Advanced Topics in Monetary Economics II[1]

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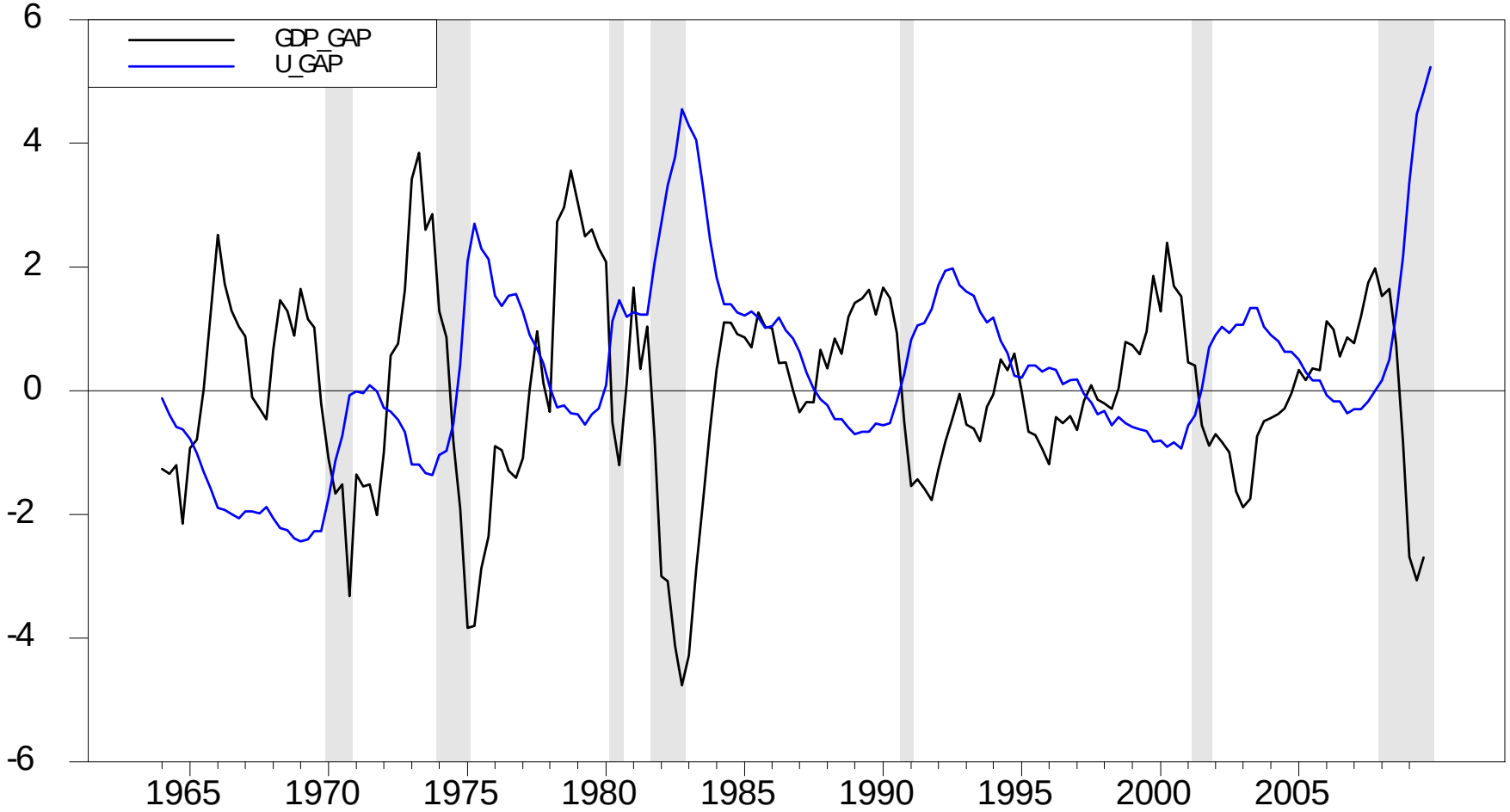
Unemployment and the business cycle



Unemployment and optimal monetary policy

- Dominant new Keynesian model
  - Has provided an important framework for thinking about policy.
  - Offers structure for conducting welfare-based policy analysis.
- But ... the framework has many shortcomings.
  - Lack of financial frictions or role for financial intermediation.
  - All labor adjustment at the intensive (hours) margin – *under-employment* but no *unemployment.*
- Questions:
  - Does stabilizing unemployment constitute a separate objective a flexible inflation targeter should pursue?
  - The canonical monetary policy model cannot cast light on the costs of inefficient fluctuations in unemployment relative to the costs of inflation volatility.

