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

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A **jobless growth recovery** is a situation in which (Bernanke 2009):

- Output **growth** recovers,
- but employment does not.

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

- the nominal interest rate is zero and
- inflation is below target.

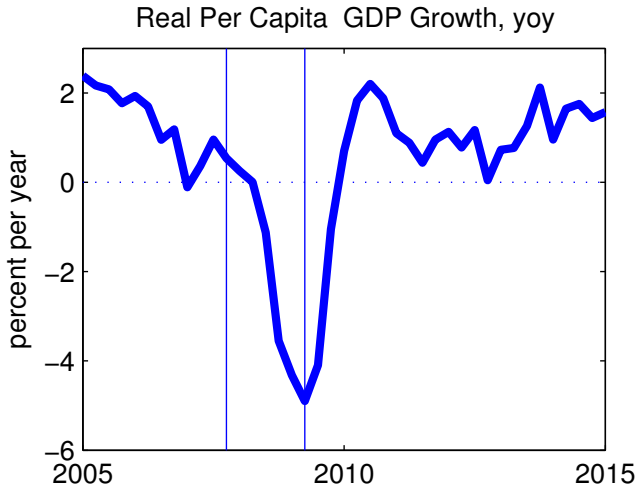
Recent Historical Examples of the Joint Occurrence of a Jobless Growth Recovery and a Liquidity Trap.

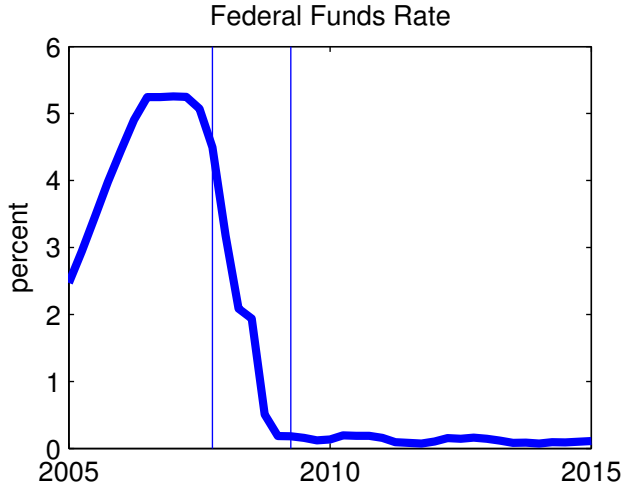
1. United States: 2008-

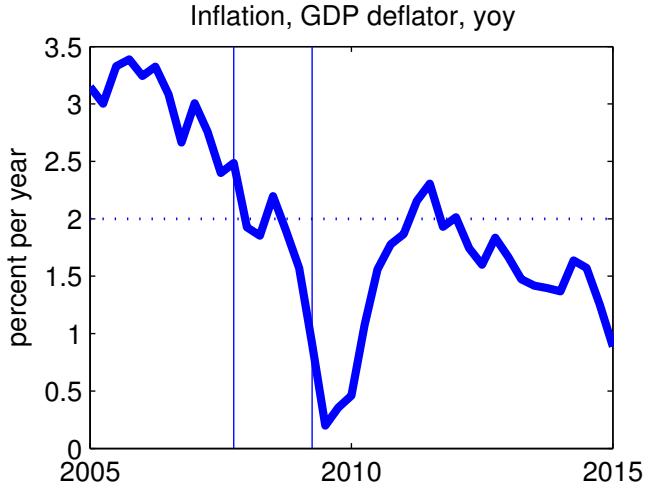
2. Japan: 1991-2000

3. Euro Area: 2008-

United States, 2005-2015

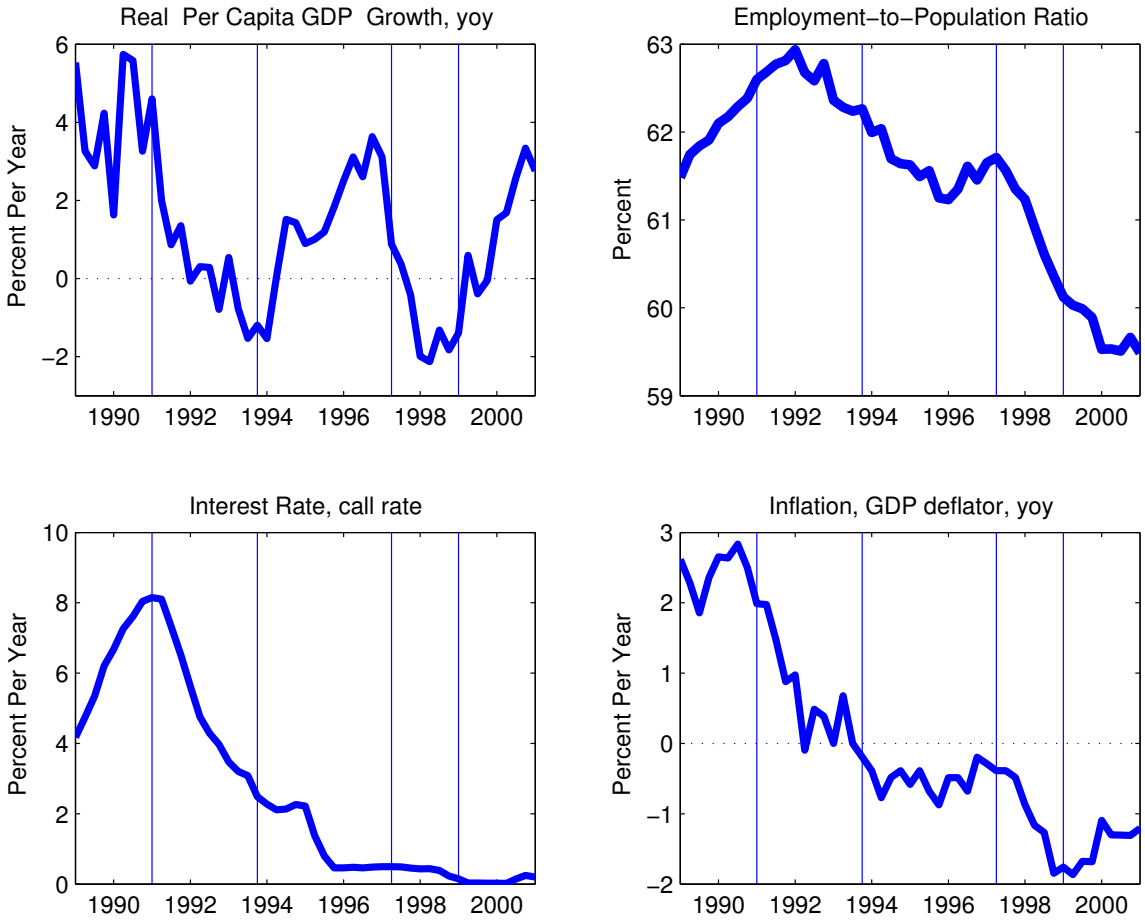






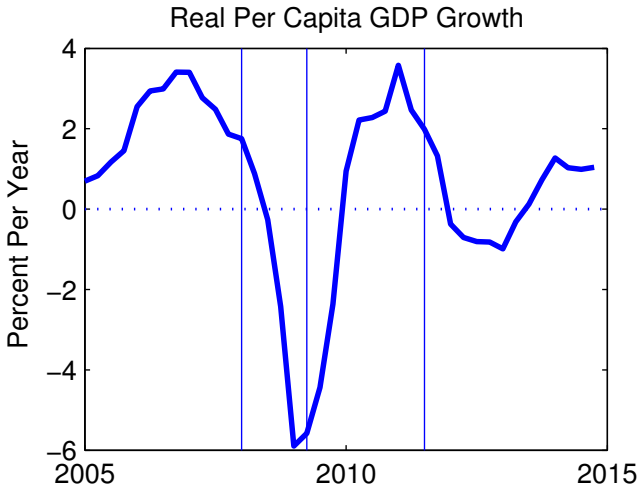
Vertical lines: NBER recession dates, 2007Q4 and 2009Q2

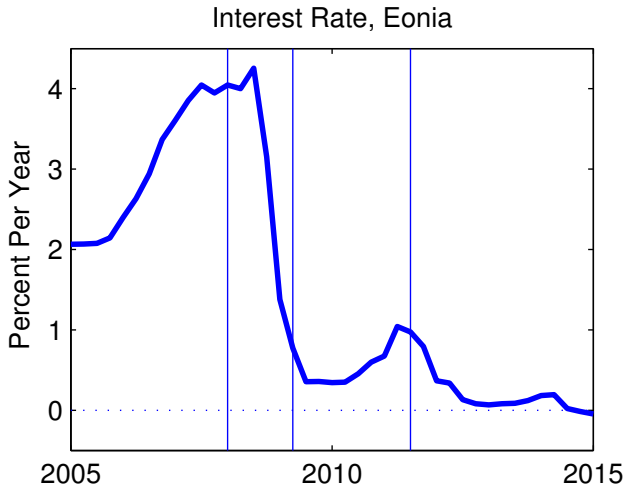
Japan, 1989-2001

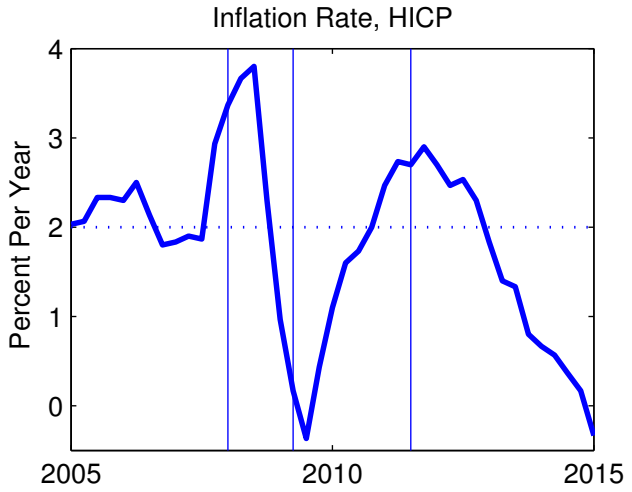


Vertical lines: Cabinet Office Recession dates, 1991Q1, 1993Q4, 1997Q2, 1999Q1.

Euro Area, 2005-2015







Vertical lines: CEPR business cycle dates, 2008Q1, 2009Q2, 2011Q3

This paper:

1. Develops a model that predicts that a confidence shock can cause a liquidity trap with a jobless growth recovery.

2. Offers a policy strategy to exit the liquidity trap and restore full employment based on raising nominal rates.

The Three Main Elements of the Model

1. Downward Nominal Wage Rigidity.

2. The Taylor Rule.

3. A Downward Revision in Inflation Expectations.

Downward Nominal Wage Rigidity.

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

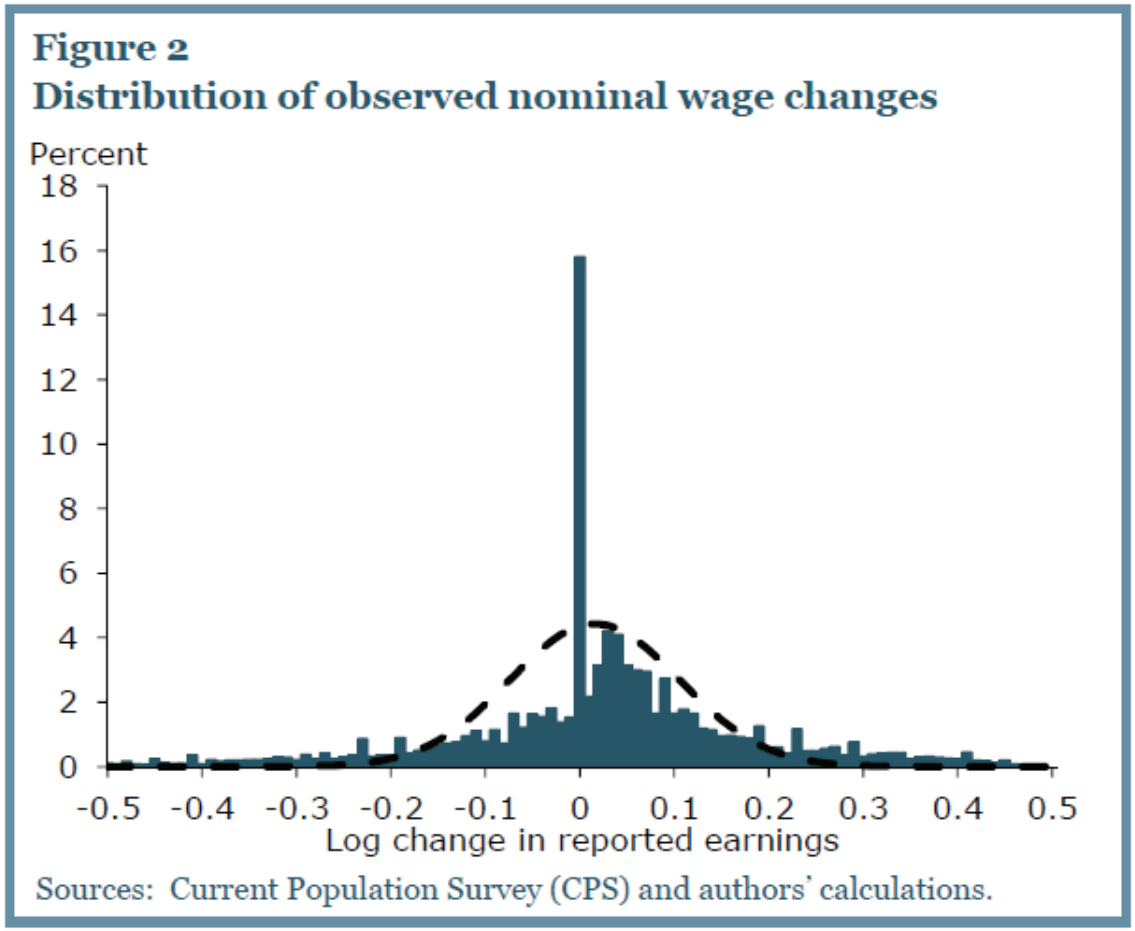
where

- W_t denotes the nominal wage rate.
- u_t denotes the unemployment rate .

