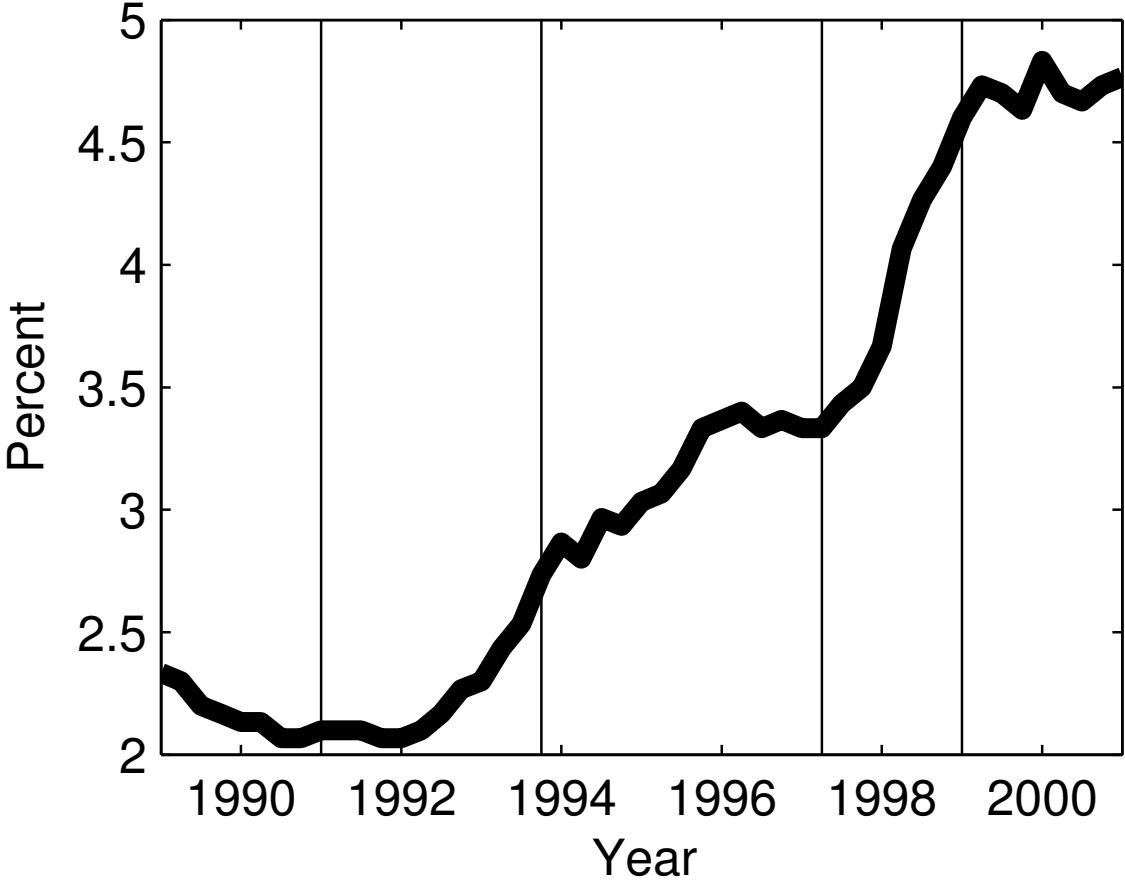

Real Per Capita GDP Growth

Japan, 1989-2001

Employment–to–Population Ratio
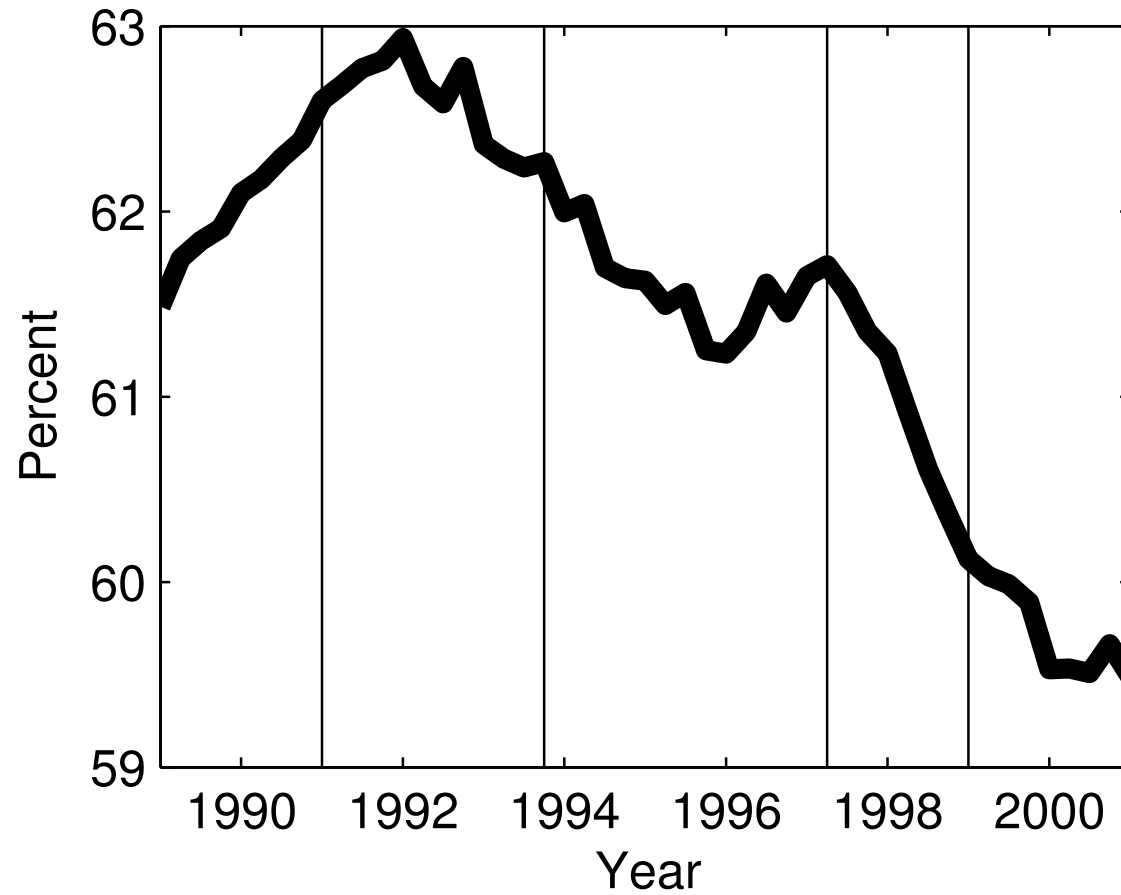
Japan, 1989-2001

Unemployment Rate

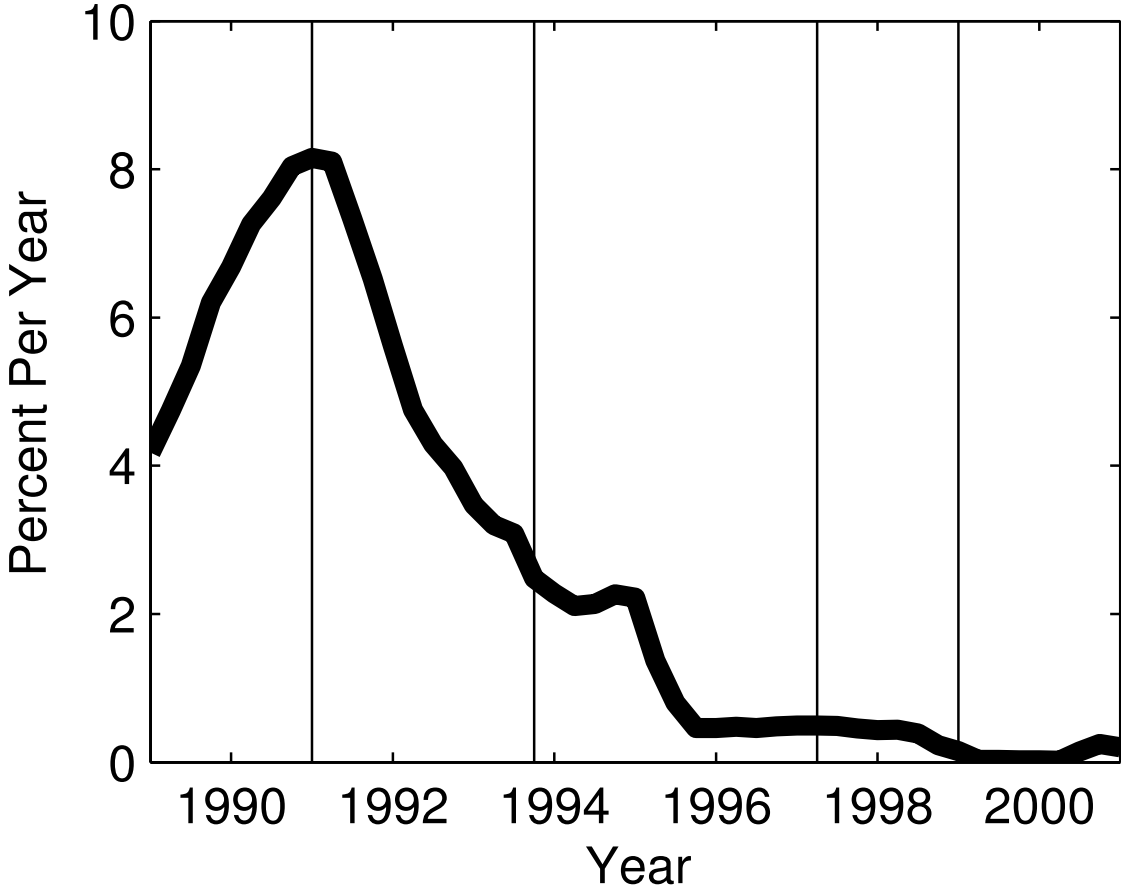$\Rightarrow$ The recovery from the recessions of the 1990s in Japan was **jobless**.