Most cyclical adjustment is at the extensive margin

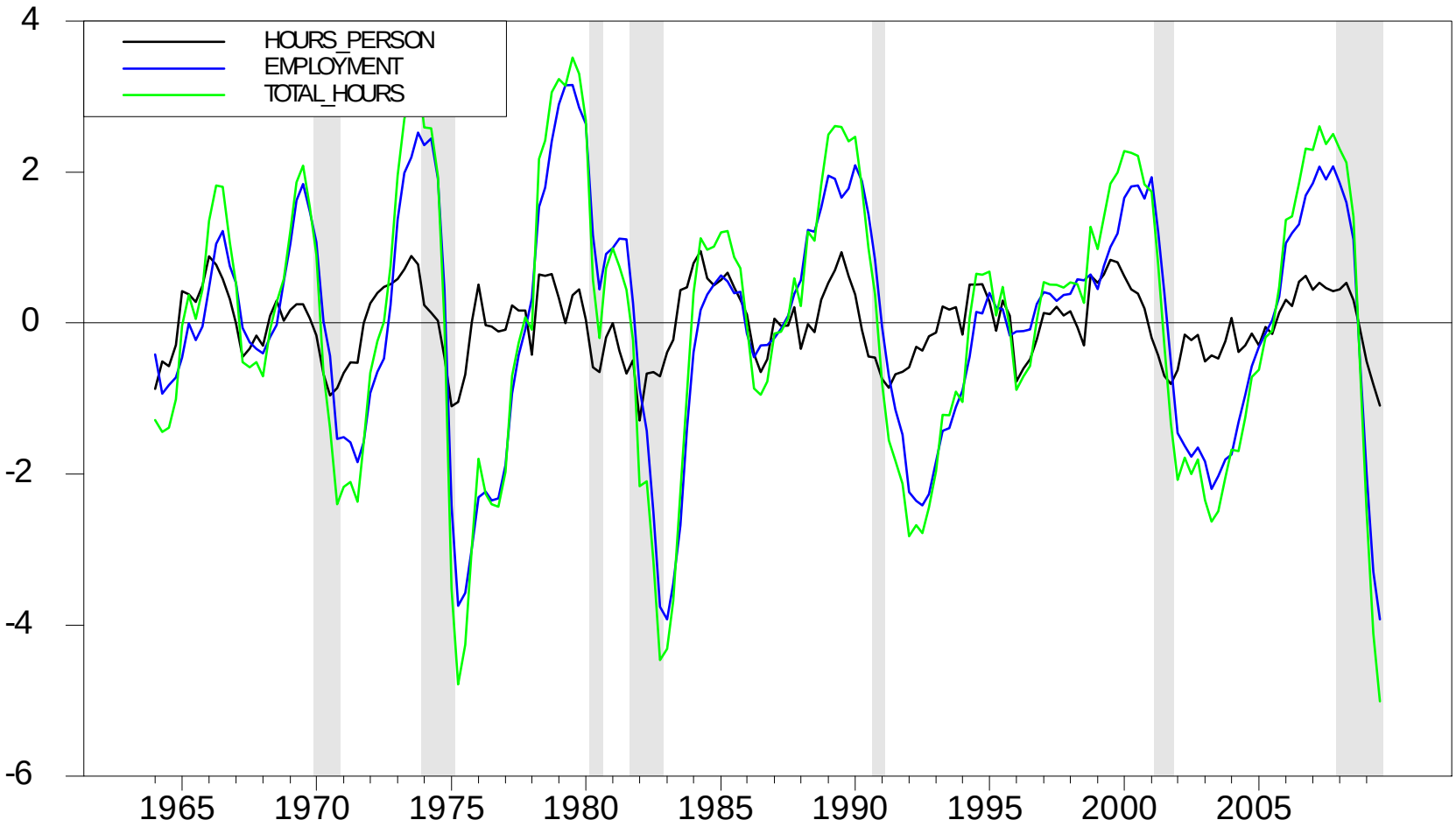


Figure: Employment (blue), hours/worker (black), total hours (green), NFB, logs, HP filtered, 1964:1 -2009:4.