Assumption: $\gamma'(u) < 0$. Wages become more downwardly flexible as unemployment increases.

Evidence On Downward Nominal Wage Rigidity

Distribution of Nominal Wage Changes, U.S. 2011



Source: Daly, Hobijn, and Lucking (2012).

Unemployment and Nominal Wages Growth Evidence from the Eurozone

Country	Unemployment Rate 2008Q1 (in percent)	Unemployment Rate 2011Q2 (in percent)	Wage Growth $\frac{W_{2011Q2}}{W_{2008Q1}}$ (in percent)
Bulgaria	6.1	11.3	43.3
Cyprus	3.8	6.9	10.7
Estonia	4.1	12.8	2.5
Greece	7.8	16.7	-2.3
Ireland	4.9	14.3	0.5
Italy	6.4	8.2	10.0
Lithuania	4.1	15.6	-5.1
Latvia	6.1	16.2	-0.6
Portugal	8.3	12.5	1.91
Spain	9.2	20.8	8.0
Slovenia	4.7	7.9	12.5
Slovakia	10.2	13.3	13.4

Source: Schmitt-Grohé and Uribe (2015).

Firms

Production function:

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

Labor demand:

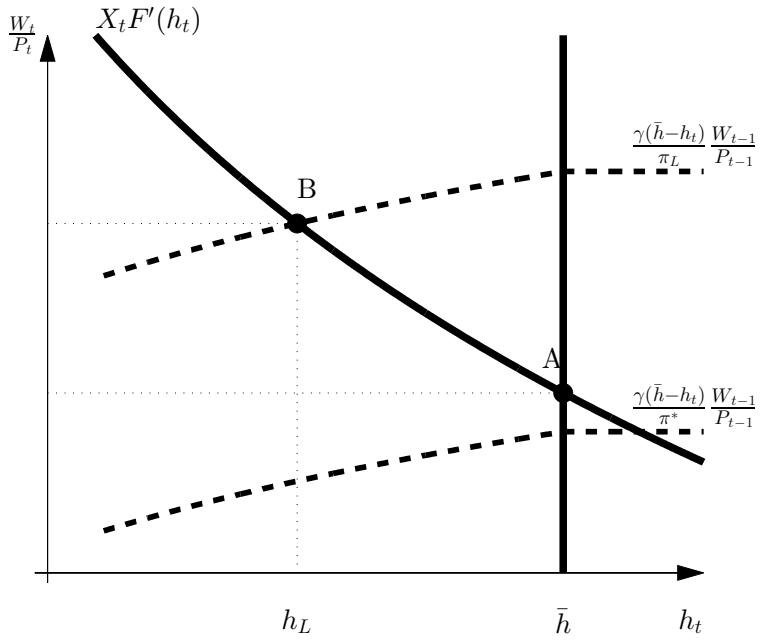
$$\frac{W_t}{P_t} = X_t F'(h_t)$$

The Labor Market

Labor Demand: $\boxed{\frac{W_t}{P_t} = X_t F'(h_t)}$

Inelastic Labor Supply: $\boxed{h_t \leq \bar{h}}$

Downward Wage Rigidity: $W_t \geq \gamma(u_t) W_{t-1} \Rightarrow \boxed{\frac{W_t}{P_t} \geq \frac{\gamma(\bar{h}-h_t)}{\pi_t} \frac{W_{t-1}}{P_{t-1}}}$



If $\pi_t = \pi^*$, then the equilibrium is at point A.

If $\pi_t = \pi_L < \pi^*$, then the equilibrium is at point B.

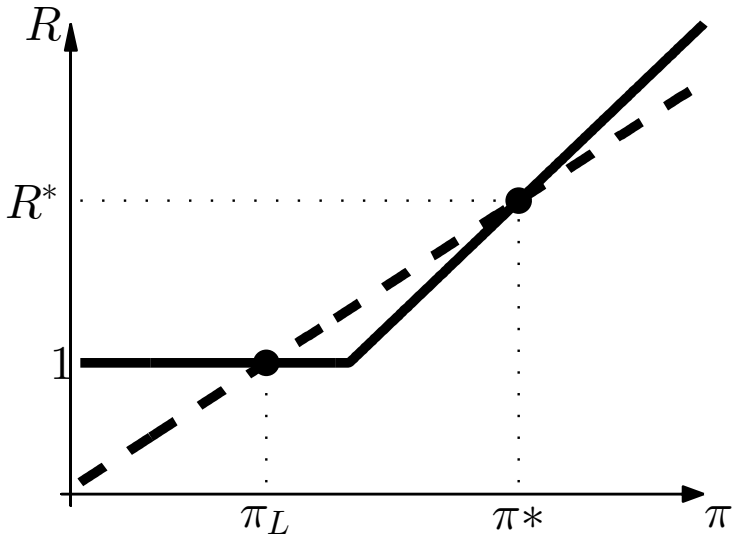
The Euler Equation and the Taylor Rule

$$U'(C_t) = \beta R_t E_t \frac{U'(C_{t+1})}{\pi_{t+1}}$$

$$R_t = \max\{1, R^* + \alpha_\pi (\pi_t - \pi^*) + \alpha_y \widehat{y}_t\}$$

In the steady state they become, respectively,

$$R = \frac{\pi}{\beta} \text{ and } R = \max\{1, R^* + \alpha_\pi (\pi - \pi^*) + \text{constant}\}$$



Solid Line: $R = \max\{1, R^* + \alpha_\pi (\pi - \pi^*)\}$

Broken Line: $R = \beta^{-1}\pi$

A Downward Revision in Expectations.