Japan, 1989-2001

Call Rate

Year over Year Growth of GDP Deflator, Japan, 1989-2001

Inflation
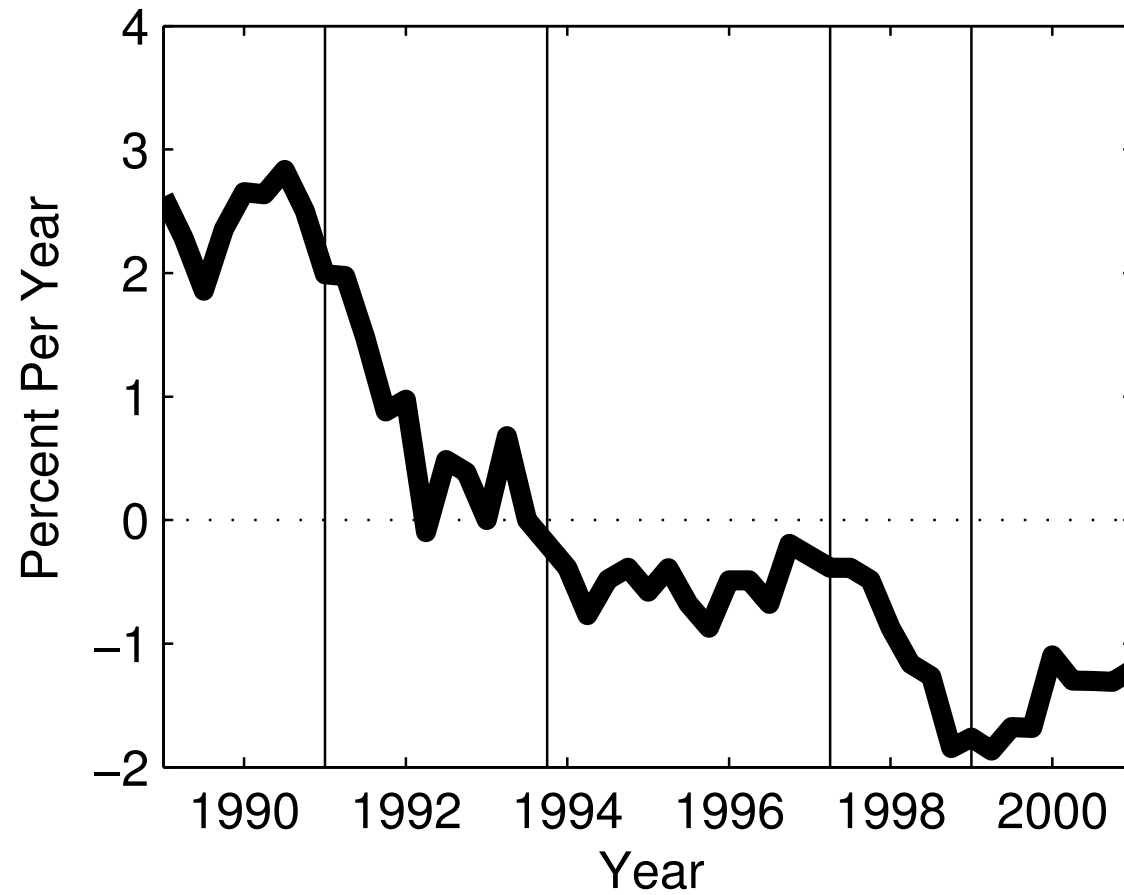
$\Rightarrow$ In the 1990s Japan fell into a **liquidity trap**.

This paper develops a theoretical model that predicts that a confidence shock can lead the economy into a liquidity trap with a jobless recovery.

Four Key Elements of the Argument:

1. Downward Nominal Wage Rigidity.

2. Monetary Policy follows a Taylor Rule.

3. The Zero Lower Bound On Nominal Interest Rates.

4. A Downward Revision in Inflation Expectations.

Related Papers on Liquidity Traps:

Krugman, 1998;

Eggertson and Woodford, 2003;

Benhabib, Schmitt-Grohé, and Uribe, 2001;

Related Papers on Jobless Recoveries:

Shimer (2012);

Calvo, Coricelli, and Ottonello (2012);

Related Papers on Interpreting the Great Recession as a Self-fulfilling Crisis:

Aruoba and Schorfheide, 2012;

Mertens and Ravn, 2012;

Element 1: Downward Nominal Wage Rigidity.

$$W_t \geq \gamma(u_t) \ W_{t-1},$$

where

- W_t nominal wage rate

- u_t, unemployment rate

Assumption: $\gamma'(u) < 0$

Empirical Evidence on

Downward Nominal Wage Rigidity

Probability of Decline, Increase, or No Change
in Nominal Wages Between Interviews

U.S. data, SIPP panel 1986-1993, within-job changes

	Interviews One Year apart	
	Males	Females
Decline	5.1%	4.3%
Constant	53.7%	49.2%
Increase	41.2%	46.5%

Source: Gottschalk (2005)

Note. Male and female hourly workers not in school, 18 to 55 at some point during the panel.

All nominal-wage changes are within-job wage changes, defined as changes while working for

the same employer.

Distribution of Non-Zero Wage Changes, Hourly Workers, 1996 F
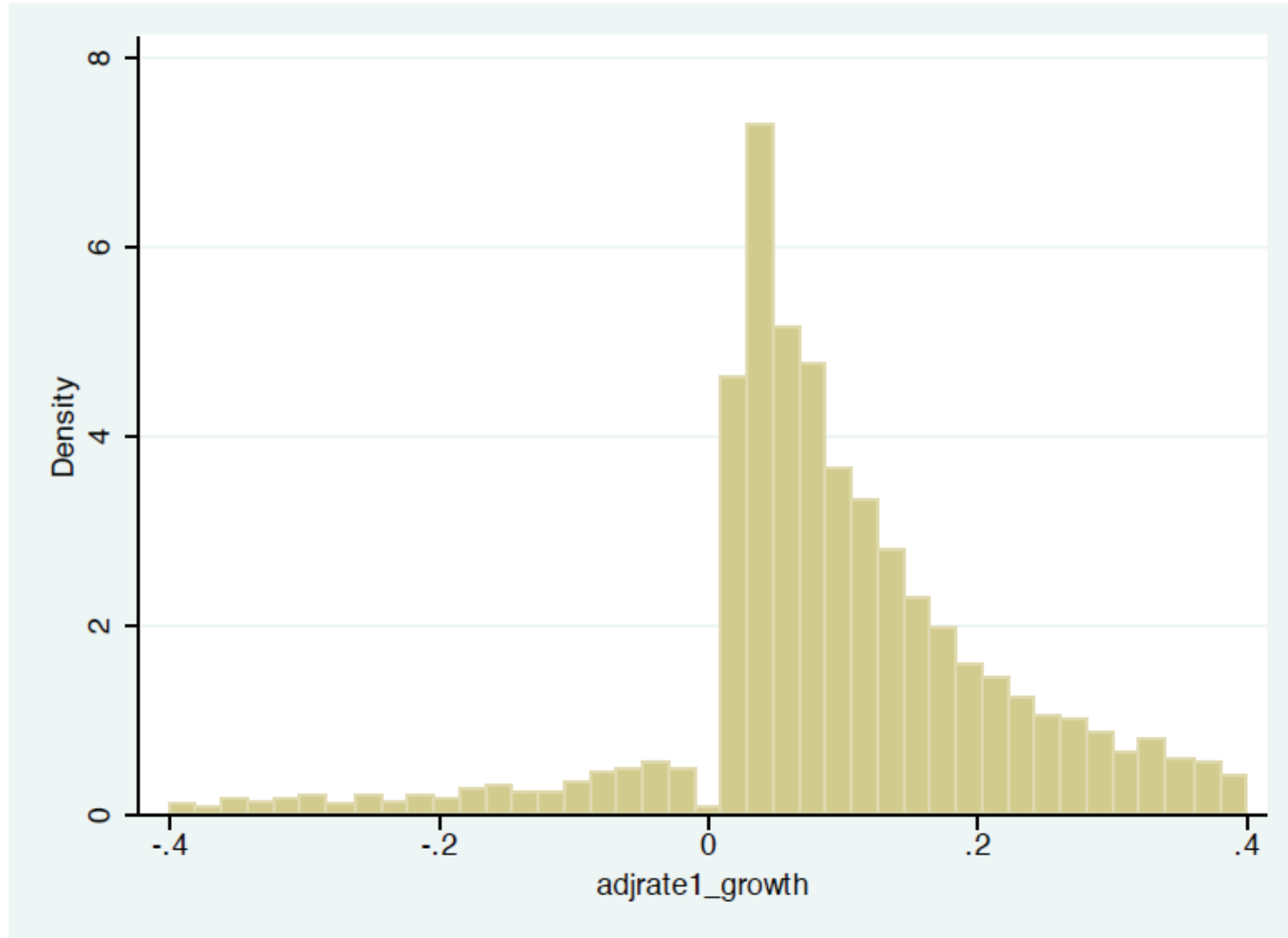
Quarterly, 1996-99. Source: Barattieri, Basu, and Gottschalk (2010)

Distribution of Nominal Wage Changes, 2011, USA

Figure 2
Distribution of observed nominal wage changes

Percent

(y-axis: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18)

(x-axis: -0.5, -0.4, -0.3, -0.2, -0.1, 0, 0.1, 0.2, 0.3, 0.4, 0.5)
Log change in reported earnings