Adding unemployment to DSGE models

- Early work focused on dynamics:
  - Cooley and Quadrini (JME 1999) – limited participation
  - Walsh (2003, RED 2005) – NK model with price stickiness.
- Empirical work:
  - Ravenna and Walsh (EER 2008) – unemployment-based Phillips curve;
  - Estimated DSGE models: Trigari (JMCB 2009), Gertler, Sala, and Trigari (JMCB 2008), Sala, Söderström, Trigari (JME 2008), Christoffel, Kuester, and Linzert (2006), Christiano, Trebrandt, and Walentin (2010), Galí, Smets and Wouter (2011).
- Policy analysis:
  - Thomas (2008); Blanchard and Galí (JMCB 2007); Ravenna and Walsh (AEJ Macro 2011, JME 2012), Christiano, Trabandt, and Walenti (2010).

The DMP model (Hall 2012)

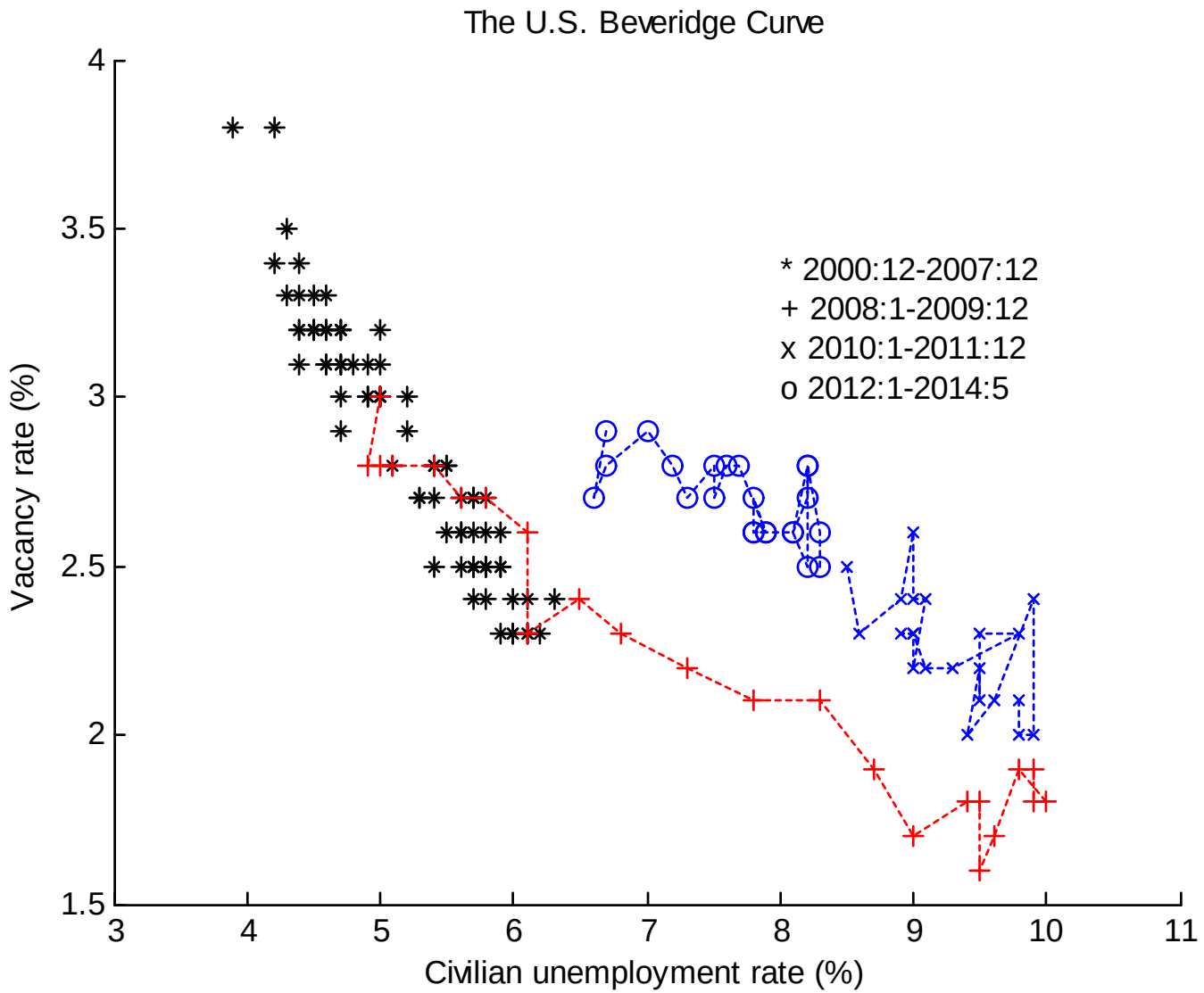
- The basic DMP model has three components:

1. Beveridge curve:

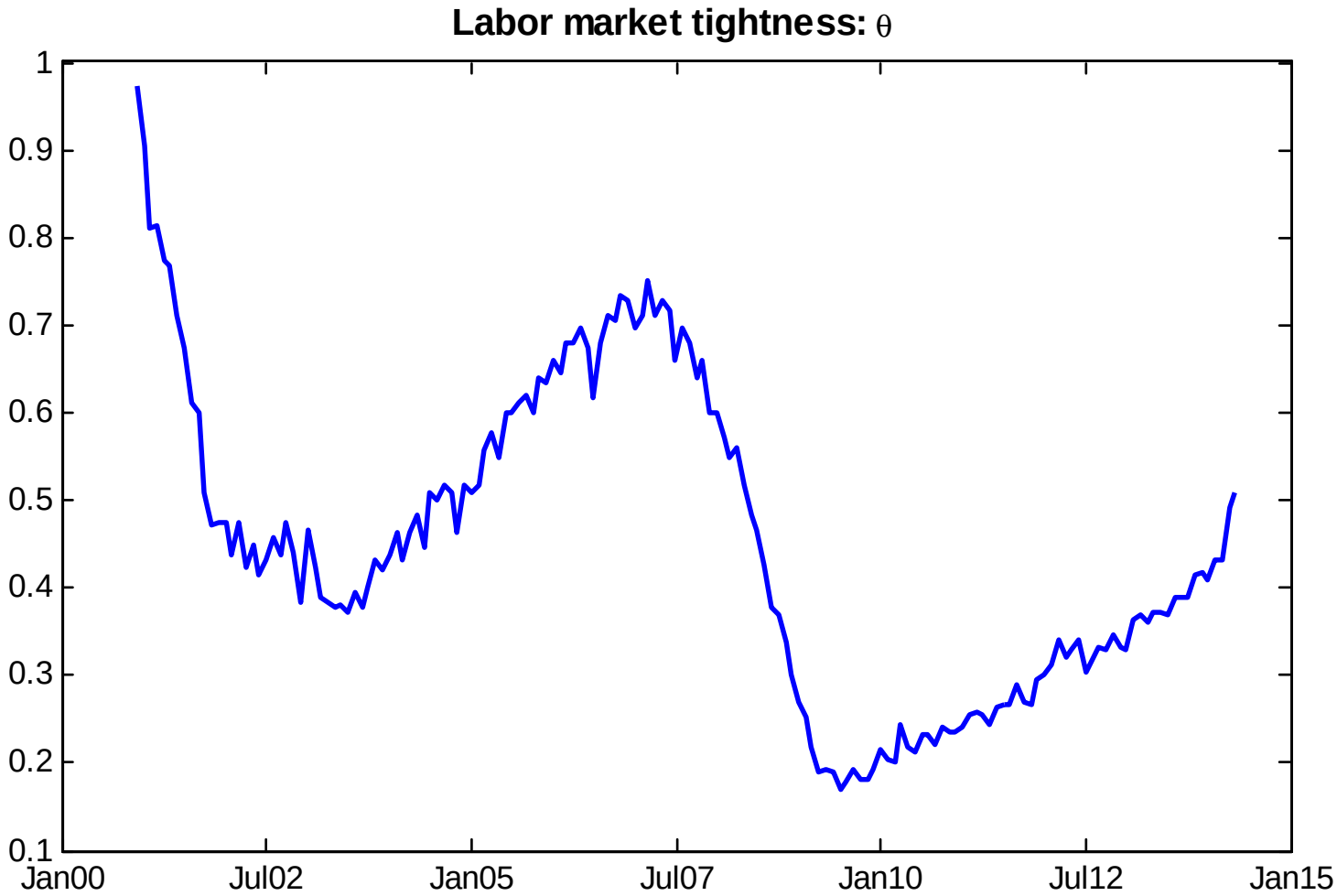
$$\Delta u_t = \rho(1 - u_t) + \mu\theta_t^a u_t,\ \theta_t = \frac{v_t}{u_t},\ 0 < a < 1$$