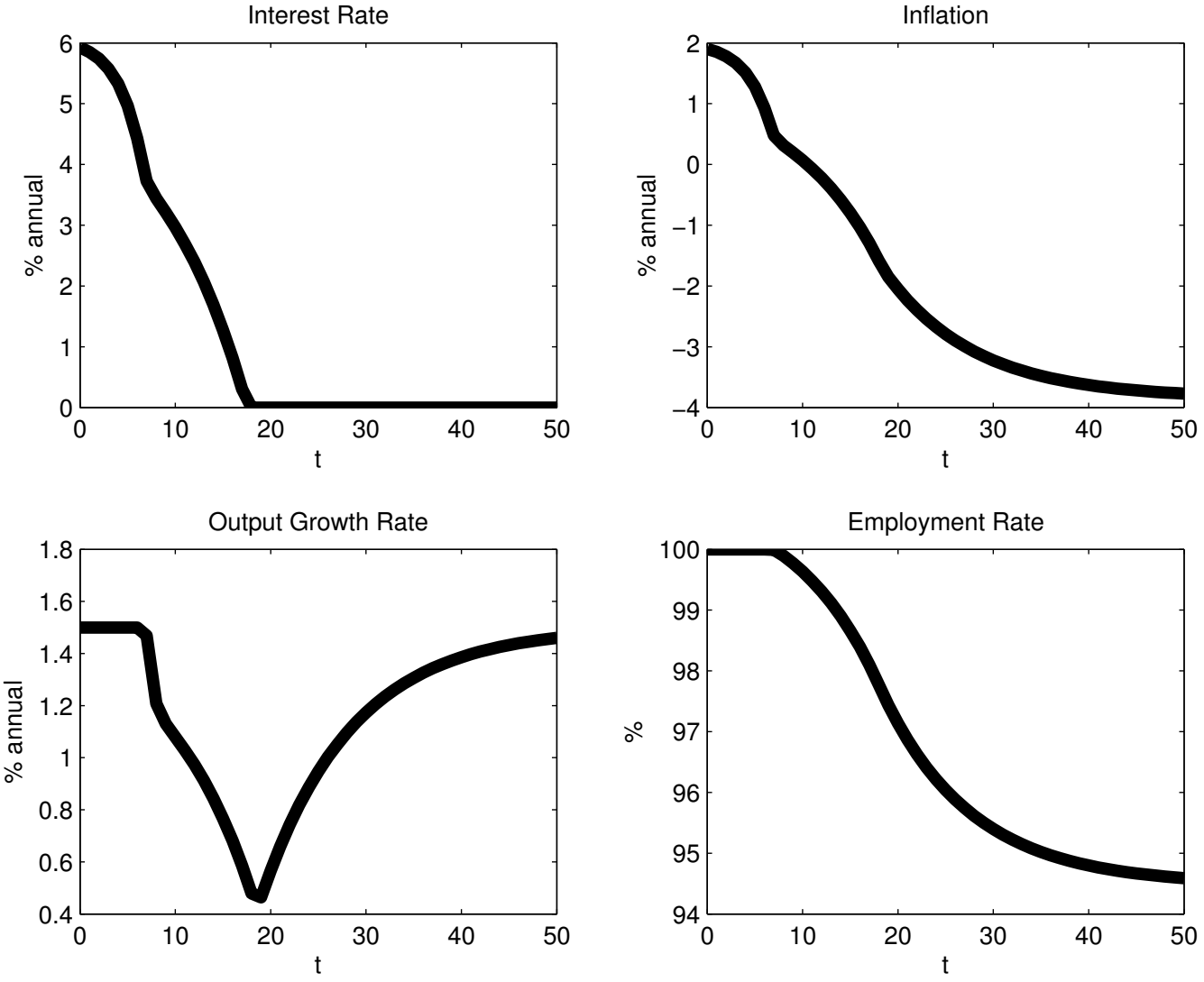
In period 0, expectations change from

$$\lim_{t\to\infty} E_0\pi_t = \pi^*$$

To

$$\lim_{t\to\infty} E_0\pi_t = \pi_L < \pi^*$$

A Lack of Confidence Shock: $\pi_0 < \pi^*$



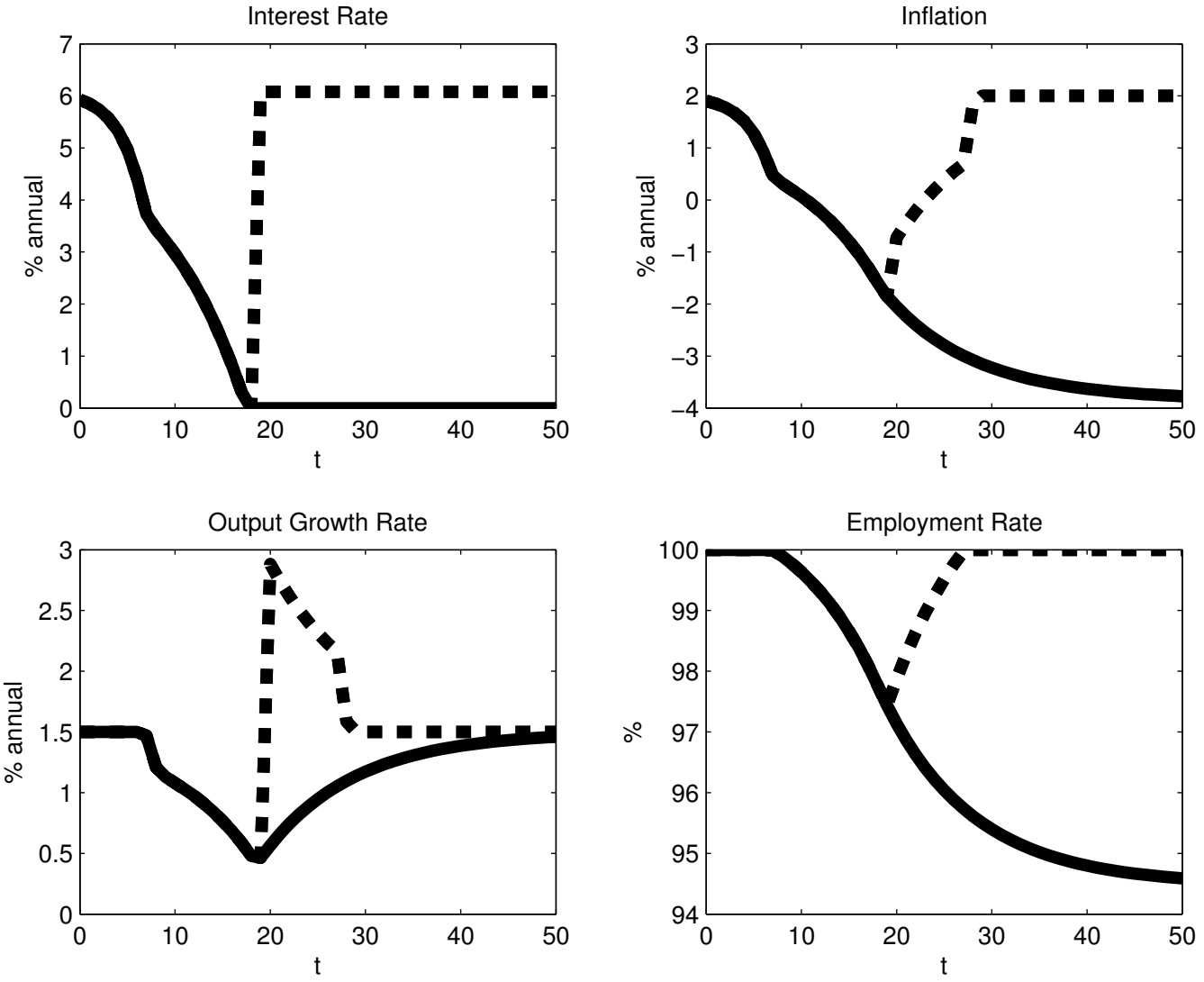
An Exit Rule Based On A Rate Increase

Consider the 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: Tightening is Easing



Capital Accumulation

Findings are robust to allowing for capital accumulation

Production Function

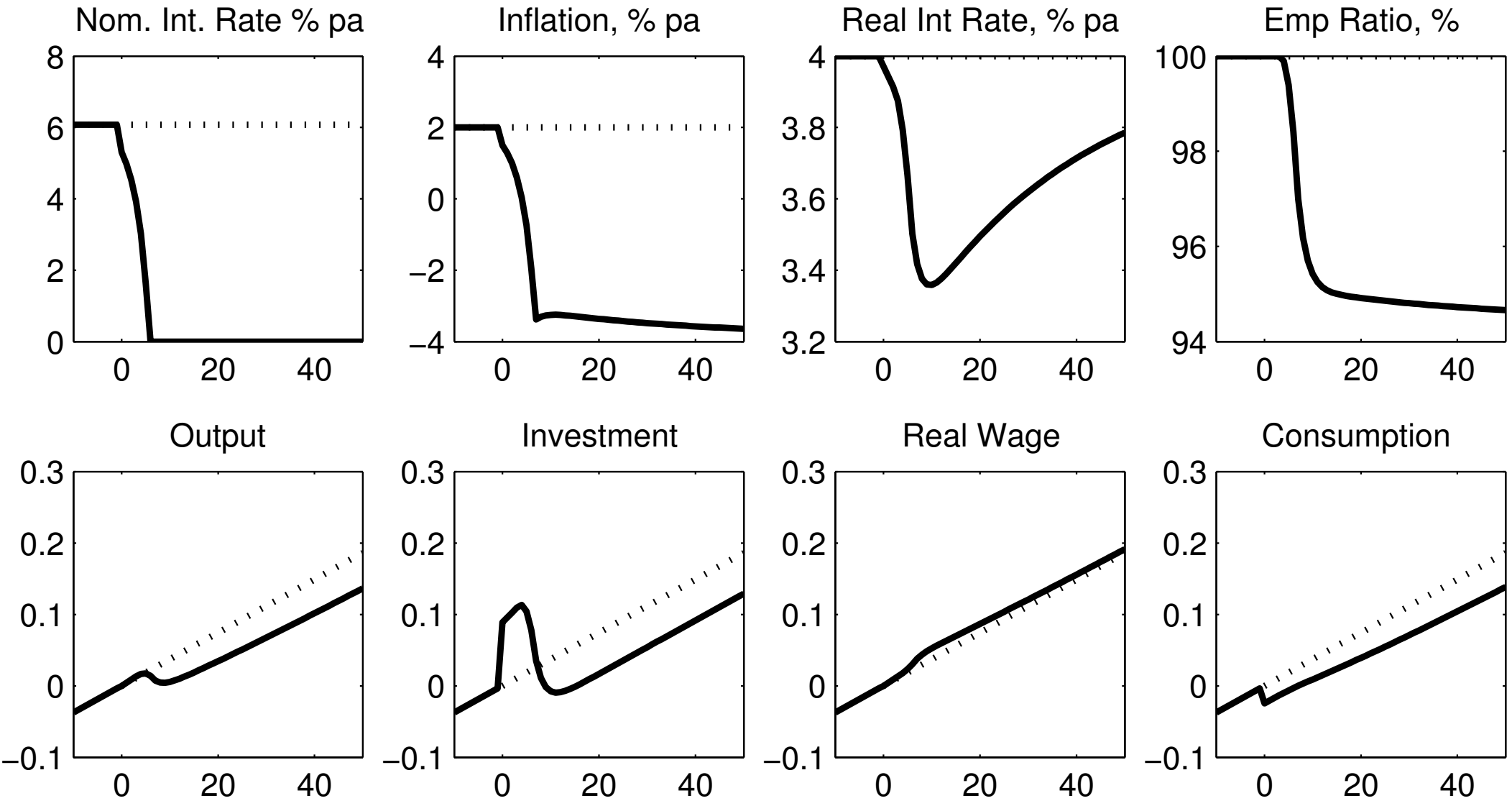
$$Y_t = K_t^{1-\alpha}(X_t h_t)^{\alpha}$$

Evolution of capital

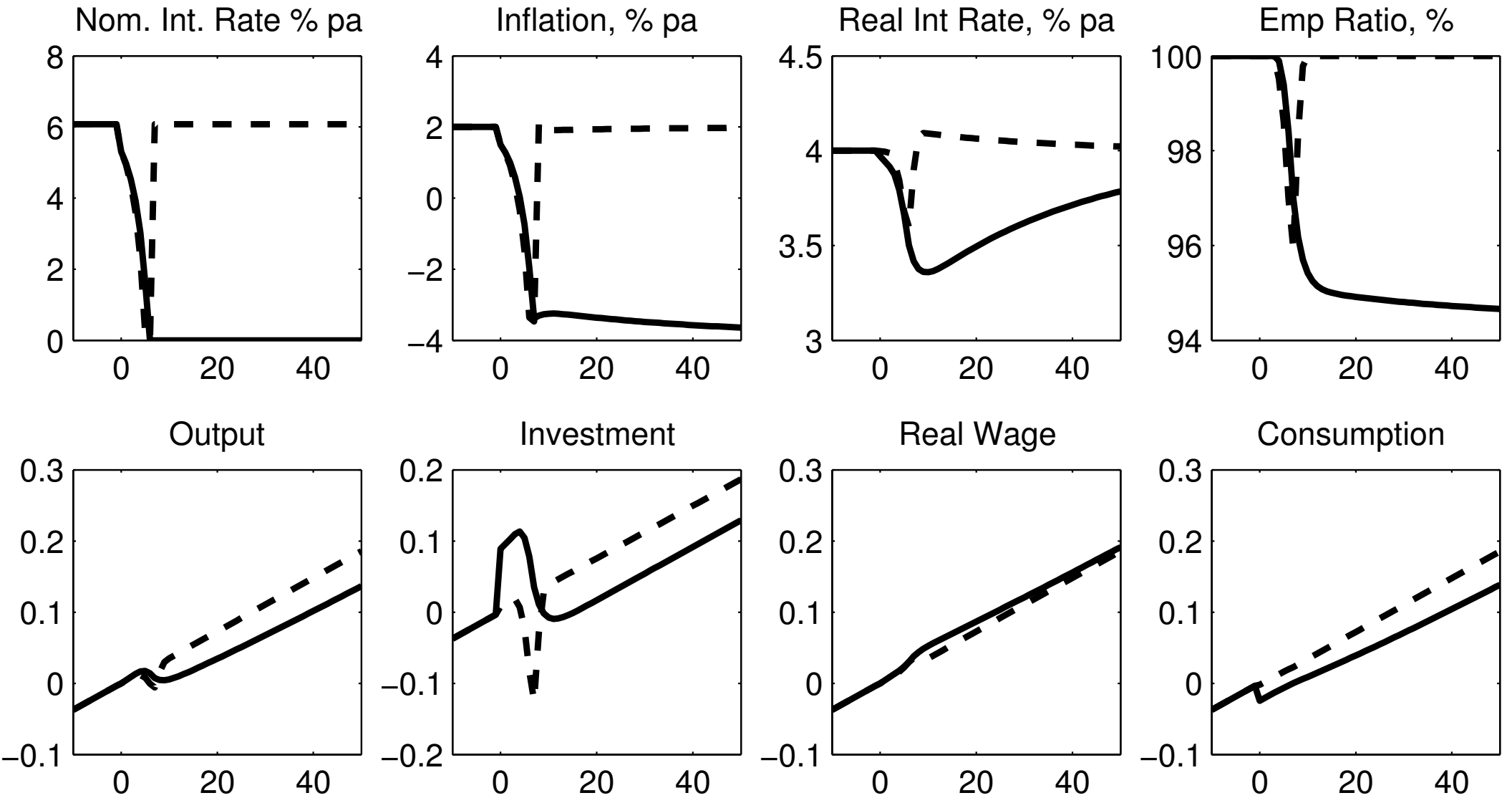
$$K_{t+1} = (1-\delta)K_t + I_t$$

Again 2 steady states exist. New now that the scaled real wage is the same in both steady states, that is, the real wage converges in the long-run to the same balanced growth path regardless of whether the economy is in the liquidity trap or the target steady state.

A Great Contraction With Capital Accumulation



Exit Strategy in Model with Capital



Conclusion

- The present model characterizes liquidity traps that are accompanied by jobless growth recoveries.

- In an environment with falling inflation expectations, an increase in nominal rates can contribute to re-anchoring expectations around the intended target and lifting the economy out of a slump.

- The results of this paper extend to economies with capital accumulation.

Extras

Recovery

Vs.

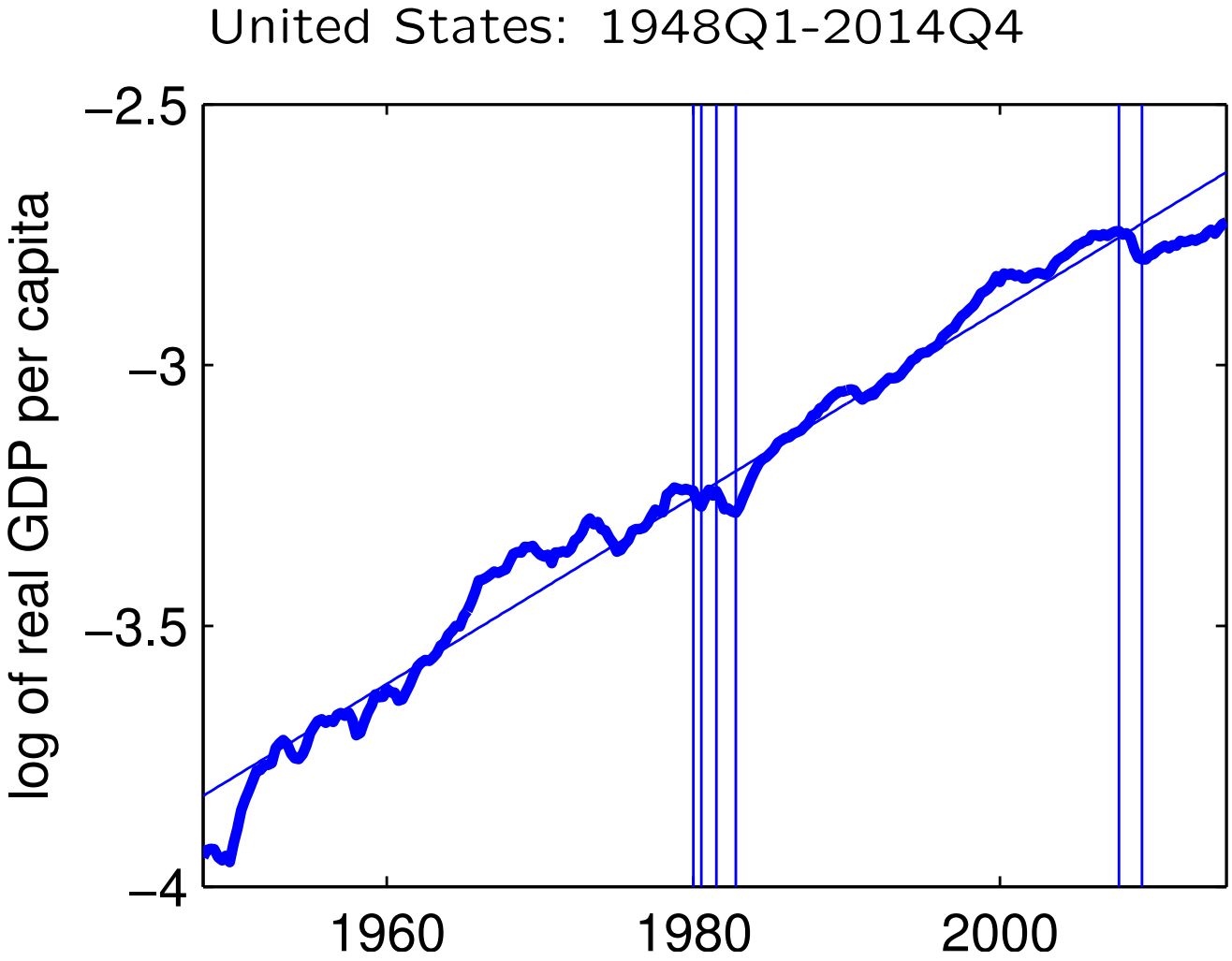
Growth Recovery

What is the difference between a **recovery** and a **growth recovery**?