Sources: Current Population Survey (CPS) and authors' calculations.
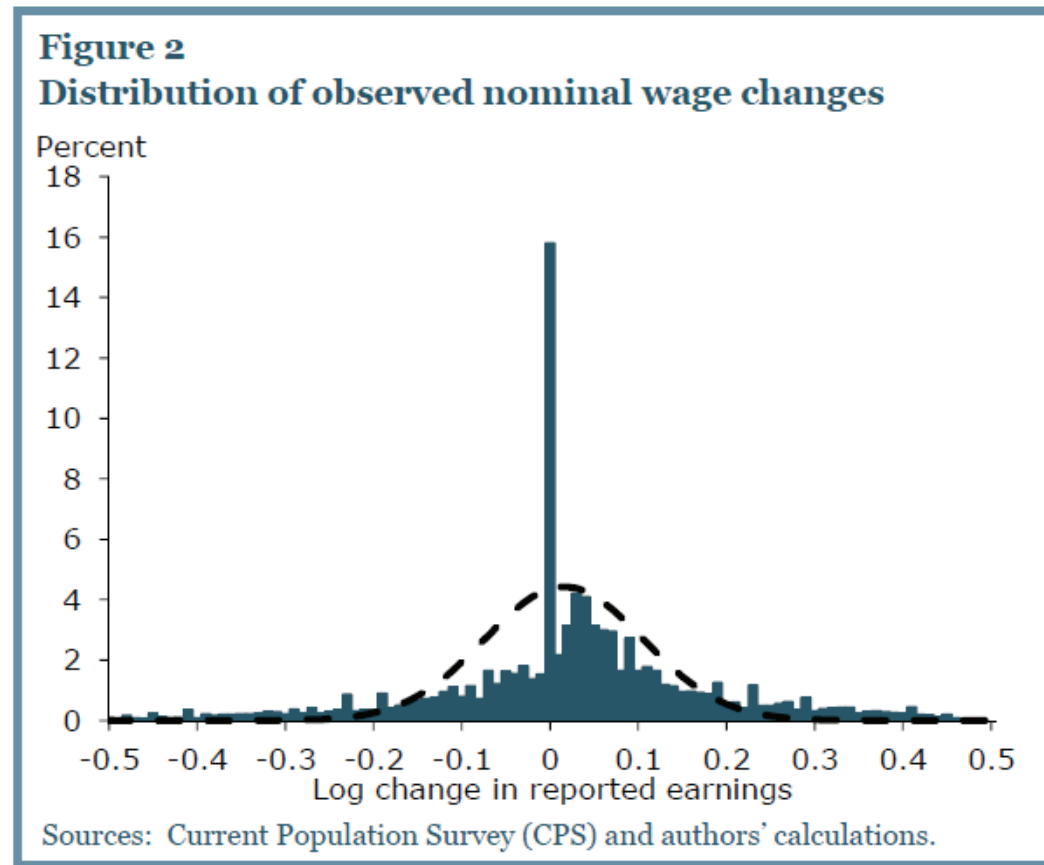
Source: Daly et al. (2012). Workers in the same job.

Distribution of 12-month log nominal wage changes in 2006 and 2011
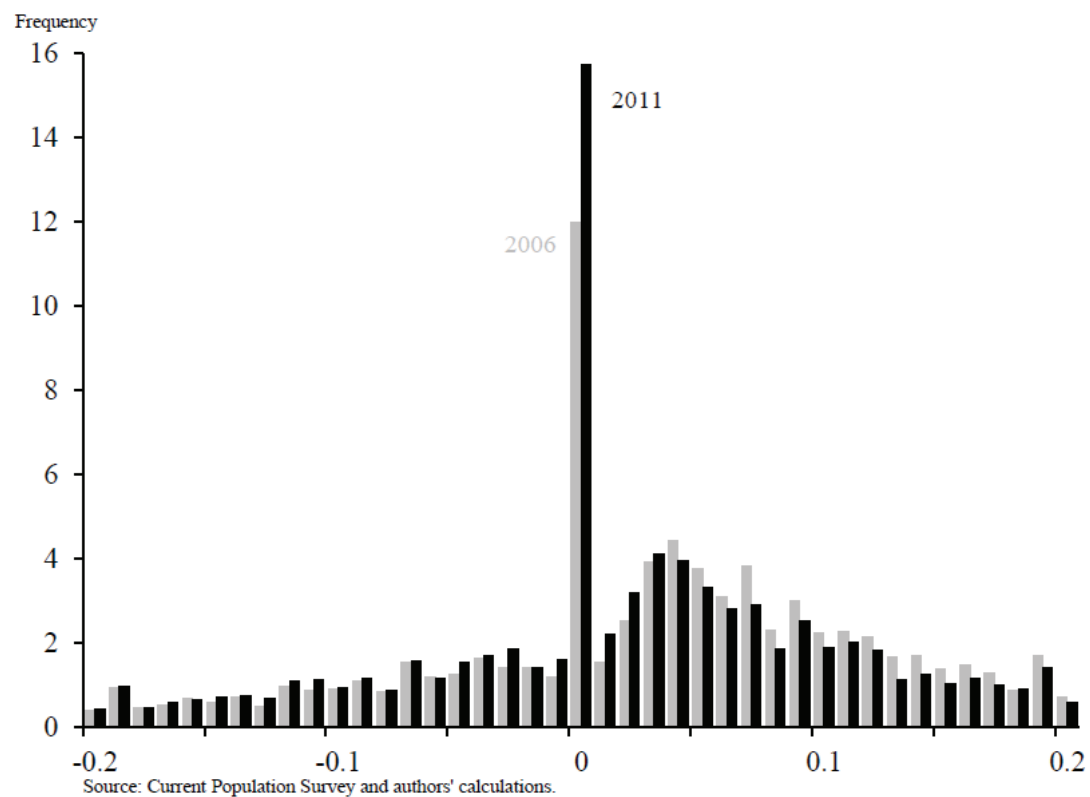
Source: Daly and Hobijn, June 2013.

Figure 1. Distribution of 12-month log wage changes in 2006 and 2011.

Source: Current Population Survey and authors' calculations.

Elements 2 and 3

- Monetary Policy Follows a Taylor Rule.

- The Zero Lower Bound on Nominal Interest Rates.

$$R_t = \max \left\{ 1, R^* + \alpha_\pi \left(\pi_t - \pi^* \right) + \alpha_y \ln \left(\frac{Y_t}{Y_t^*} \right) \right\}$$

$$\alpha_\pi > 1, \quad \alpha_y > 0$$

Households

Preferences:

$$E_0 \sum_{t=0}^{\infty} e^{\xi_t} \beta^t U(C_t)$$

Budget constraint:

$$P_t C_t + B_t + T_t = W_t h_t + R_{t-1} B_{t-1} + \Phi_t$$

Inelastic Labor Supply:

$$h_t \leq \bar{h}$$

Firms

Production function:

$$Y_t = X_t F(h_t); \quad \text{with } X_t/X_{t-1} = \mu > 1$$

Labor demand:

$$P_t X_t F'(h_t) = W_t$$

The Labor Market

$$h_t \leq \bar{h}$$

$$W_t \geq \gamma(u_t)W_{t-1}$$

$$(\bar{h} - h_t)\left(W_t - \gamma(u_t)W_{t-1}\right) = 0$$

Equilibrium: Let $w_t \equiv \frac{W_t}{P_t X_t}$ and $c_t \equiv C_t / X_t$

$$e^{\xi_t} U'(c_t) = \tilde{\beta} R_t E_t \left[\frac{e^{\xi_{t+1}} U'(c_{t+1})}{\pi_{t+1}} \right]$$

$$R_t = \max \left\{ 1, \frac{\pi^*}{\tilde{\beta}} + \alpha_\pi (\pi_t - \pi^*) + \alpha_y \ln \left(\frac{F(h_t)}{F(\bar{h})} \right) \right\}$$

$$c_t = F(h_t)$$

$$w_t = F'(h_t)$$

$$h_t \leq \bar{h} \quad \text{and} \quad w_t \geq \frac{\gamma(u_t)}{\pi_t \mu} w_{t-1}; \quad \text{where } u_t \equiv \frac{\bar{h} - h_t}{\bar{h}}$$

$$(\bar{h} - h_t) \left(w_t - \frac{\gamma(u_t)}{\pi_t \mu} w_{t-1} \right) = 0$$