$$\Delta u_t = 0 \Rightarrow u_t = \frac{\rho}{\rho + \mu\theta_t^a}$$

The Beveridge curve



Labor market tightness



The DMP model (Hall 2012)

The basic DMP model has three components (steady state version):

1. Beveridge curve;
2. A theory of job creation:

$$V = -\kappa + q(\theta)(\mu z - w) + [1 - q(\theta)]V \Rightarrow (\mu z - w) = \frac{\kappa}{q(\theta)}$$

$$q(\theta)(\mu z - w) = \kappa$$

The DMP model (Hall 2012a)

- The basic DMP model has three components:

1. Beveridge curve;
2. A theory of job creation:
3. A bargaining model of wages (typically Nash):

$$w - R = \beta(\mu z - R) \Rightarrow w = (1-\beta)R + \beta\mu z$$

- Problem – the Shimer puzzle

Ravenna and Walsh (2011)

- Basic new Keynesian model for households and retail firms
- Add a Mortensen-Pissarides search and matching model of the labor market.
- Ignore adjustment on the intensive margin to focus on the extensive margin.
- Wages are flexible and set by Nash bargaining (but bargaining share is stochastic).
  - Keeps model very similar to basic NK model, but most recent work also assumes real wage stickiness.

Final goods

- Household obtain utility from consumption:

$$U(C_t) = \frac{C_t^{1-\sigma}}{1-\sigma}$$

- Consumption consists of market goods and home productions:

$$C_t = C_t^m + w^u(1 - N_t).$$

- The total expenditure on final goods from households and wholesale firms is

$$\int_0^1 P_t(j) C_t^m(j) dj + \kappa \int_0^1 P_t(j) v_t(j) dj = P_t(C_t^m + \kappa v_t)$$

- Goods market clearing:

$$Y_t = C_t^m + \kappa v_t$$

Wholesale goods, employment and wages

- Production by wholesale firm i is

$$Y_{it}^{w} = Z_t N_{it},$$

  where Z_t is a common, aggregate productivity disturbance with a mean equal to 1 and bounded below by zero.
- Wholesale firms sell their output in a competitive market at the price P_t^w.
- The real marginal cost of a retail firm is the inverse of the retail-price mark up:

$$\frac{1}{\mu_t} \equiv \frac{P_t^w}{P_t}.$$

The labor market

- Wholesale firms must post vacancies to obtain new employees.
- If a job produces output Z_t and w_t is the wage paid to the worker, than the value of a filled job in terms of final goods is

$$J_t = \left(\frac{P_t^w}{P_t}\right) Z_t - w_t + (1-\rho)\beta \mathrm{E}_t \left(\frac{\lambda_{t+1}}{\lambda_t}\right) J_{t+1},$$

- The job posting condition is $q_t J_t = \kappa$, where κ is the vacancy posting cost and q_t is the probability of filling a vacancy, so

$$\frac{Z_t}{\mu_t} = w_t + \frac{\kappa}{q_t} - (1-\rho)\beta \mathrm{E}_t \left(\frac{\lambda_{t+1}}{\lambda_t}\right)\left(\frac{\kappa}{q_{t+1}}\right)$$

- If $\kappa = 0$, this yields the standard result that $1/\mu_t = P_t^w / P_t = w_t / Z_t$.

Employment dynamics

- Each period, an exogenous fraction ρ of existing matches terminate. The number of unemployed job seekers in period t is

$$u_t \equiv 1 - (1 - \rho) N_{t-1}.$$

- Unemployed workers are matched stochastically with job vacancies, with matching process is represented by a CRS matching function:

$$m(u_t, v_t) = \chi v_t^{\alpha} u_t^{1-\alpha} = \chi \theta_t^{\alpha} u_t$$

where $\theta_t \equiv v_t / u_t$ is the measure of labor market tightness, and $0 < \alpha < 1$.