Recovery — output level returns to trend path.

Growth recovery — output growth rates return to long-run mean but level does not return to trend path

We can use data from the Great Recession in the United States to illustrate this difference.



Vertical lines: NBER recession dates, 1980Q1-1980Q3, 1981Q3-1982Q4, 2007Q4-2009Q2.

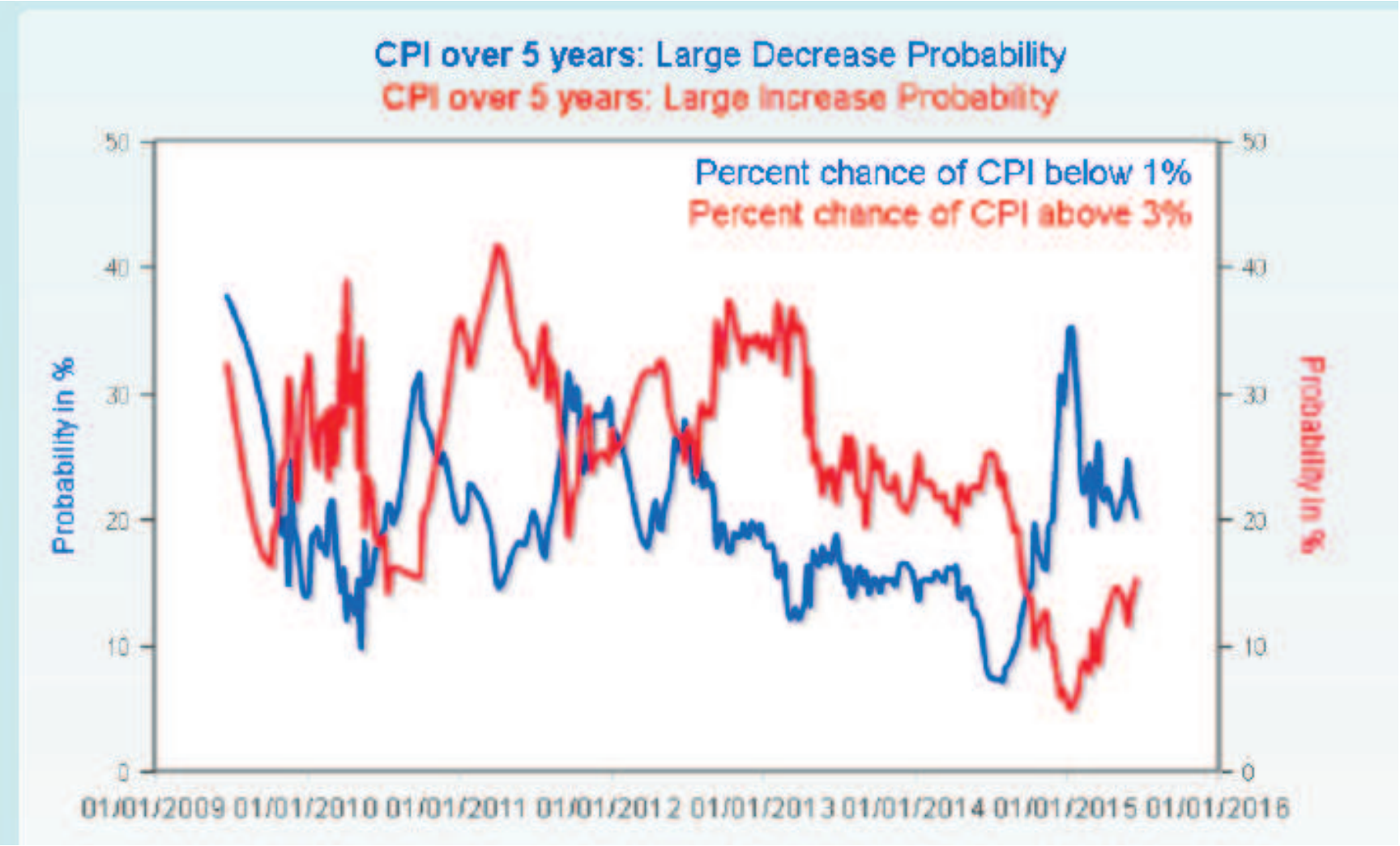
Observations on the figure.

Recovery from great recession was a growth recovery. Recession ends in 2009Q2. But output level does not return to trend path. It grows at a rate of 1.2% percent per year, not very different from the average growth rate since the 1990s. (And close to the average growth rate in real per capita GDP since 1870, which is 1.5 percent). Graphically, a growth recovery is a parallel downward shift in the path of the log level of output.

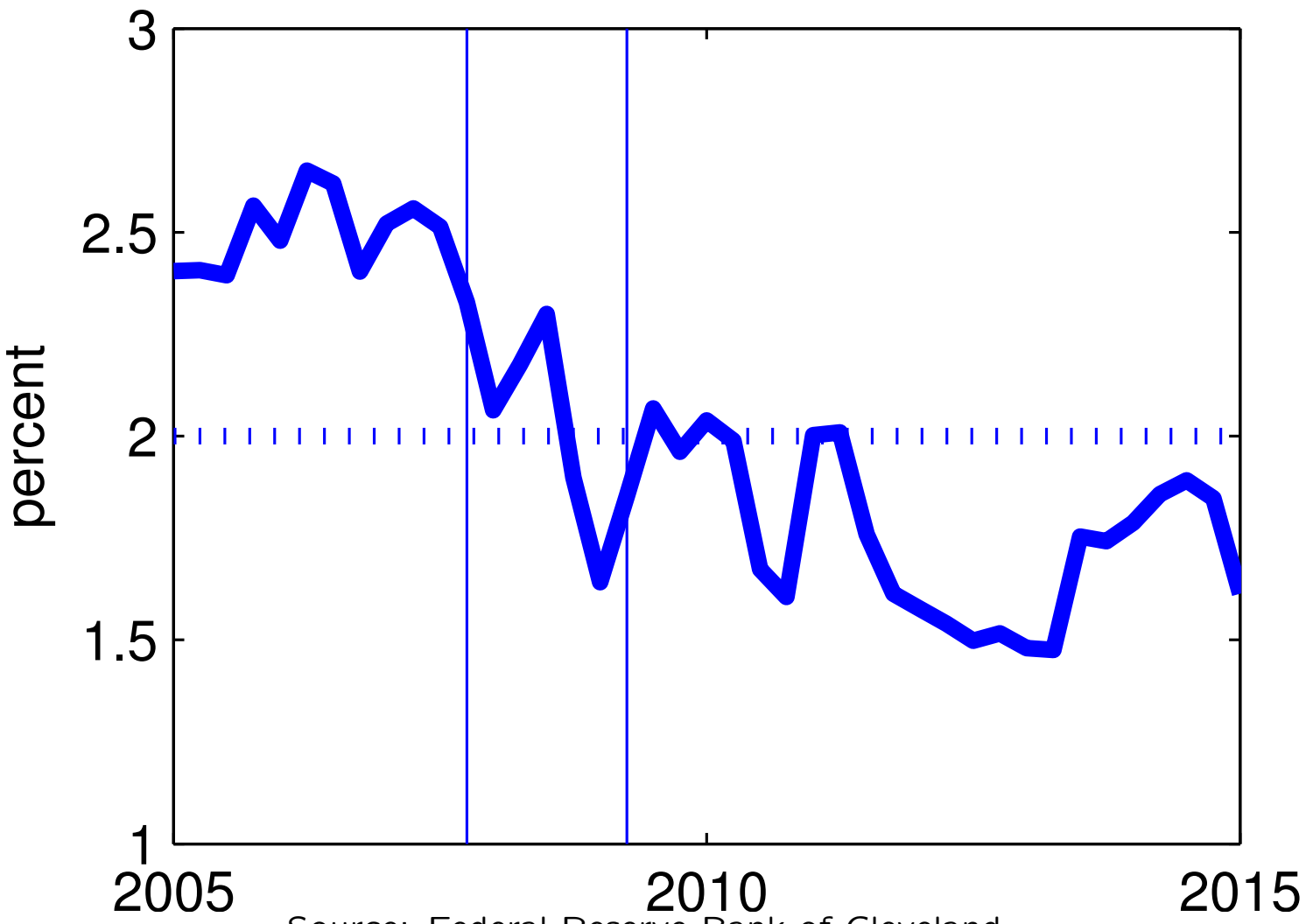
Compare this to the recovery from the double dip recession of early 1980s. Those were recoveries because the level of output returned to the trend path. After the recession ends, 1982Q4, output grows at a faster rate than normal taking the level of output back to its trend path.

Expected Inflation

Expected inflation evidence from the United States



U.S. 10-Year Expected Inflation: 2005Q1-2015



Source: Federal Reserve Bank of Cleveland.

Additional Evidence On Downward Nominal Wage Rigidity

• Downward nominal wage rigidity is the central friction in the present model $\Rightarrow$ natural to ask if it is empirically relevant.

• Downward nominal wage rigidity is a widespread phenomenon:

— Evident in micro and macro data.

— Rich, emerging, and poor countries.

— Developed and underdeveloped regions of the world.

Probability of Decline, Increase, or No Change in Wages

U.S. data, SIPP panel 1986-1993, between interviews one year apart.

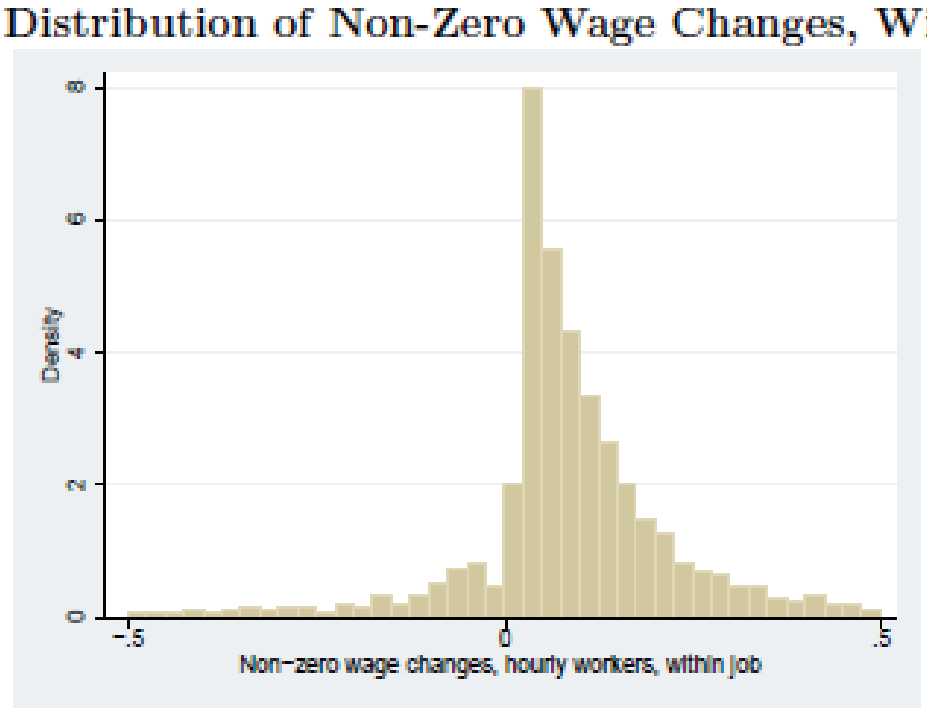
	Interviews One Year apart	
	Males	Females
Decline	5.1%	4.3%
Constant	53.7%	49.2%
Increase	41.2%	46.5%

Source: Gottschalk (2005)

• Large mass at 'Constant' suggests nominal wage rigidity.