A Key Inflation Threshold

$$\bar{\pi} \equiv \frac{\gamma(0)}{\mu}$$
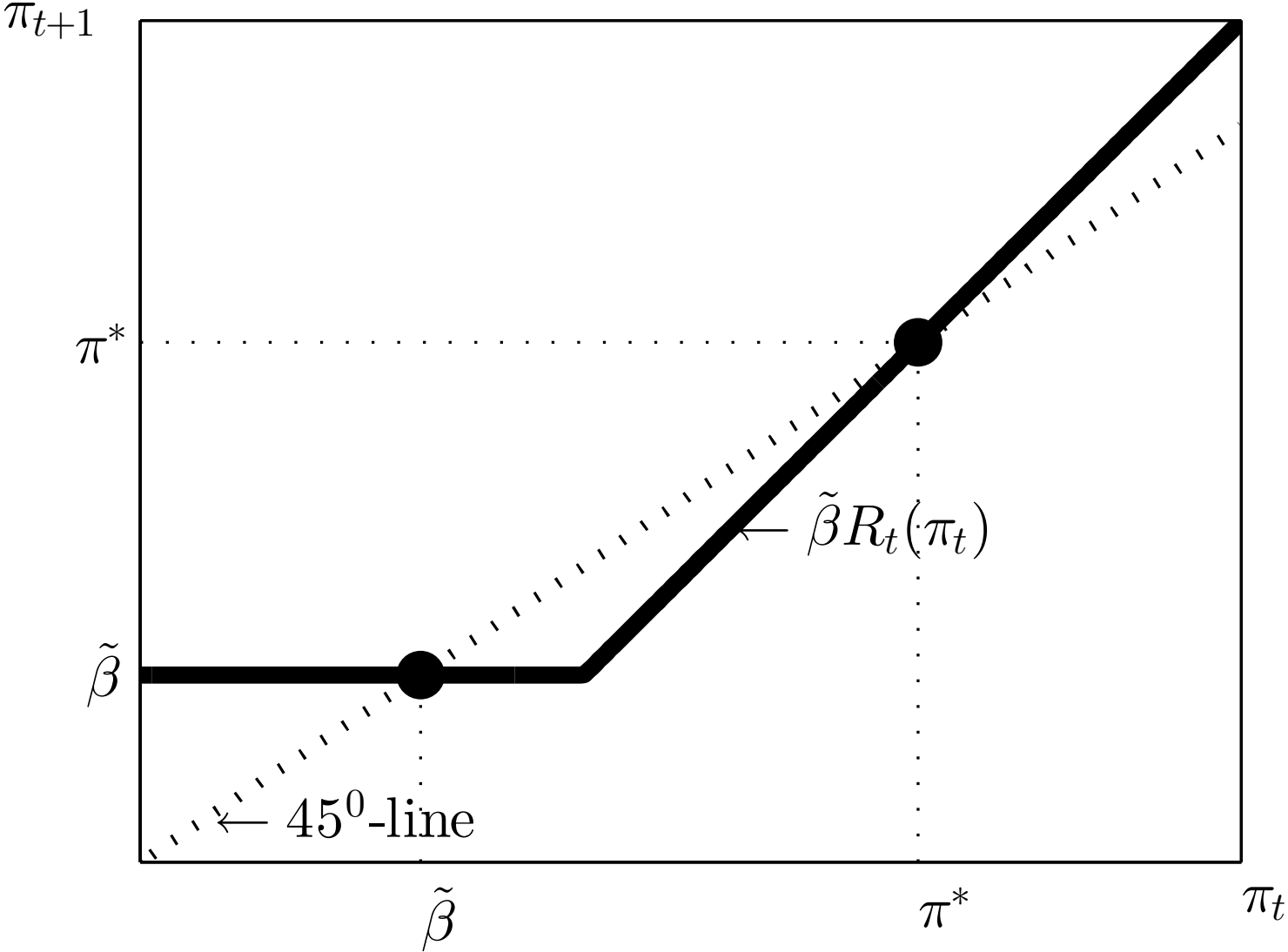
$\pi_t < \bar{\pi} \Rightarrow$ involuntary unemployment.

Steady State Equilibria:

$c_t = c, \ h_t = h, \ w_t = w, \ \pi_t = \pi, \ R_t = R$

$$R = \frac{\pi}{\tilde{\beta}}$$

$$R = \max\left\{1, R^* + \alpha_\pi \left(\pi - \pi^*\right) + \alpha_y \ln\left(\frac{F(h)}{F(\bar{h})}\right)\right\}$$

Two Steady States

Multiple Steady States

Proposition 1 (Existence of a Full-Employment Steady State)
*There exists a unique full-employment steady state ($u = 0$).
Moreover, at the full-employment steady state the inflation rate
equals the inflation target π^*.*

Proposition 2 (Existence of an Unemployment Steady State)
*There exists a unique unemployment steady state ($u = \bar{u} > 0$).
Moreover, at the unemployment steady state the economy is in
a liquidity trap ($R = 1$ and $\pi = \tilde{\beta} < \pi^*$).*

Element 4: A Downward Revision in Inflation Expectations (or confidence shock)

$$\pi_0 < \pi^*$$

Proposition 3 (Liquidity Trap) *Suppose that $\xi_t = 0$ and deterministic for $t \geq 0$. Further, assume that $\pi_0 < \pi^*$. Then, in any perfect foresight equilibrium,*

$$\pi_{t+1} \begin{cases} < \pi_t < \pi^* & \text{if } \pi_t \geq \dfrac{\gamma(0)}{\mu} \\ < \dfrac{\gamma(0)}{\mu} < \pi^* & \text{if } \pi_t < \dfrac{\gamma(0)}{\mu} \end{cases}, \qquad \text{for all } t \geq 0.$$

Furthermore, there exists a finite integer $T \geq 0$ such that $\pi_T < \dfrac{\gamma(0)}{\mu}$.

Proposition 4 (Chronic Involuntary Unemployment) *Suppose that $\xi_t = 0$ and deterministic for $t \geq 0$. Further, assume that $\pi_0 < \pi^*$. Then, in any perfect foresight equilibrium $u_t > 0$ for all $t \geq T$, where $T \geq 0$ is the finite integer defined in proposition 3.*

Calibrated Example:

$F(h) = h^\alpha$; with $\alpha = 0.75$

$u(c) = c^{1-\sigma}/(1-\sigma)$; with $\sigma = 2$

$X_t = 1.015^{1/4} X_{t-1}$;

$\tilde{\beta} = 1.04^{-1/4}$; real rate of 4 percent

$\pi^* = 1.02^{1/4}$; inflation target of 2 percent

$\alpha_\pi = 1.5$

$\alpha_y = 0.125$

$\gamma(u_t) = \gamma_1 \cdot (1 - u_t)^{\gamma_2}$; $\gamma_1 = 1.02^{1/4}$; $\gamma_2 = 0.19$.

Calibration of the Degree of Downward Wage Rigidity, $\gamma(u) = \gamma_1 (1-u)^{\gamma_2}$

- Set $\gamma_1 = \pi^* \Rightarrow$ At the full-employment steady state, nominal wages must grow at a rate larger than inflation, or 2%. Weak restriction: due to productivity growth, lower bound on nominal wages does not bind in the intended steady state.

- Set γ_2 so that if unemployment is 5 percent above the natural rate, then wages can fall frictionlessly by up to 2 percent per year.

This is a conservative criterion: Between 2008 and 2010, US unemployment increased from 5 to 10 percent, but nominal hourly wages did not fall. They actually **grew** by 3 percent per year.
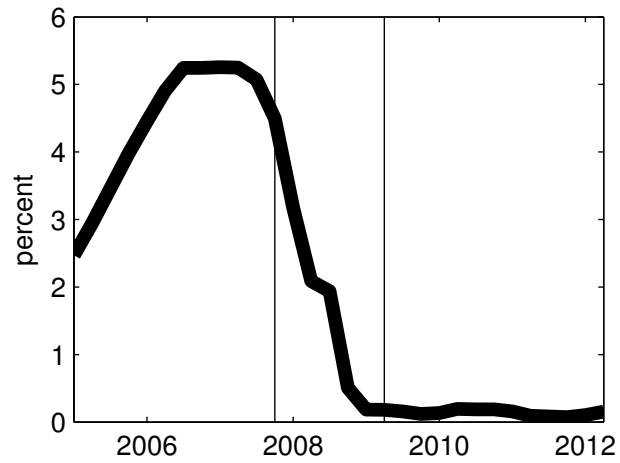
Dynamics Under Lack of Confidence Shock
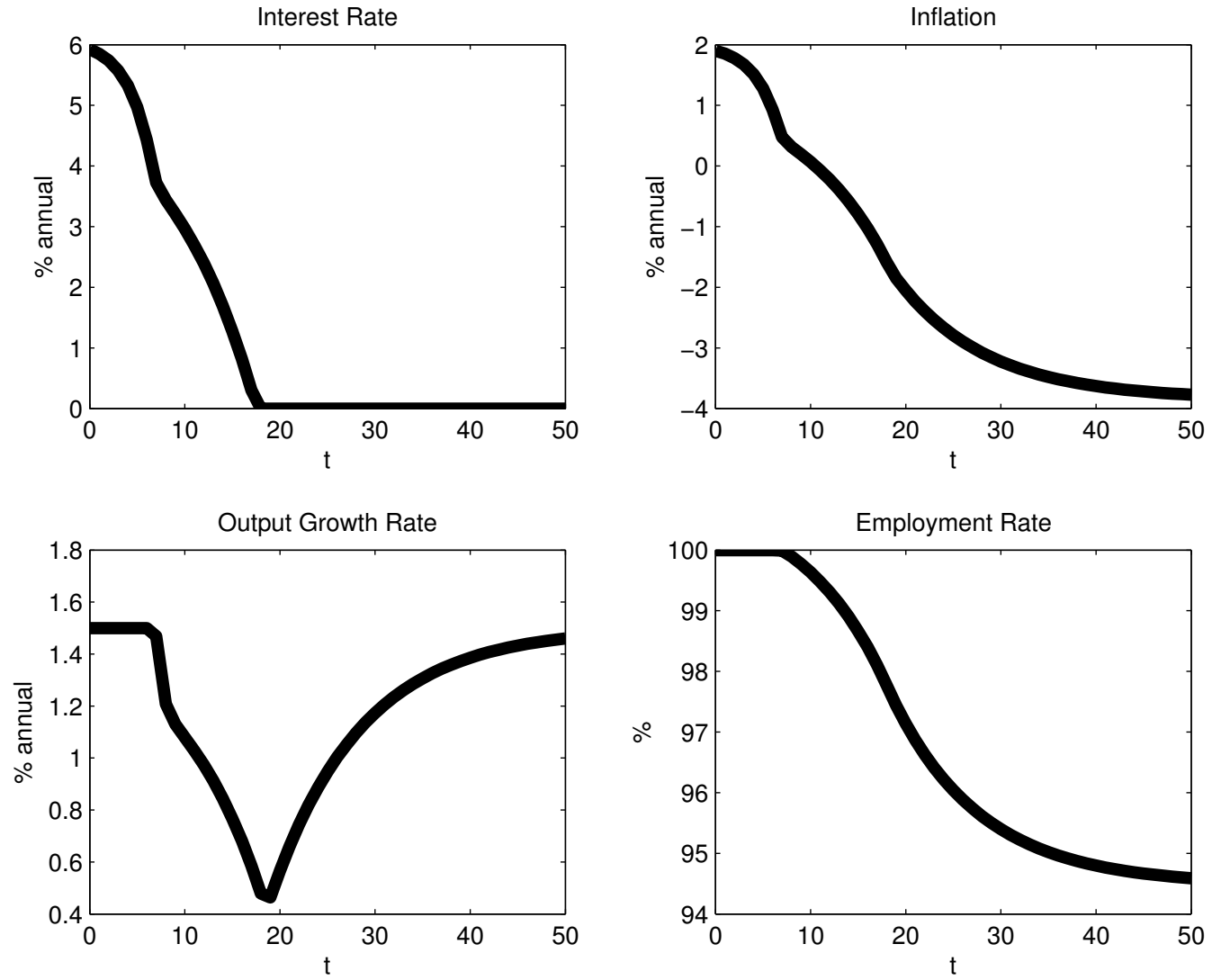
$\Rightarrow$ **A Lack of Confidence Shocks Leads** to