- Aggregate employment evolves according to

$$N_t = (1 - \rho) N_{t-1} + m(u_t, v_t).$$

Wages and the relative price

- The equilibrium real wage under Nash bargaining is

$$w_t = (1 - b_t) w^u + b_t \left[\frac{Z_t}{\mu_t} + (1 - \rho) \left(\frac{1}{R_t} \right) \kappa \mathrm{E}_t \theta_{t+1} \right]$$

- The relative price of wholesale goods in terms of retail goods is equal to $P_t^w / P_t = 1/\mu_t = \tau_t / Z_t$.where

$$\begin{aligned} \xi_t &\equiv w^u + \left(\frac{1}{1 - b_t} \right) \left(\frac{\kappa}{q_t} \right) \\ &\quad - (1 - \rho) \left(\frac{1}{R_t} \right) \mathrm{E}_t \left(\frac{1 - b_{t+1} p_{t+1}}{1 - b_{t+1}} \right) \left(\frac{\kappa}{q_{t+1}} \right). \end{aligned}$$

- Labor market tightness affects inflation through ξ_t.

Linearized model

The unemployment-based Phillips curve

- The linearized Phillips curve takes the standard form:

$$\pi_t = \beta \mathrm{E}_t \pi_{t+1} - \delta \hat{\mu}_t.$$

- To obtain a Phillips curve in terms of unemployment gaps, we use the fact that real marginal cost can be expressed as a function of labor market tightness and $\hat{u}_{t+1} = \rho_u \hat{u}_t - \alpha\rho\eta\hat{\theta}_t$ to obtain

$$\pi_t = \beta \mathrm{E}_t \pi_{t+1} - \delta\gamma_1 \tilde{u}_{t+1} + \delta\gamma_2 \tilde{r}_t + \delta B \hat{b}_t,$$

  where the a_i are functions of the model's structural parameters.
- There is also a cost channel and bargaining shocks act like cost shocks in a basic NK model.

Welfare

- The second order approximation to welfare is

$$\sum_{i=0}^{\infty} \beta^i U(C_{t+i}) = \frac{U(\bar{C})}{1-\beta} - \frac{\varepsilon}{2\delta} U_c \bar{C} \sum_{i=0}^{\infty} \beta^i L_{t+i} + t.i.p.$$

  where $t.i.p.$ denotes terms independent of policy, and the period-loss function is

$$L_t = \pi_t^2 + \lambda_0 \tilde{c}_t^2 + \lambda_1 \tilde{\theta}_t^2.$$

- The weight on $\tilde{c}_t^2$ is the same as that obtained in a standard NK model if utility is linear in hours worked.
- Weight on labor market tightness is

$$\lambda_1 = (1-\alpha)(\delta/\varepsilon)(\kappa \bar{V}/\bar{C}).$$

Distortions: intuition

$$U(C_t) = U\left\{\int \left[(c_t(j))^{\frac{\varepsilon-1}{\varepsilon}}\, dj\right]^{\frac{\varepsilon}{\varepsilon-1}} + C_t^{non-market}\right\}$$

1. Inefficient volatility in consumption when the consumption gap is non-zero.
2. Inefficient composition of market consumption resulting from relative price dispersion due to non-zero inflation.
3. Inefficient composition of total consumption due to search frictions when the labor market tightness gap is non-zero.

Calibration

Table 1: Parameter Values		
Exogenous separation rate	ρ	0.1
Vacancy elasticity of matches	α	0.5
Replacement ratio	ϕ	0.54
Steady state vacancy filling rate	q	0.9
Labor force	N	0.9416
Discount factor	β	0.99
Relative risk aversion	σ	2
Markup	μ	1.2
Price adjustment probability	$1-\omega$	0.25