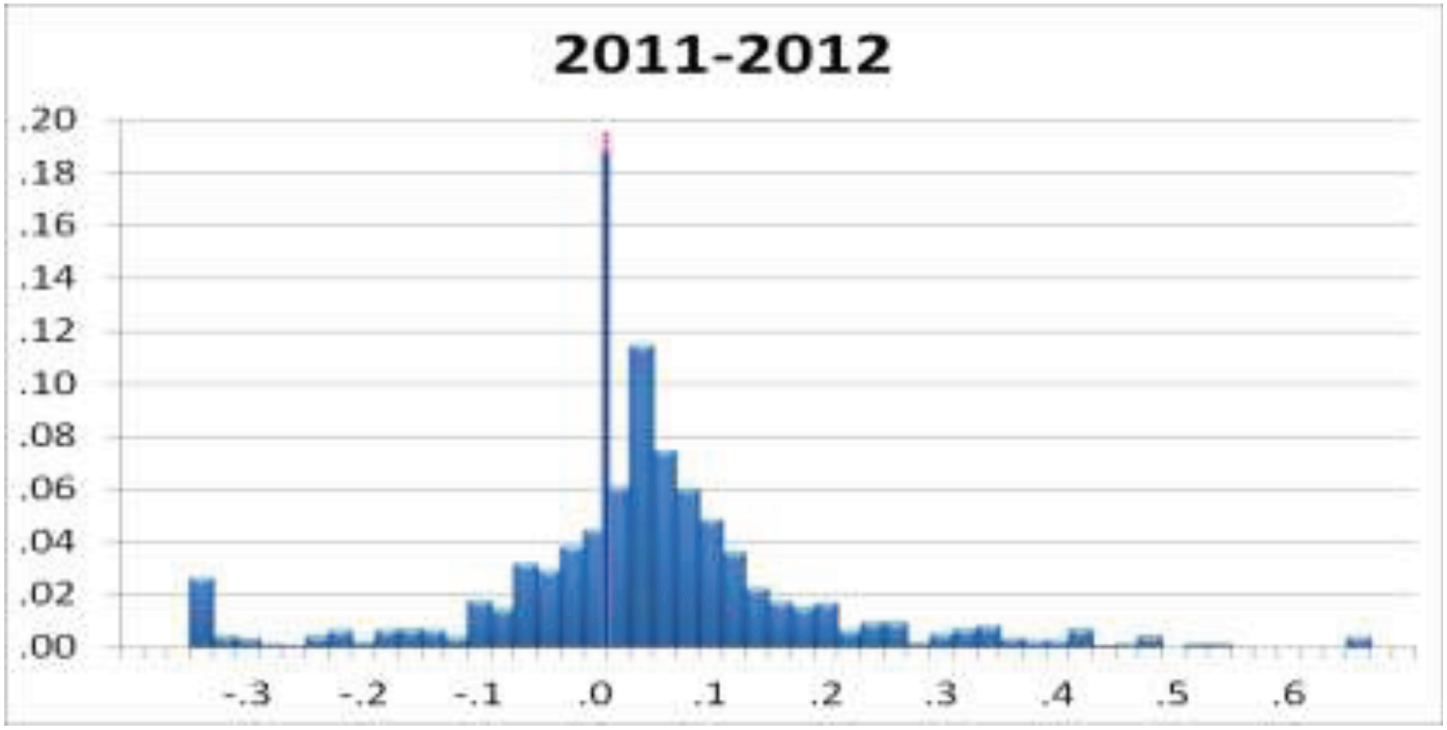
• Small mass at 'Decline' suggests downward nominal wage rigidity.

Distribution of Non-Zero Nominal Wage Changes
United States 1996-1999



Source: Barattieri, Basu, and Gottschalk (2012)

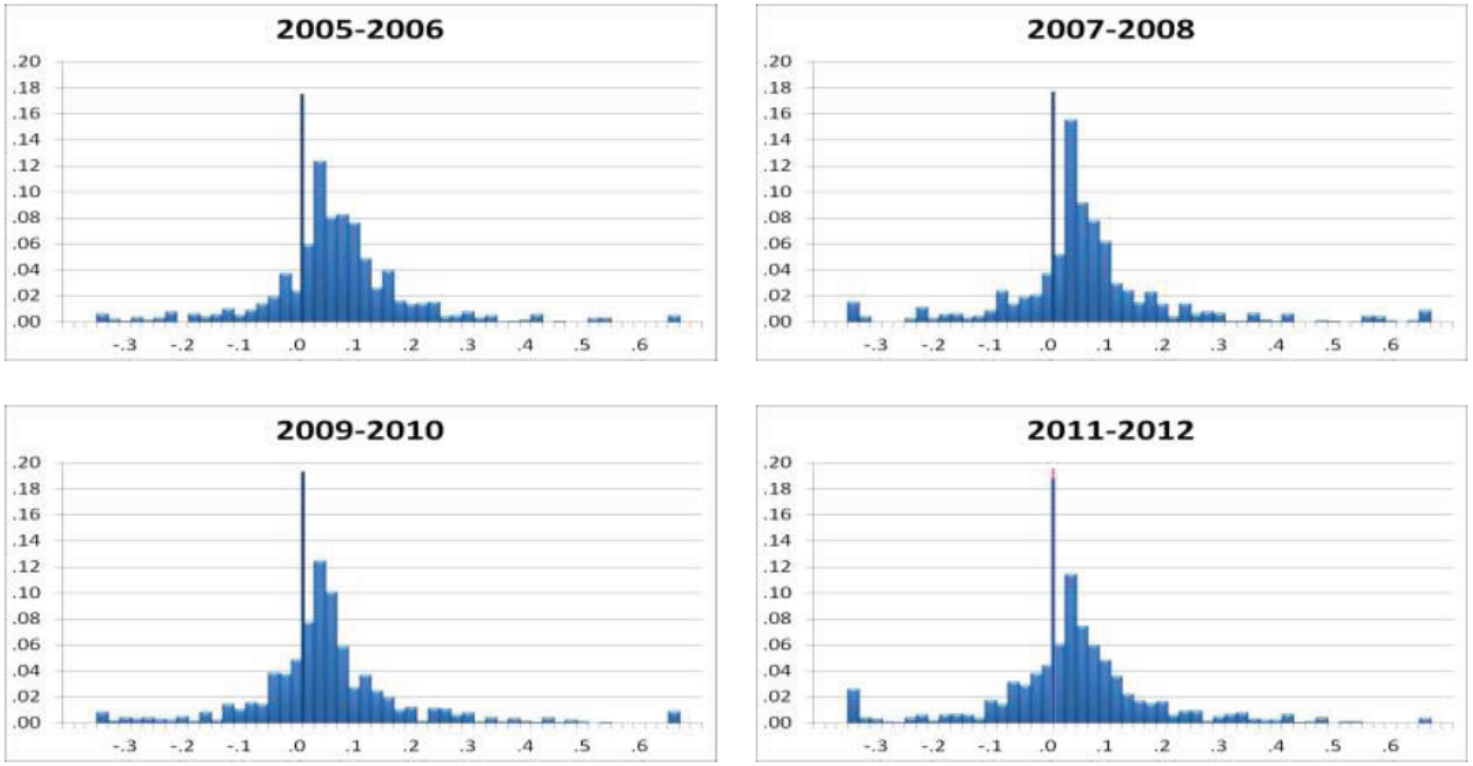
Distribution of Nominal Wage Changes, USA



Source: Elsby et al. (2013). Hourly workers in the same employer.

Distributions of Year-to-Year Hourly Nominal Wage Changes , U.S. 2005 to 2012, Hourly Workers

Figure 5 continued



Source: Elsby et al. 2013.

Micro Evidence On Downward Nominal Wage Rigidity From Other Developed Countries

- Canada: Fortin (1996).

- Japan: Kuroda and Yamamoto (2003).

- Switzerland: Fehr and Goette (2005).

- Industry-Level Data: Holden and Wulfsberg (2008), 19 OECD countries from 1973 to 1999.

Evidence From Informal Labor Markets

• Kaur (2012) examines the behavior of nominal wages, employment, and rainfall in casual daily agricultural labor markets in rural India (500 districts from 1956 to 2008).

• Finds asymmetric nominal wage adjustment:

— W_t increases in response to positive rainfall shocks

— W_t fails to fall, labor rationing, and unemployment are observed in response to negative rain shocks.

• Inflation (uncorrelated with local rain shocks) tends to moderate rationing and unemployment during negative rain shocks, suggesting downward rigidity in nominal rather than real wages.

Evidence From the Great Depression In Europe

• Countries that left the gold standard earlier recovered faster than countries that remained on gold.

— Left Gold Early (sterling-bloc): United Kingdom, Sweden, Finland, Norway, and Denmark.

— **Countries That Stuck To Gold (gold bloc):** France, Belgium, the Netherlands, and Italy.

• Think of the gold standard as a currency peg (a peg not to a currency, but to gold).

• When sterling-bloc left gold, they effectively devalued, as their currencies lost value against gold.

• Look at the figure on the next slide. Between 1929 and 1935, sterling-bloc countries experienced less real wage growth and larger increases in industrial production than gold-bloc countries.

Changes In Real Wages and Industrial Production, 1929-1935

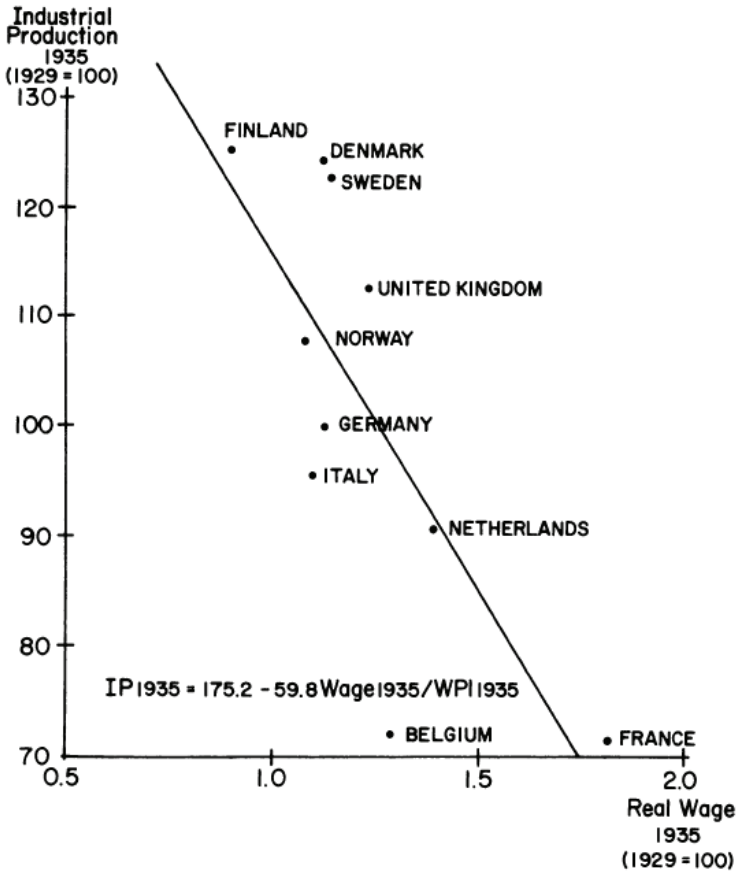


FIGURE 2
CHANGES IN REAL WAGES AND INDUSTRIAL PRODUCTION, 1929–1935

Source. Eichengreen and Sachs (1985).