- A Great Contraction

- A Liquidity Trap
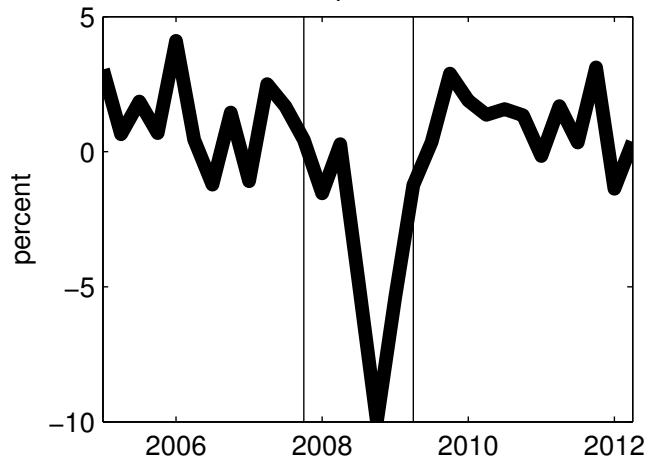
- A Jobless Recovery

The U.S. Great Contraction of 2008
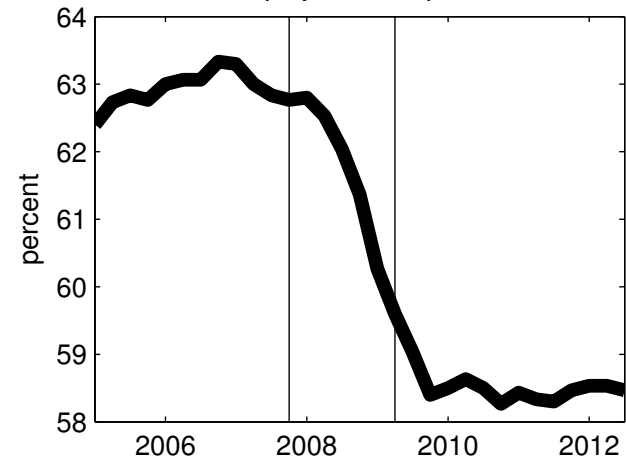
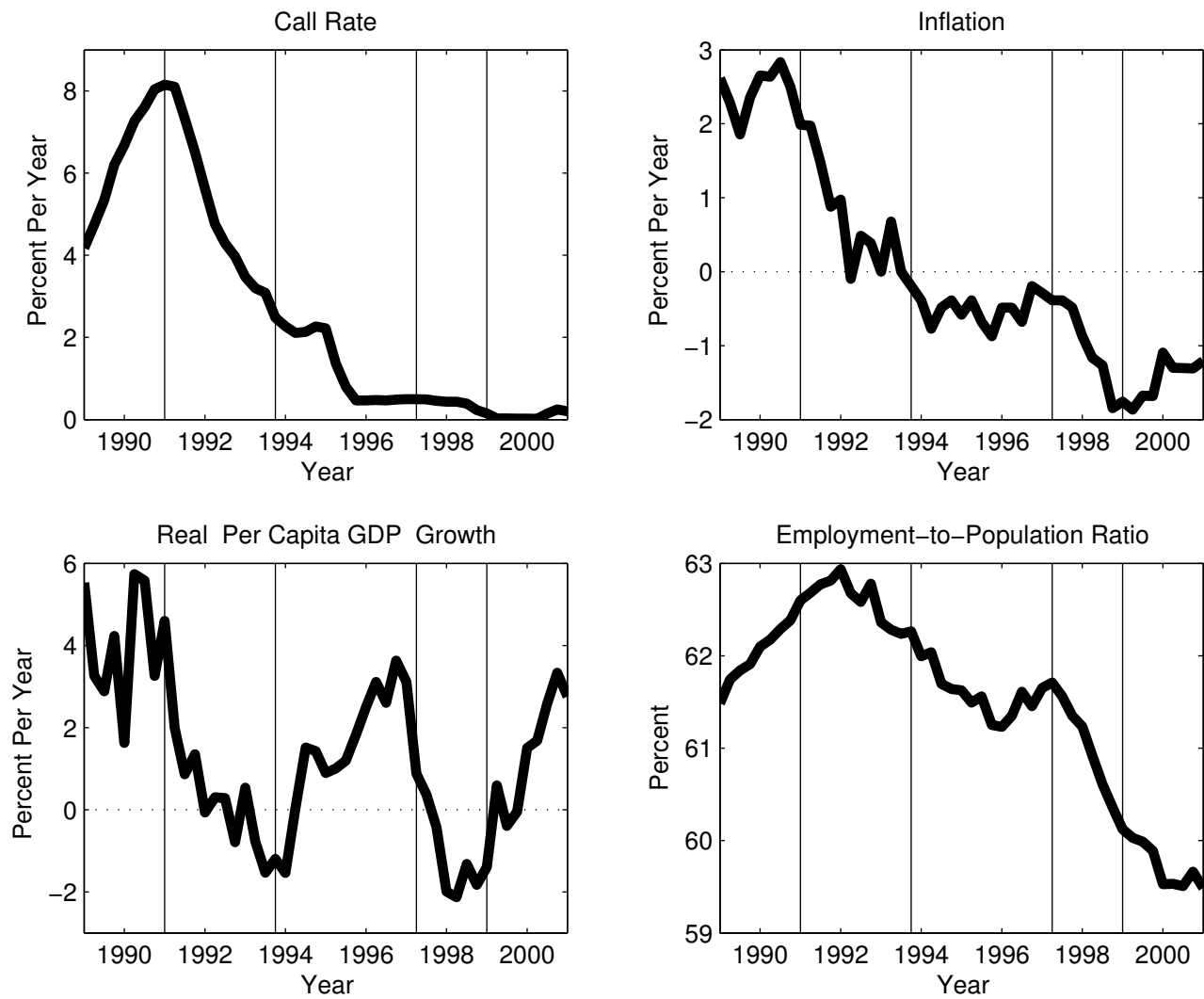### Federal Funds Rate

10−Year Expected Inflation

Real Per Capita GDP Growth

Civilian Employment−Population Ratio

The Japanese Slump of the 1990s

Alternative Hypothesis:

What if **inflationary expectations are well anchored** (i.e., loss of confidence shocks are ruled out by assumption)?

Specifically, consider the response to a decline in the natural rate of interest (following Eggertson and Woodford, 2003)

$$\text{Natural Rate of Interest} = \tilde{\beta}^{-1} e^{\xi_t - \xi_{t+1}}$$

Exercise: Assume that the natural rate falls from its steady-state value of 4 percent per year to -2 percent per year for 10 quarters and then returns to 4 percent forever.

A Contraction With A Job-Creating Recovery:
Response to a Persistent Decline In The Natural Rate
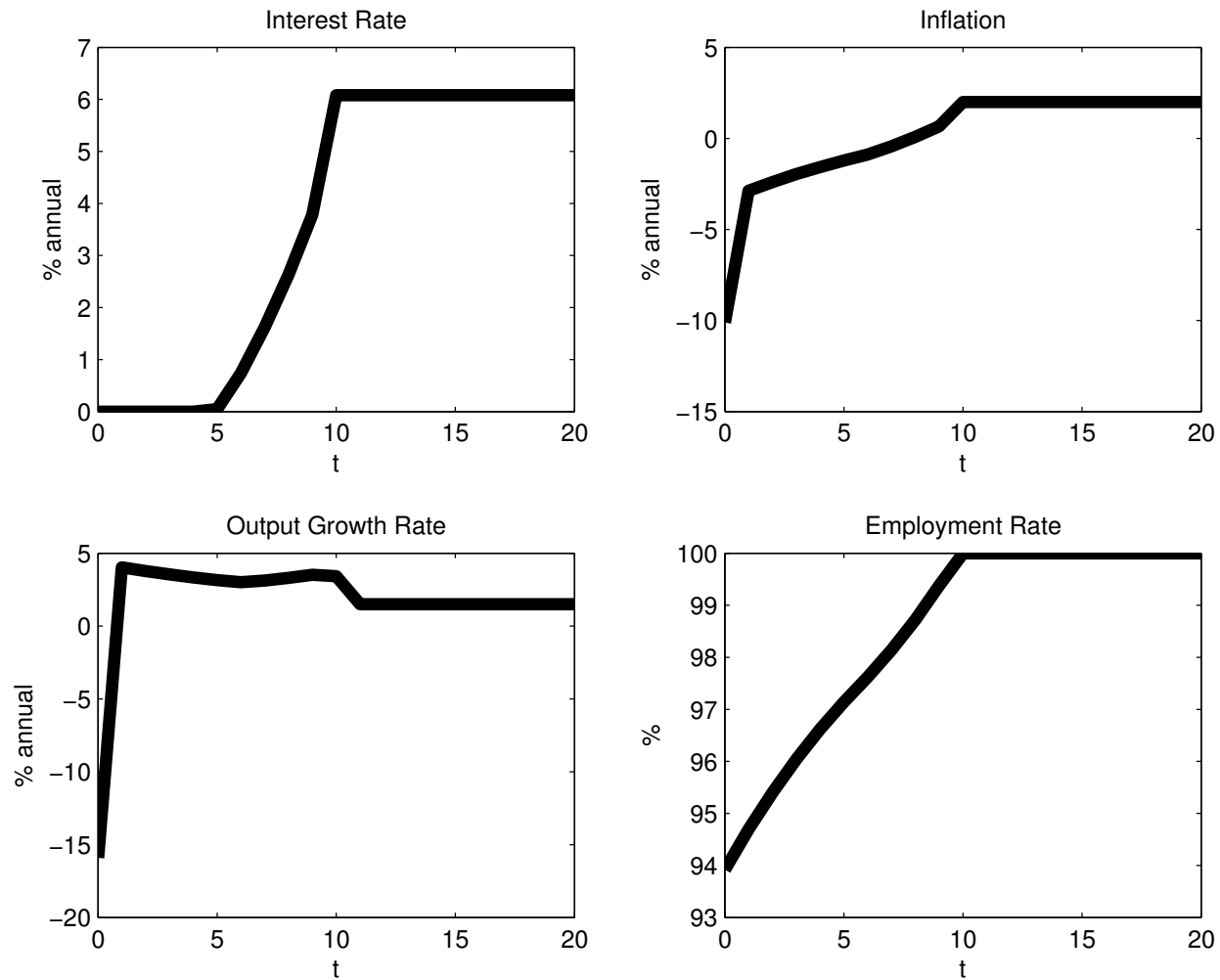
- A negative natural rate shock leads to unemployment and a liquidity trap