Optimal commitment – response to a bargaining shock

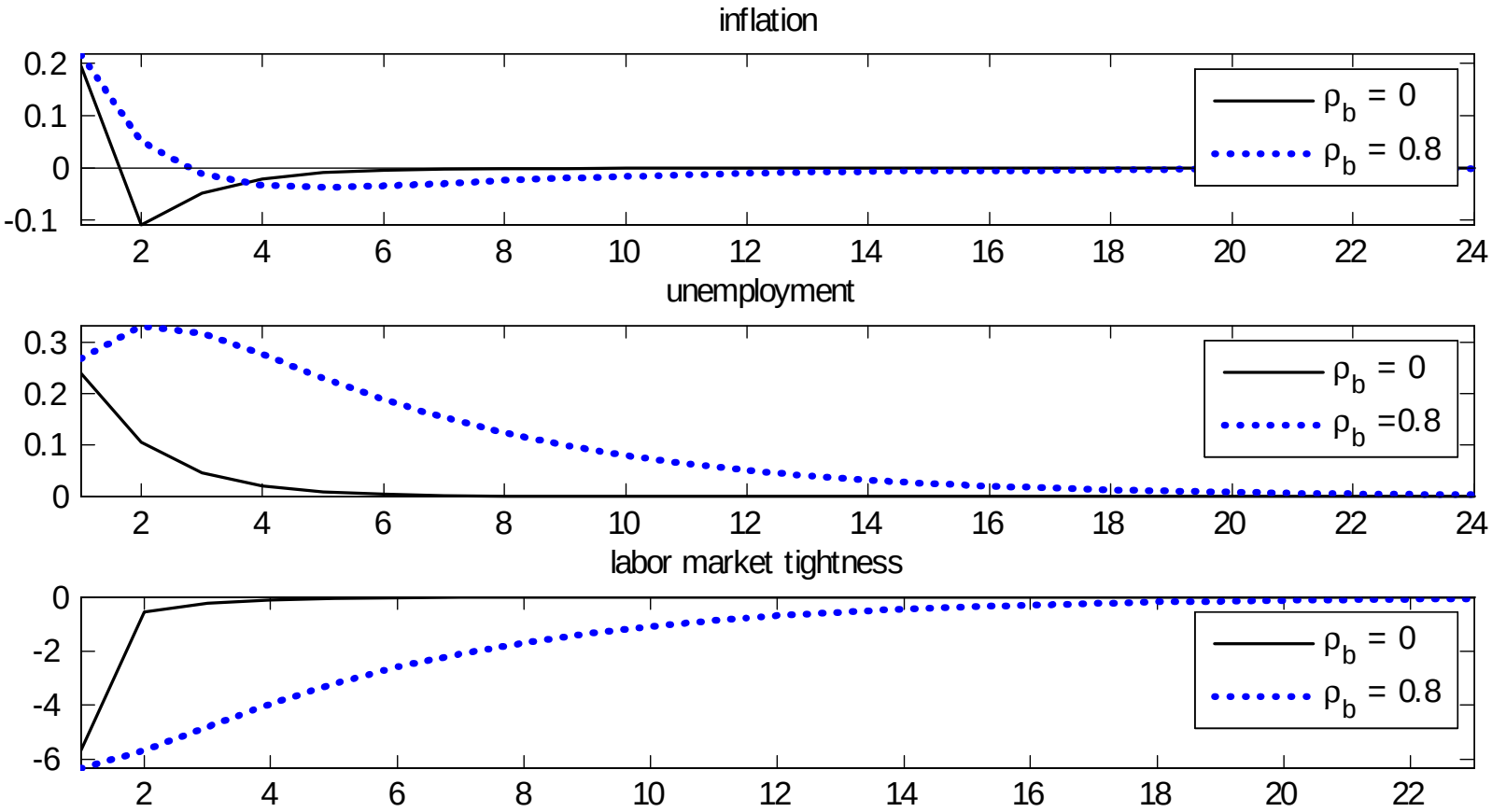


Figure: Response to a one standard deviation bargaining shock under optimal commitment (π and θ scaled in percentage point deviations from steady state; unemployment scaled as percentage points of total labor force).