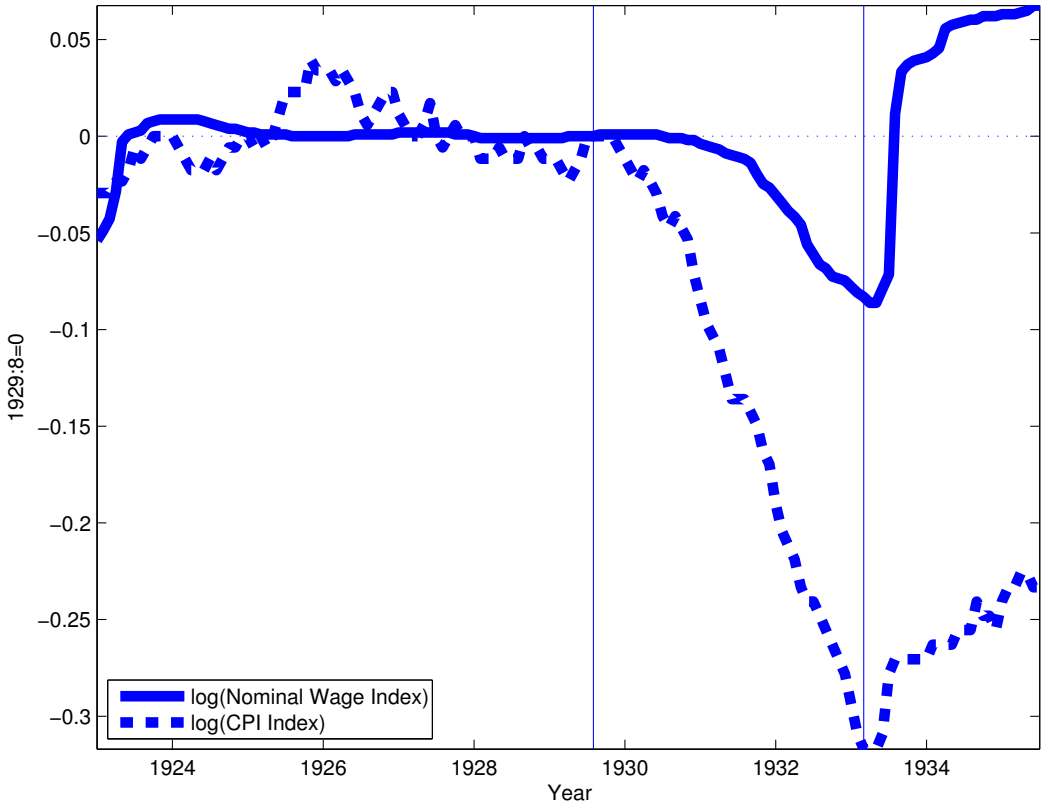
Evidence From the U.S. Great Depression, 1929-1933

• Enormous contraction in employment: 31% between 1929 and 1931.

• Nonetheless, during this period nominal wages fell by 0.6% per year, while consumer prices fell by 6.6% per year. See the figure on the next slide.

• A similar pattern is observed during the second half of the Depression. By 1933, real wages were 26% higher than in 1929, in spite of a highly distressed labor market.

Nominal Wage Rate and Consumer Prices, United States 1923:1-1935:7



Source: Uribe and Schmitt-Grohe, 2015. Solid line: natural logarithm of an index of manufacturing money wage rates. Broken line: logarithm of the consumer price index.

Evidence From Emerging Countries

• Argentina: pegged the peso at a 1-to-1 rate with the dollar between 1991 and 2001.

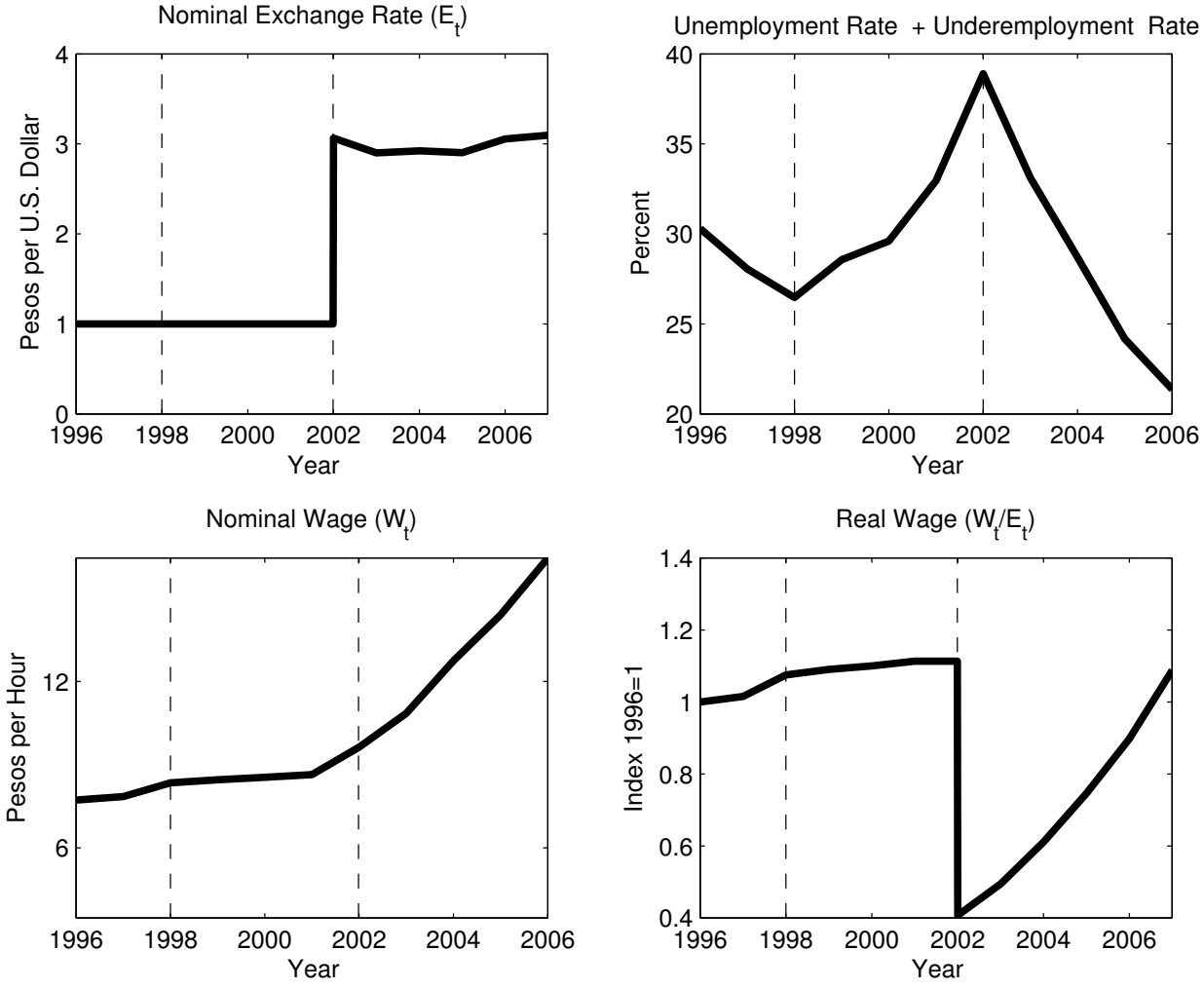
• Starting in 1998, the economy was buffeted by a number of large negative shocks (weak commodity prices, large devaluation in Brazil, large increase in country premium, etc.).

• Not surprisingly, between 1998 and 2001, unemployment rose sharply.

• Nonetheless, nominal wages remained remarkably flat.

• This evidence suggests that nominal wages are downwardly rigid.

Argentina 1996-2006



Source: Schmitt-Grohé and Uribe, *JPE* forthcoming.

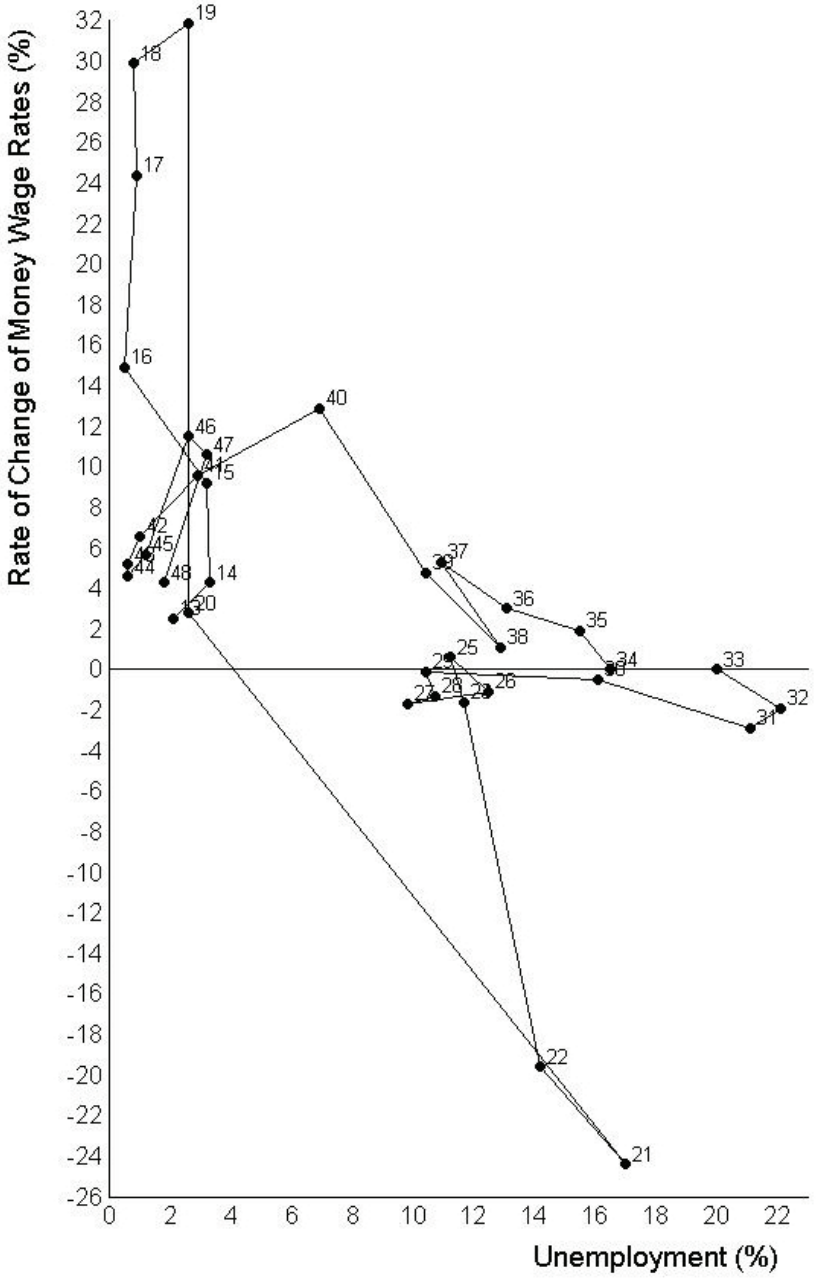
Phillips

(or why $\gamma'(u_t) < 0$?)

Why Assume $\gamma'(u_t) < 0$?

Any evidence that wages become more downwardly flexible as unemployment increases?

$\gamma'(u) < 0$?



Source: "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom 1861-1957," A. W. Phillips, Economica 25, November 1958, 283-299.

Comment on the figure.

The present theory implies that the relationship between wage inflation and the unemployment rate should be: 1.) For $u_t > 0$: $W_t/W_{t-1} = \gamma(u_t)$. The figure shows a downward sloping relation, giving support to the assumption that $\gamma'(u) < 0$.

2.) For $u_t = 0$: $W_t/W_{t-1} \geq \gamma(0)$. The figure shows that for low unemployment rates (between 0 and 2) observed wage inflation is anywhere between 2 and 32 percent.

Thus the empirical observations plotted in the figure are consistent with the predictions of the theoretical model.

EPOP

Vs.

Unemployment

EPOP vs. Unemployment Rate

Take a look at the next slide. In Japan and Europe the employment-to-population ratio (EPOP) and the unemployment rate both indicate that labor market condition have not improved much since the beginning of the recovery. Thus, one could use either labor market indicator the make the point that the recoveries have been jobless. However, in the United States, the unemployment rate suggests steady improvement of labor conditions since 2010, whereas the the EPOP ratio suggests no such improvement. Why?