- However, the recovery features **job creation**.

$\Rightarrow$ If inflationary expectations are well anchored, a persistent drop in the natural rate of interest <u>cannot</u> explain the observed jobless recovery.

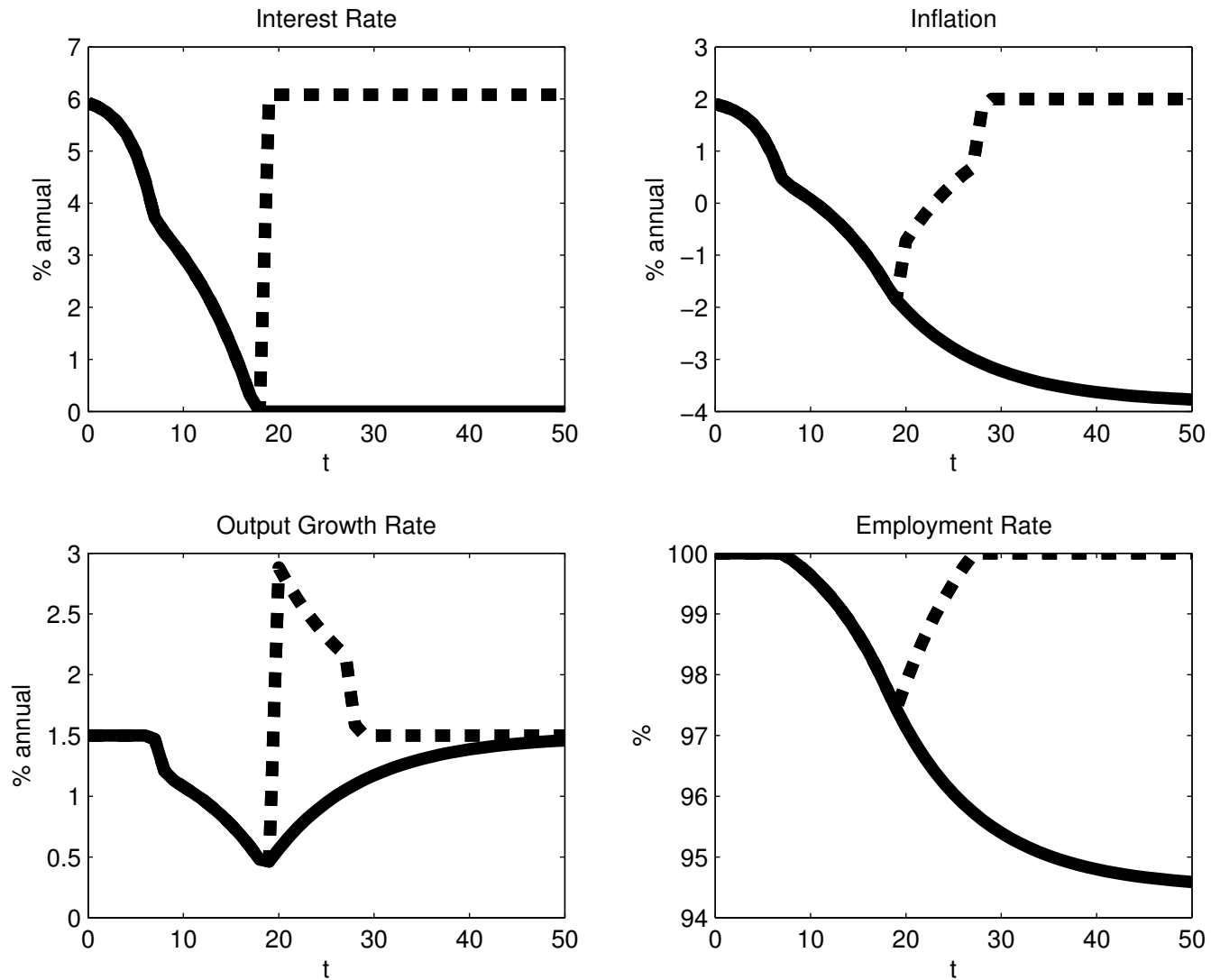# Exiting The Slump with <u>Truly</u> Unconventional Monetary Policy

Interest rate policy:

$$
R_t = \begin{cases} \max\left\{1, \frac{\pi^*}{\tilde{\beta}} + \alpha_\pi \left(\pi_t - \pi^*\right) + \alpha_y \ln\left(\frac{F(h_t)}{F(\bar{h})}\right)\right\} & \text{if } s_t = 0 \\ R^* & \text{if } s_t = 1 \end{cases}.
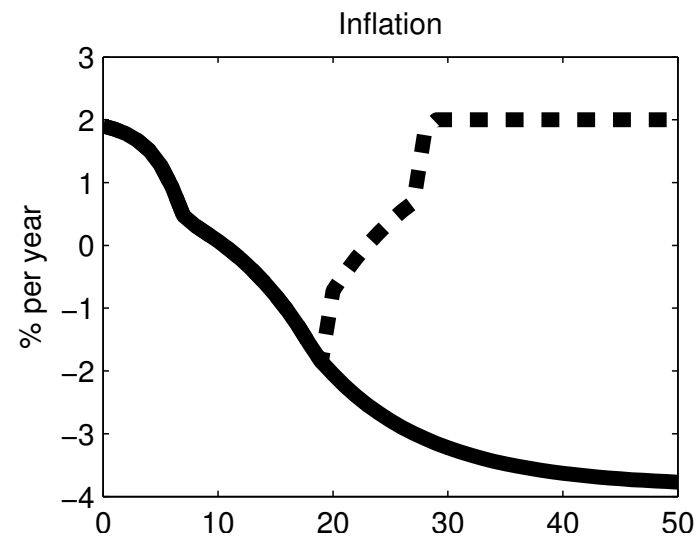$$

$$
s_t = \begin{cases} 1 & \text{if } R_j = 1 \text{ for any } 0 \leq j < t \\ 0 & \text{otherwise} \end{cases}.
$$

Exiting the Slump with Truly Unconventional Policy

Interest Rate

Inflation

Output Growth Rate

Employment Rate

Response of Real Wages, $W_t/(P_tX_t)$, and Inflation to a Nonfundamental Shock Under the Exit Strategy

Solid Line: Taylor Rule   Dashed Line: Exit Strategy

Conclusions

- Great contraction of 2008 is characterized by a jobless recovery and a liquidity trap.

- When inflationary expectations are well anchored, standard model cannot explain jobless recoveries and a prolonged liquidity trap.

- U.S. could be suffering from a negative shock to inflation expectations.

- If so, conventional monetary policy, such as promising extended periods of low rates, is powerless.

- Instead, truly unconventional monetary policy, i.e., raising nominal rates, is needed to jolt the economy out of the slump.

Extras

Bernanke's Definition of a Jobless Recovery:

"Given this weakness in the labor market, a natural question is whether we might be in for a so-called jobless recovery, in which output is growing but employment fails to increase."

Speech given by Chairman Ben S. Bernanke at the Economic Club of New York in New York on November 16, 2009.

U.S. Unemployment Rate: 2005-2012

Source: Bureau of Labor Statistics.