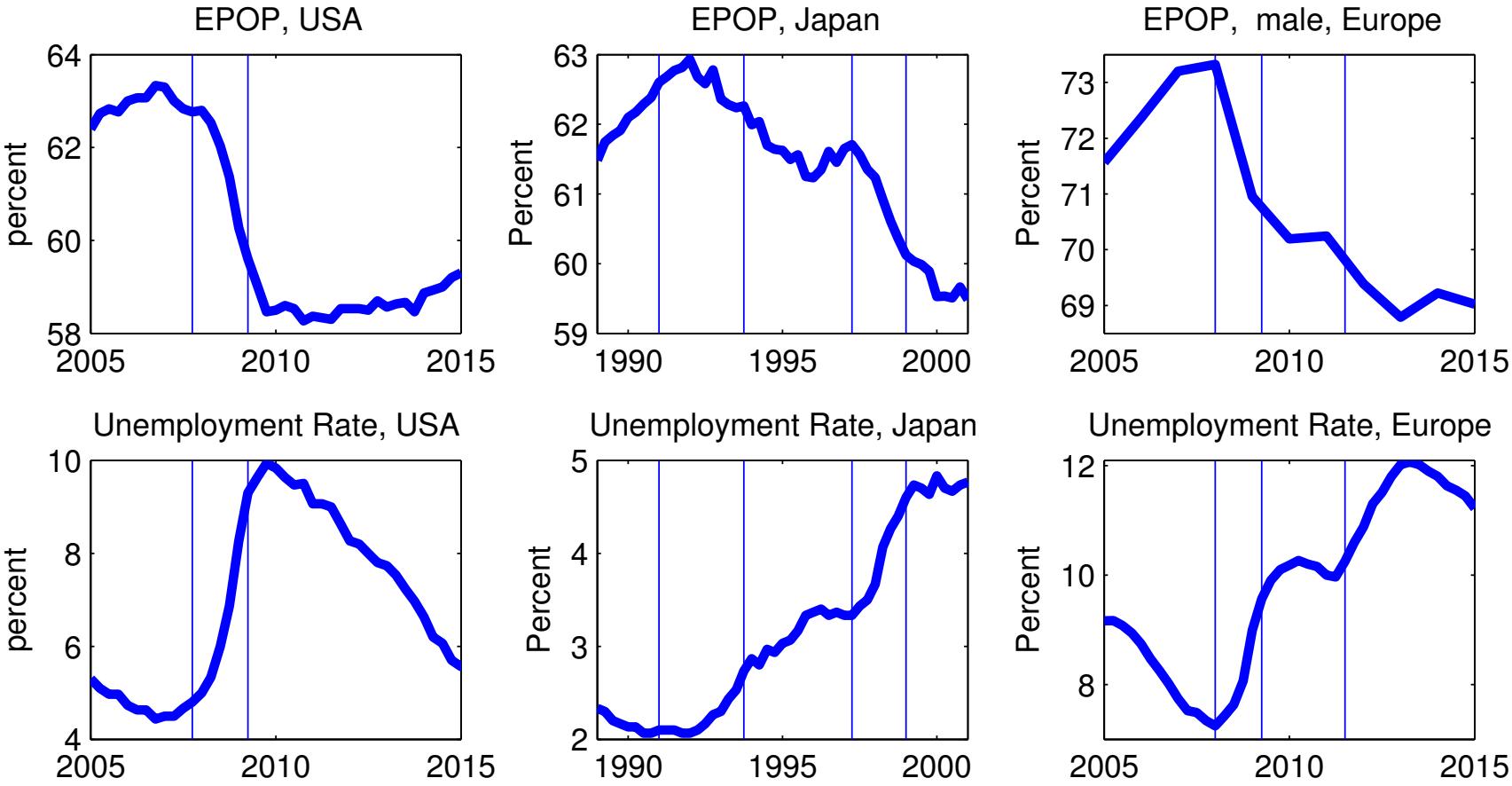
Because labor force participation rate declined by 2.5 percent during the recovery in the U.S..

Is the observed decline in the labor force participation ratio cyclical or not (i.e., due to demographic factors)?

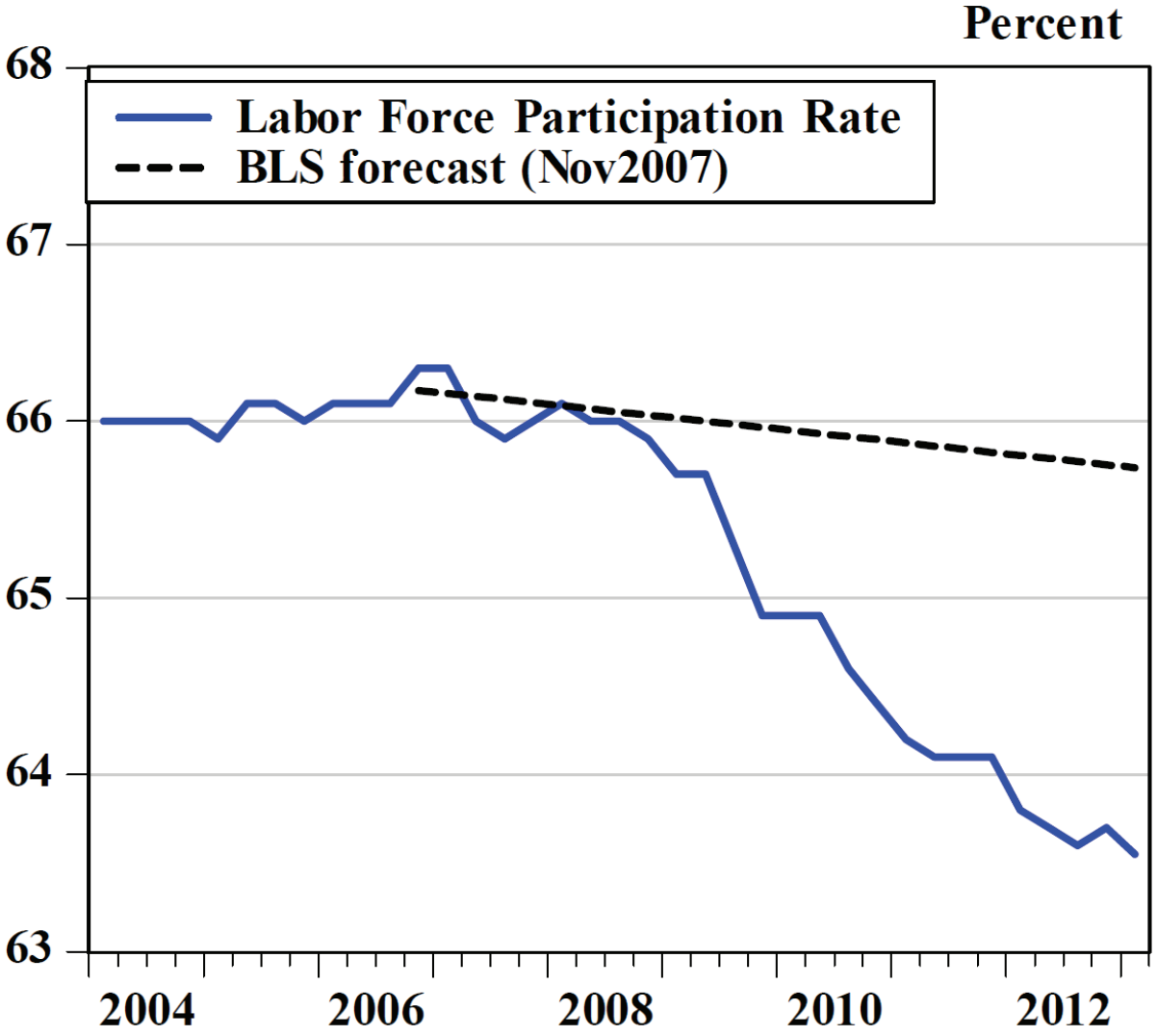
Erceg and Levin (2013) cite several studies and also present original evidence that it is mainly cyclical.

Erceg and Levin also show that the decline in LFPR was largest for young people, 16 to 24 years of age, 2nd largest for 25 to 54 years of age. So this is not old people retiring because of age or taking early retirement because the job market looks bad.

Employment-to-Population Ratio versus Unemployment Rate: USA, Japan, Euro Area



U.S. Labor Force Participation



Source: Erceg and Levin (2013)

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

Demographic Group	Population Share			Labor Force Participation Rate		
	2007	Change (2007 to 2012)		2007	Change (2007 to 2012)	
	Actual	*Projection*	*Actual*	*Actual*	*Projection*	*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)

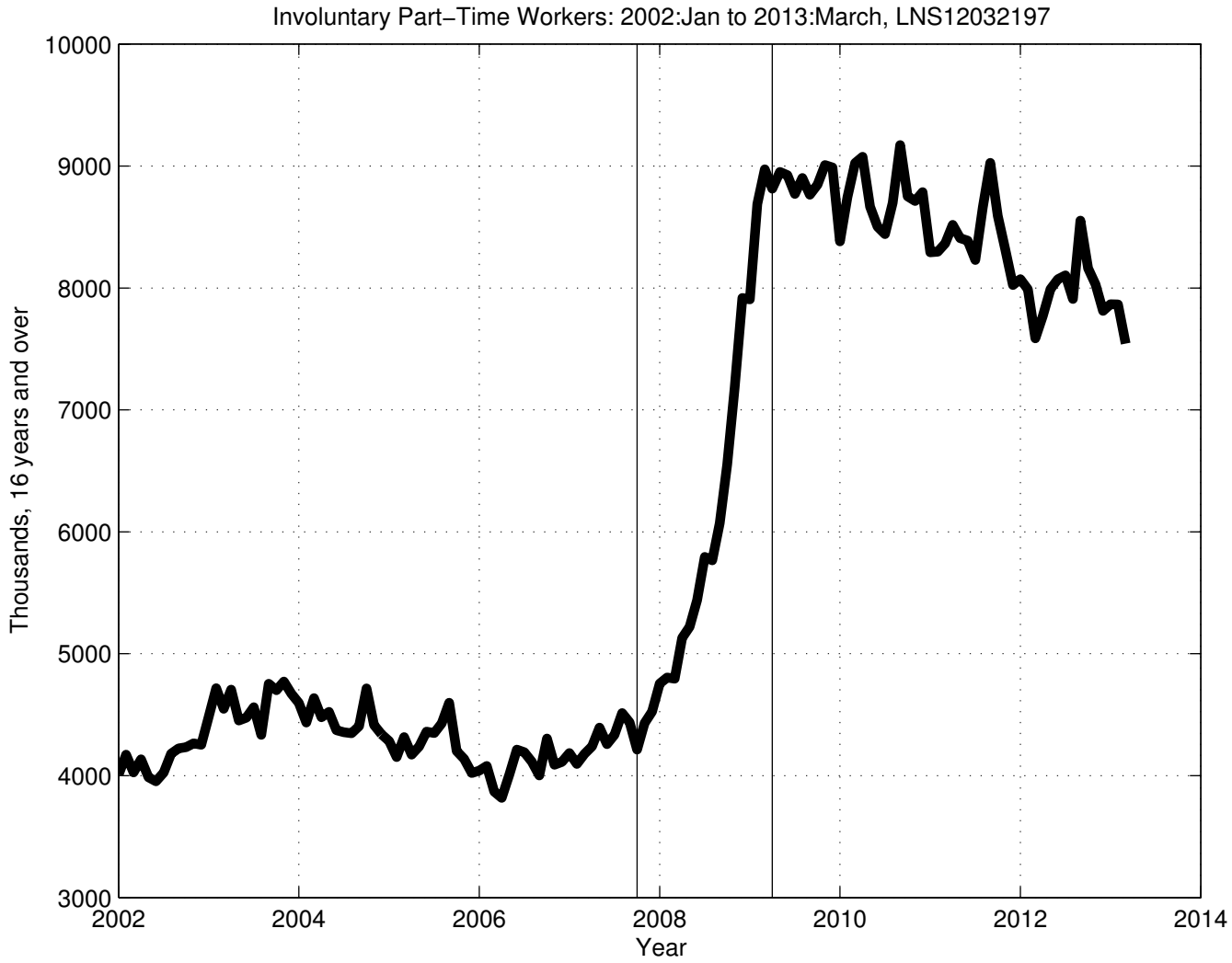
Other evidence in support of the claim that the U.S. recovery was jobless: no recovery in involuntary part-time work

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.



Data Source: Bureau of Labor Statistics.