Percent
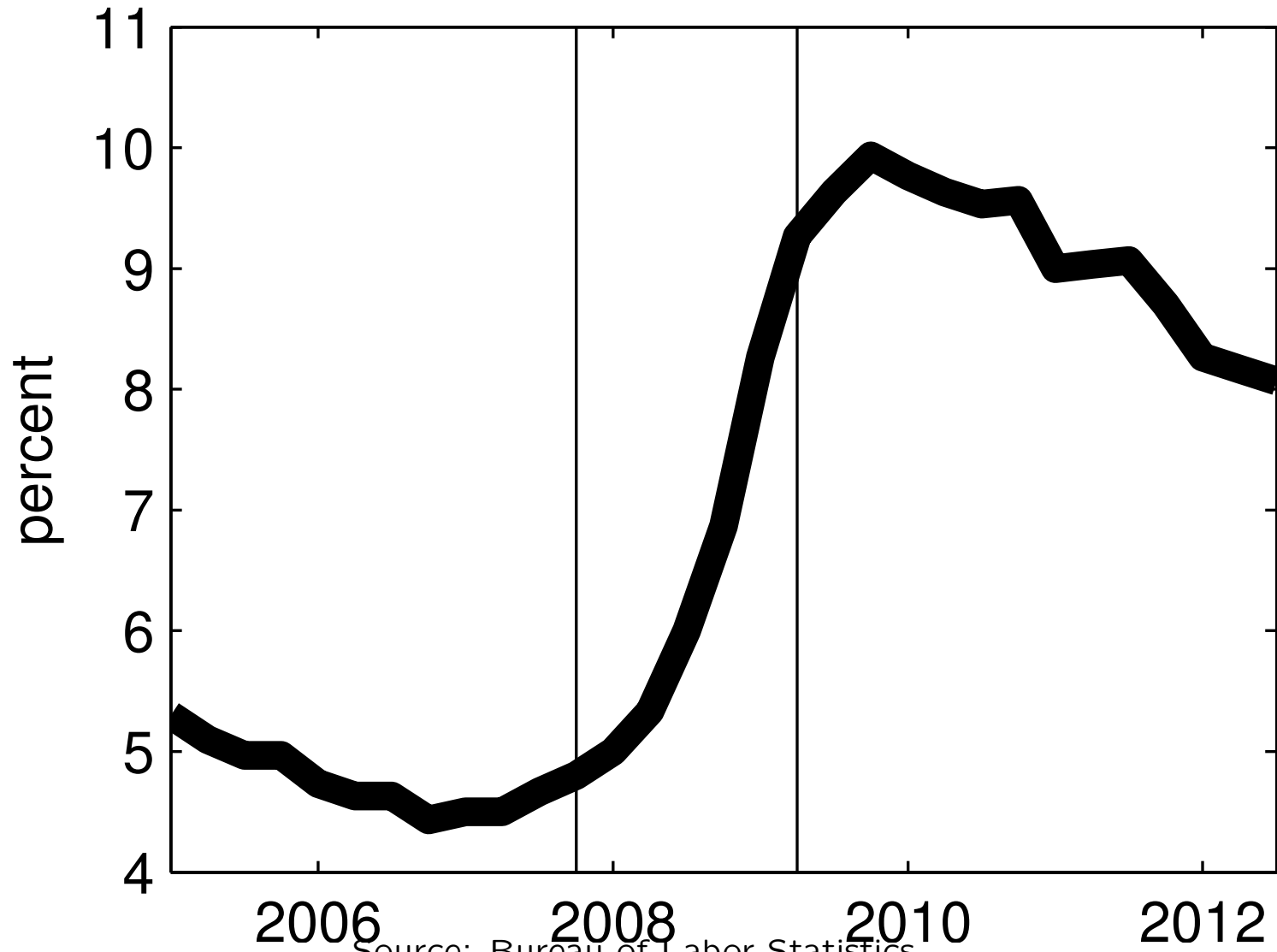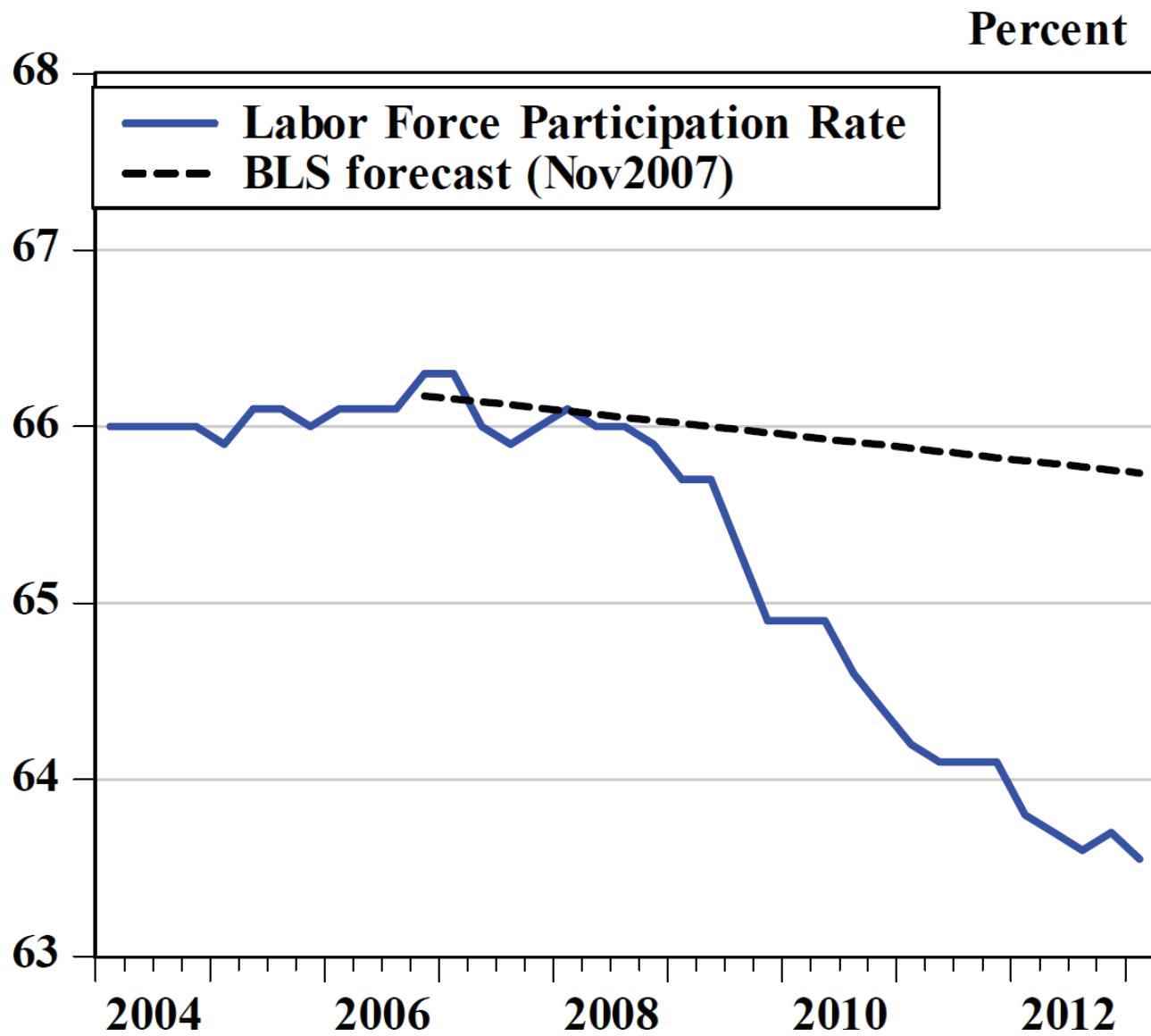
Source: Erceg and Levin (2013)

Table 1: Demographic Factors and the Recent Evolution of the LFPR

Demographic Group	Population Share 2007 Actual	Population Share Change (2007 to 2012) Projection	Population Share Change (2007 to 2012) Actual	Labor Force Participation Rate 2007 Actual	Labor Force Participation Rate Change (2007 to 2012) Projection	Labor Force Participation Rate Change (2007 to 2012) Actual
16 to 24 yrs	16.1	-0.9	-0.2	59.4	-0.9	-4.5
25 to 54 yrs	54.2	-2.0	-3.1	83.0	0.3	-1.5
55 to 64 yrs	14.0	1.3	1.8	64.0	1.5	0.5
65 and older	15.6	1.7	1.6	15.4	2.6	3.1
Total	100	0	0	66.1	-0.3	-2.4

Note: The columns labelled "Projection" refer to the BLS labor force projections published in November 2007.

Source: Erceg and Levin (2013)

NYTimes, April 19, 2013

"It was a relief just to find something," said Amie Crawford, 56, of Chicago. After four months looking for a new job as an interior designer, which she had been for 30 years before the recession, she accepted a position as a part-time cashier at a quick-service health-food cafe called Protein Bar.

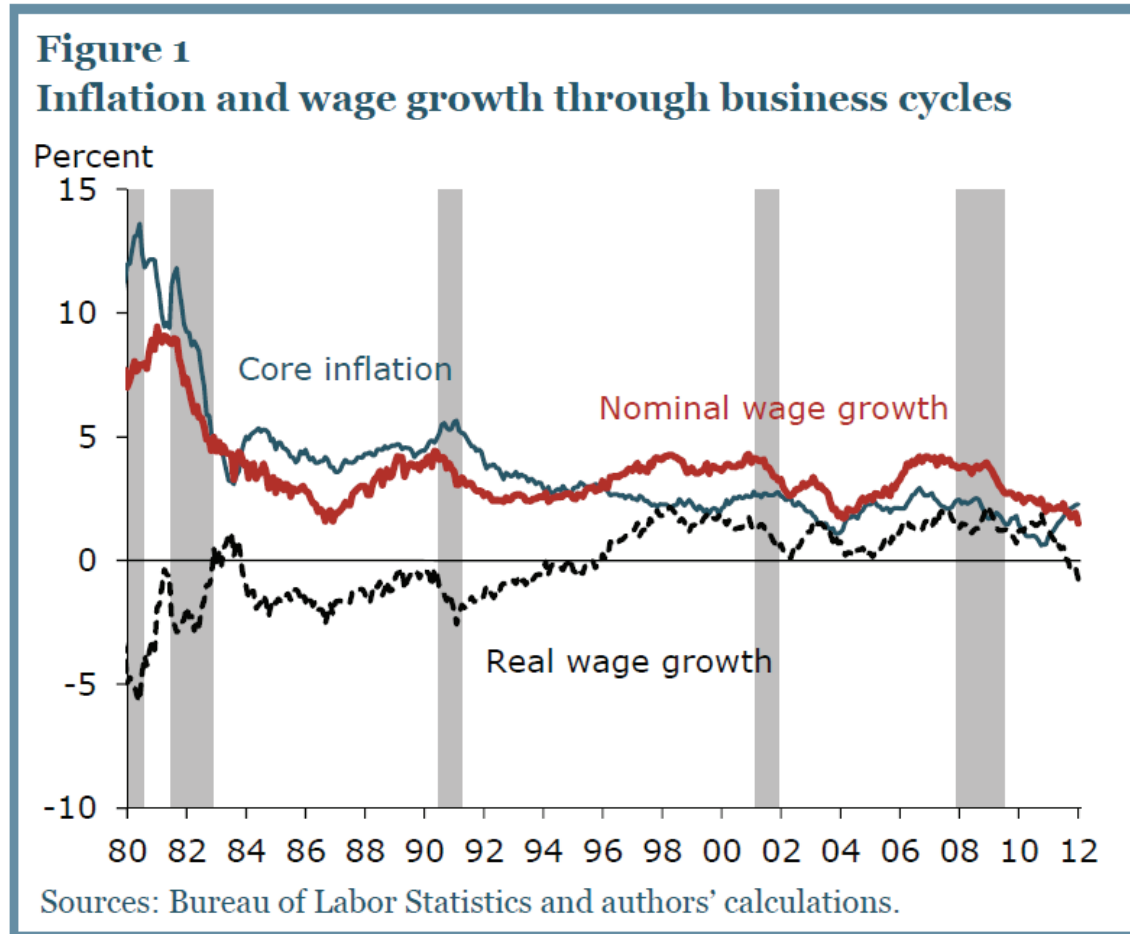She keeps asking for more hours, but her manager's response is always the same.