Natural Rate Shocks

Alternative Hypothesis:

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

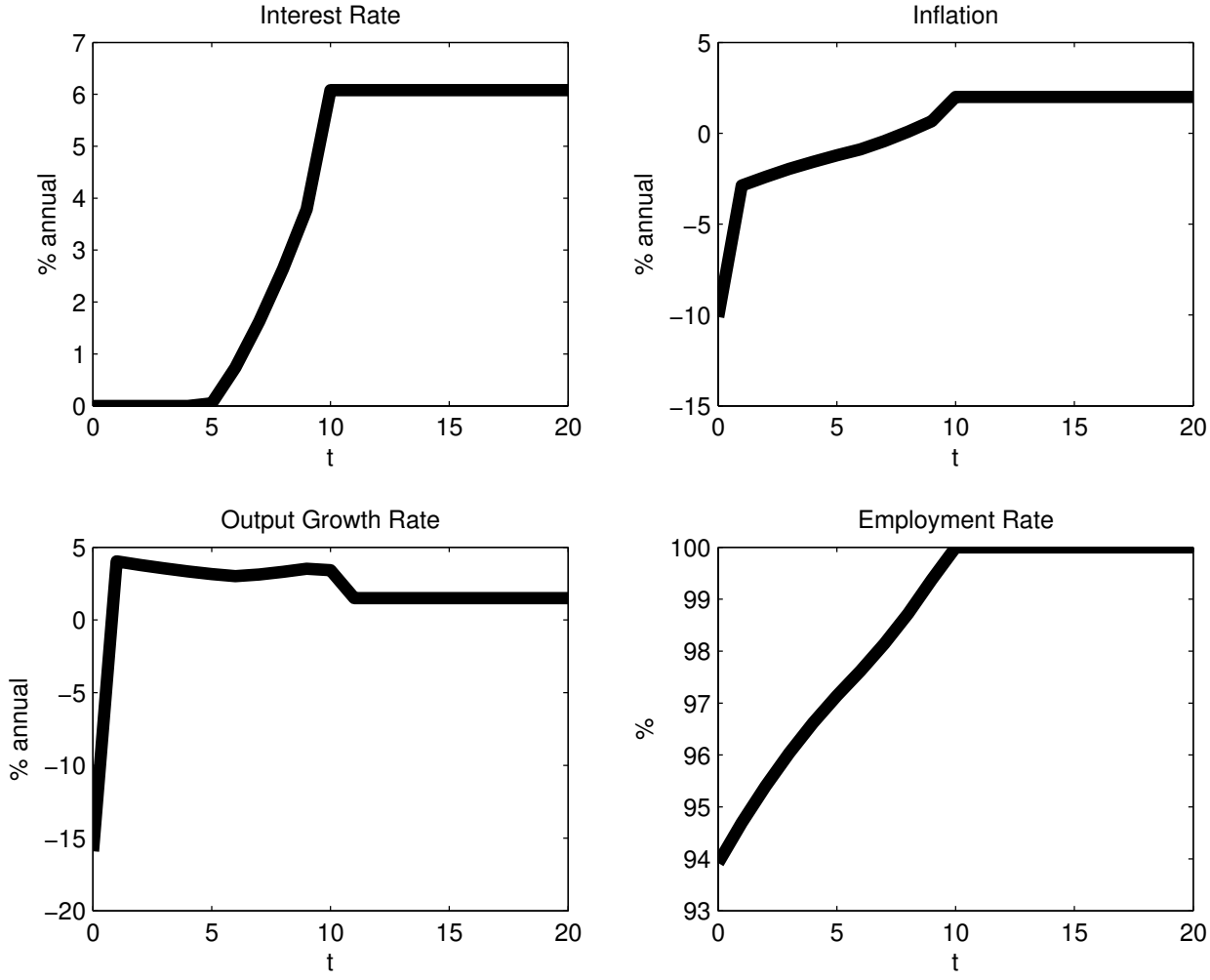
Specifically, consider the response to a decline in the natural rate of interest (following Eggertson and Woodford, 2003)

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

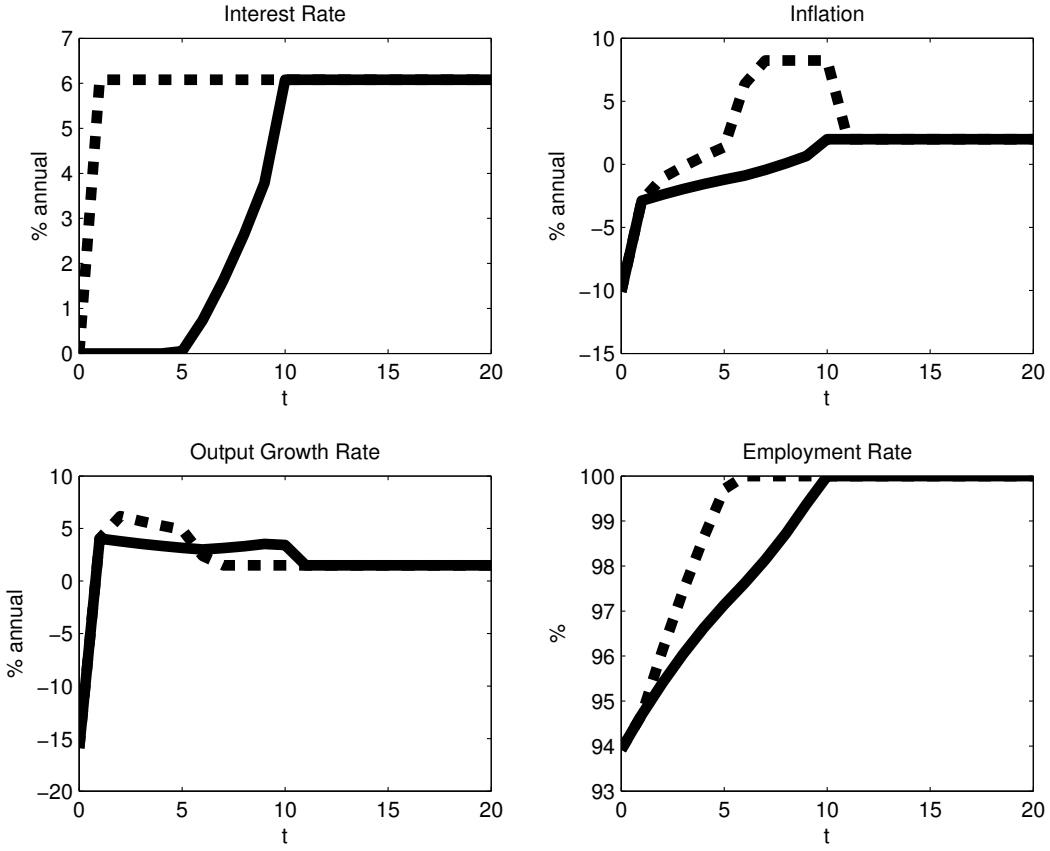
Exercise: Assume that the natural rate falls from its steady-state value of 4 percent per year to -2 percent per year for 10 quarters and then returns to 4 percent forever.

Proposition 1 (Recoveries With Job Creation) *Suppose that assumptions 1 and 2 hold and that* $w_{-1} = F'(\bar{h})$. *Then, in any perfect-foresight equilibrium with well-anchored inflationary expectations unemployment converges monotonically to zero in finite time. That is,* $u_{t+1} \leq u_t$ *for all* $t \geq 0$ *and there* $\exists T > 0$ *such that* $u_{T+j} = 0$ *for all* $j \geq 0$.

A Contraction With A Job-Creating Recovery: Response to a Persistent Decline In The Natural Rate



Dynamics Effects of a Fundamental Shock Under the Exit Strategy

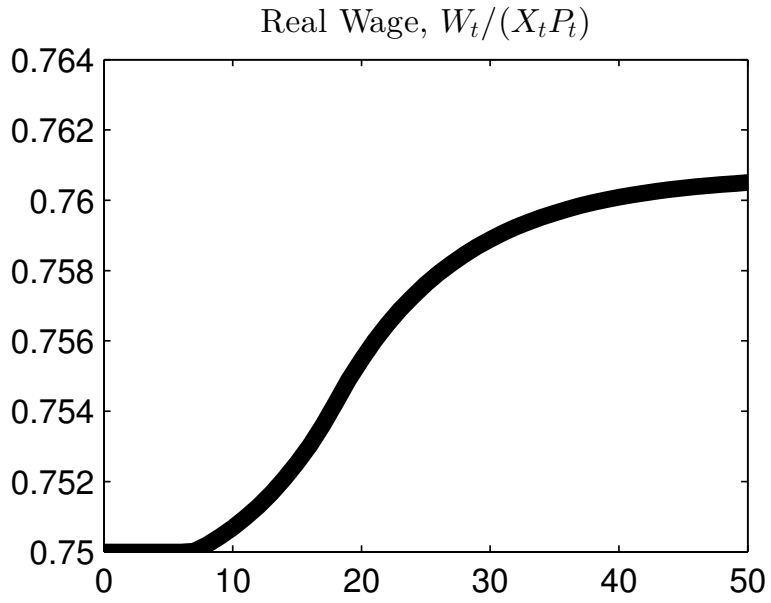


Solid Line: Taylor Rule Dashed Line: Exit Strategy

Real Wage in

Run-Up to Slump

Response of Detrended Real Wages, $W_t/(P_tX_t)$ to a Nonfundamental Shock



Did Real Wage Growth Exceed TFP Growth in the Recovery?

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

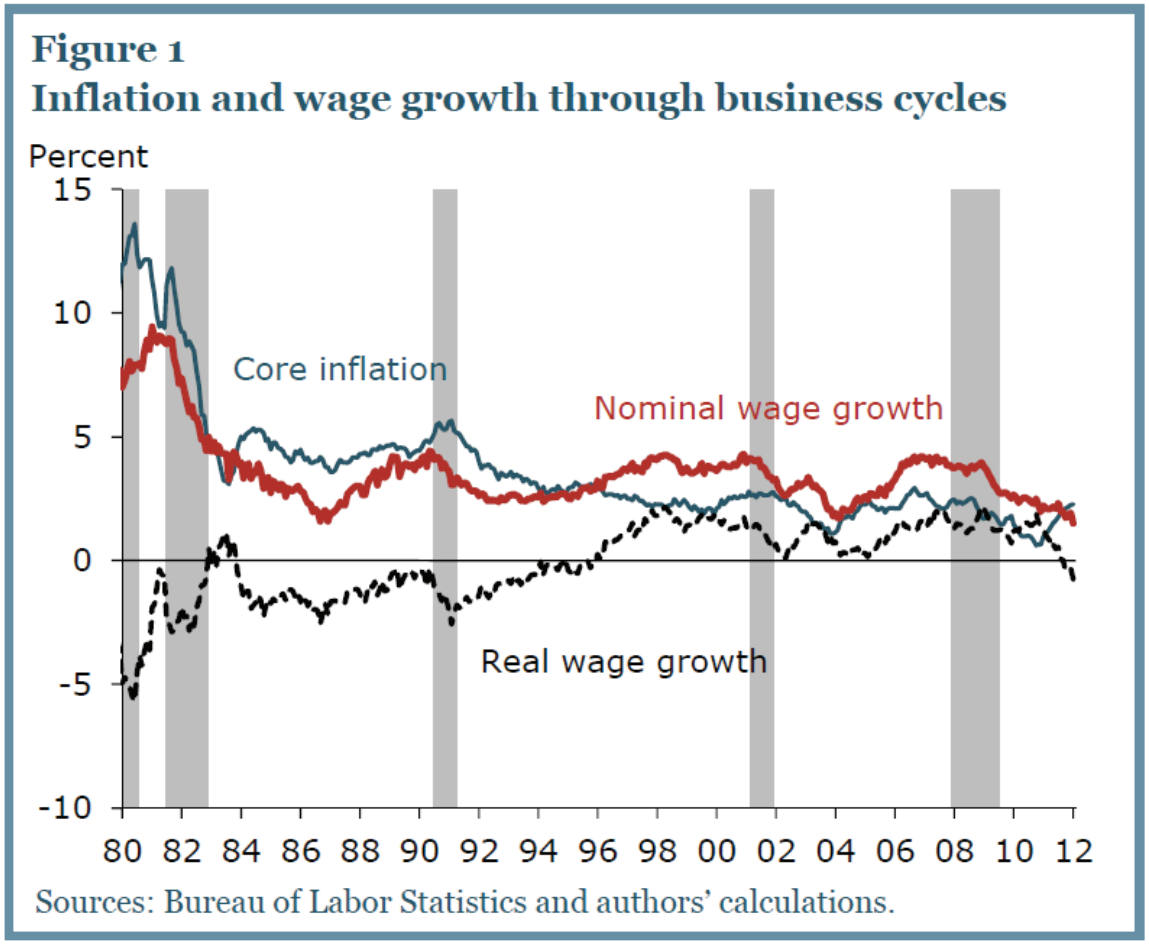
Fernald, FRBSF Productivity Data Base: Average Annual TFP Growth from 2008 to 2011 was 0.65 percent

Year	2009	2010	2011
%ΔTFP	3.34	-1.17	-0.22

Daly et al. report that real wages grew 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.

Real Wage Growth Held up Relatively Well During the 2008 Recession



Source: Daly et al. April 2012.

The Model

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:

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

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:*

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

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

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

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

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

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

$$c_t = F(h_t)$$

$$w_t = F'(h_t)$$

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

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

Steady State Equilibria:

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

Euler equation becomes:

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

Policy rules becomes:

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

Slackness becomes:

$$(\bar{h} - h)\left(1 - \frac{\gamma(u)}{\pi\mu}\right) = 0$$

Multiple Steady States

Proposition 2 (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 3 (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 $\pi = \tilde{\beta} < \pi^*$).*

Proposition 4 (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,*

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

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

Proposition 5 (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 4.*

Calibration

Calibration

$F(h) = h^{\alpha}$; 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

$\alpha_\pi = 1.5$

$\alpha_y = 0.125$

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

• Set $\gamma_1 = 1.02^{1/4} \Rightarrow$ At the full-employment steady state, nominal wages must grow at a rate of 2% per year or higher. Weak restriction: due to productivity growth, lower bound on nominal wages does not bind in the intended steady state.

• Set $\gamma_2 = 0.1942$ 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.