"He tells me, 'I try to give you as many hours as I can, but everybody wants as many hours as they can,' " Ms. Crawford said.

Involuntary Part−Time Workers: 2002:Jan to 2013:March, LNS12032197
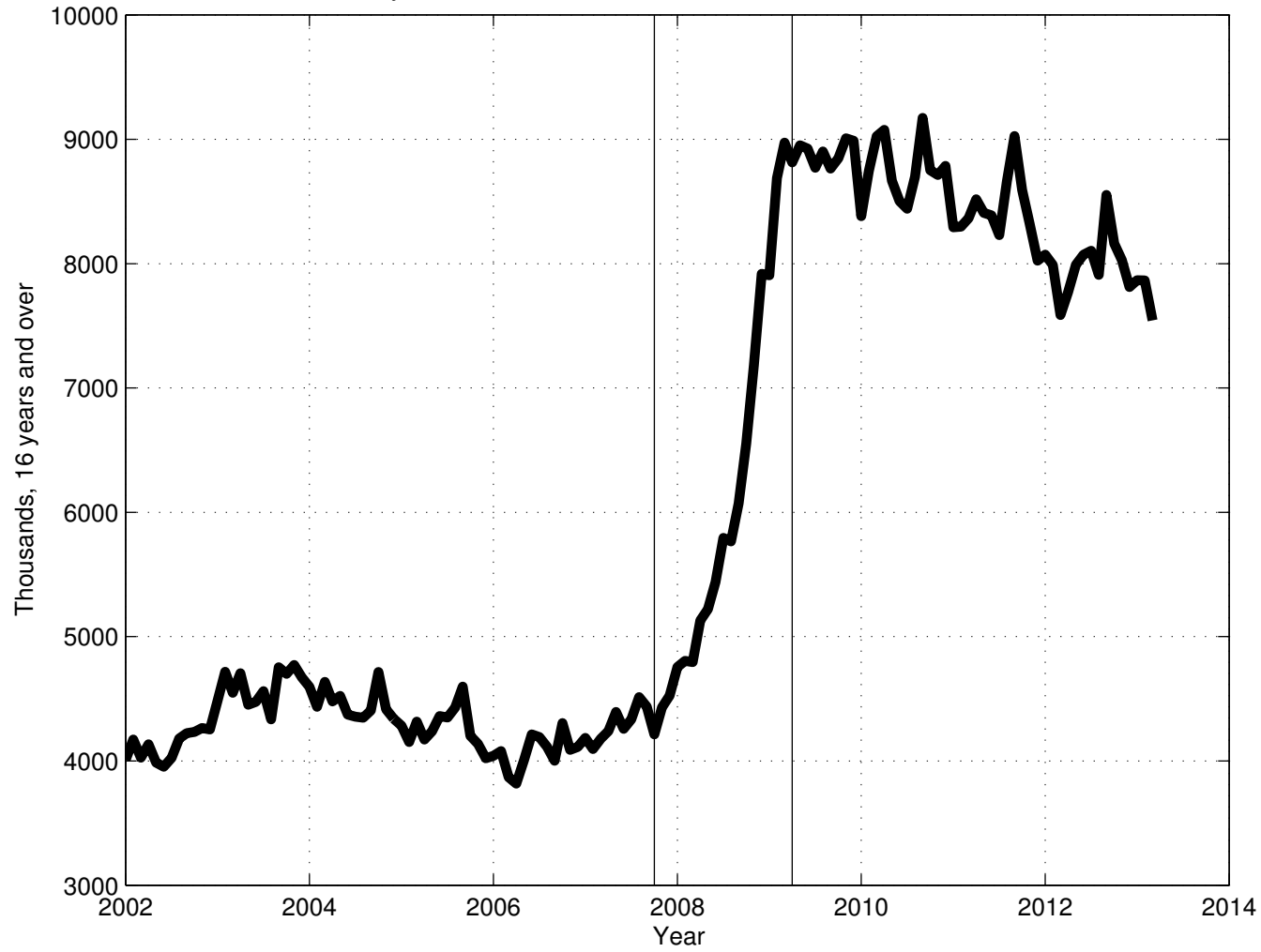
Data Source: Bureau of Labor Statistics.

Real Wage Growth Held up Relatively Well During the 2008 Recession

Source: Daly et al. April 2012.

Real Wage Growth relative to TFP Growth between 2008 and 2011 in the United States

Fernald, FRBSF Productivity Data Base: Average Annual TFP Growth from 2008 to 2011 was 0.65 percent

Daly et al. report that real wages grews by 1.1 percent per year on average between 2008 and 2011.

Hence real wage growth exceeded TFP growth by 0.45 percent per year, for a total of 1.35 percent over the period 2008-2011.

Assumption 1 *The function $\gamma(u_t)$ satisfies*

$$\gamma'(u_t) < 0,$$

and

$$\gamma(0) > \tilde{\beta}\mu,$$
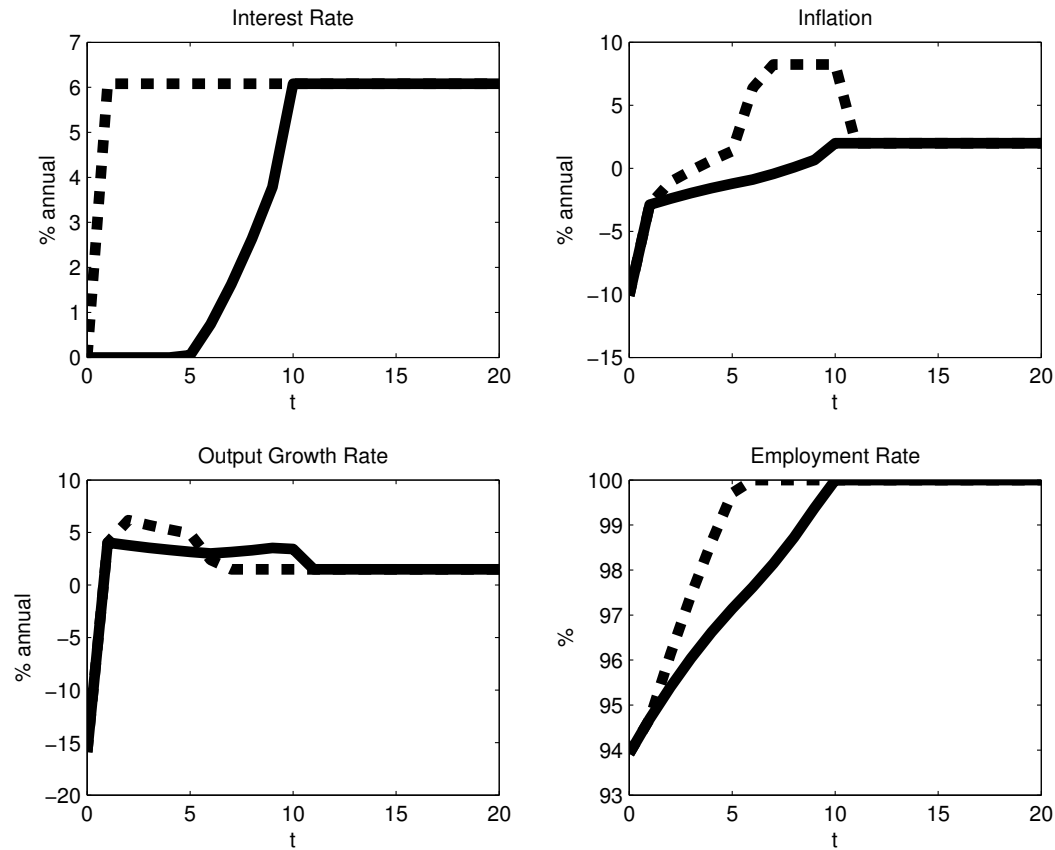
where $\tilde{\beta} \equiv \beta\mu^{-\sigma}$.

Assumption 2 *The parameters R^*, π^*, and α_π satisfy:*

$$R^* \equiv \frac{\pi^*}{\tilde{\beta}} > 1,$$

$$\alpha_\pi \tilde{\beta} > 1,$$

$$\pi^* > \frac{\gamma(0)}{\mu}.$$

Dynamics Effects of a Fundamental Shock Under the Exit Strategy

Solid Line: Taylor Rule   Dashed Line: Exit Strategy