Optimal commitment – role of the loss function

We consider three alternative objectives for the central bank:

1. The welfare based objective:

$$L_t = \pi_t^2 + \lambda_0 \tilde{c}_t^2 + +\lambda_1 \tilde{\theta}_t^2.$$

2. A standard inflation-consumption gap loss function:

$$L_t = \pi_t^2 + \lambda_0 \tilde{c}_t^2$$

3. An inflation and unemployment gap loss function:

$$L_t = \pi_t^2 + \lambda \tilde{u}_t^2.$$

Optimal commitment – role of the loss function

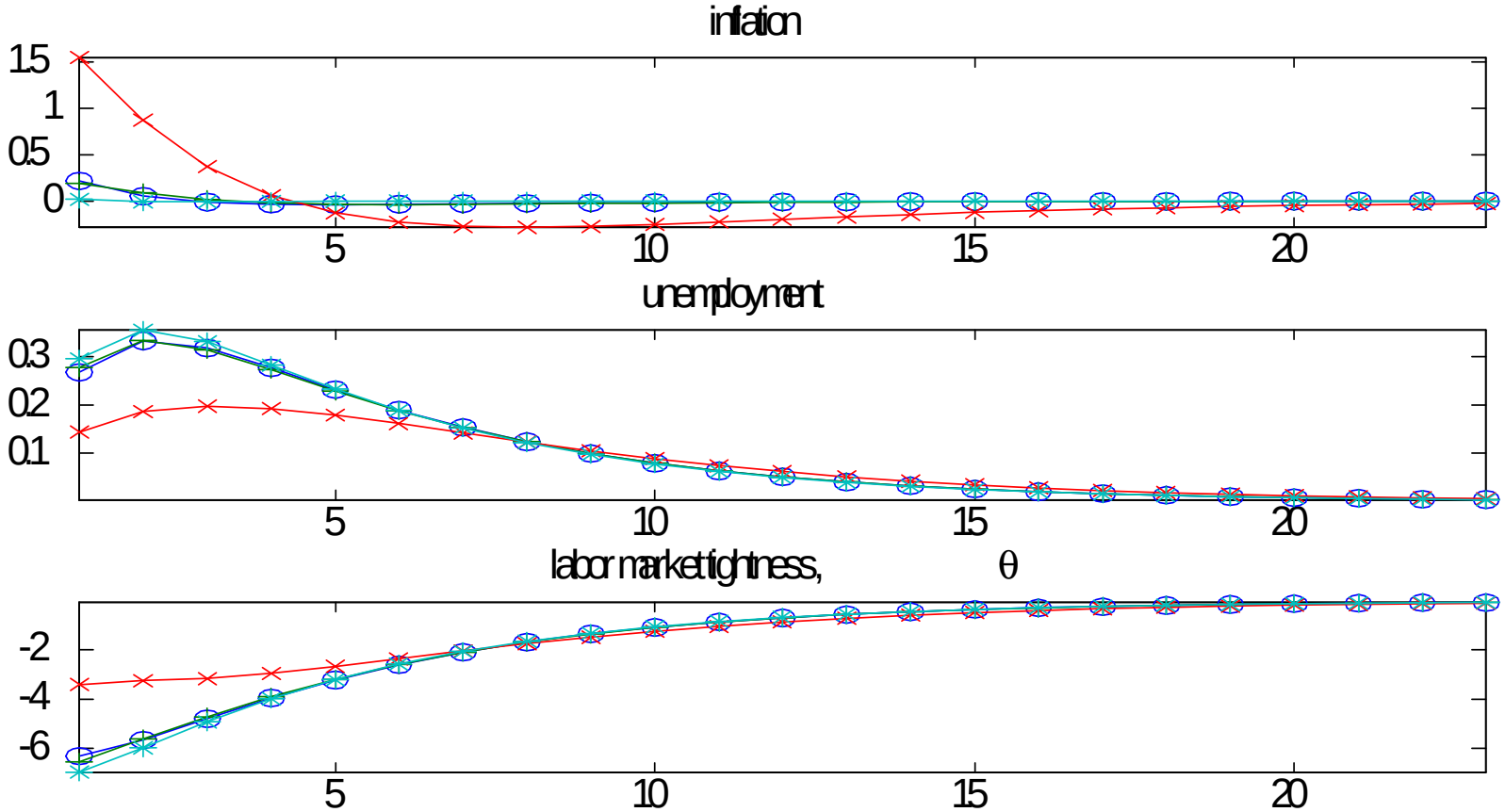


Figure: Responses to one std dev. bargaining shock under optimal commitment policies minimizing different loss functions: o welfare loss; $*$ eq. 32, $+$ eq. 33 with $\lambda = 0.0035$; x eq. 33 with $\lambda = 0.0521$.

U.S. versus EU. calibration

- Stylized comparison of U.S. and E. U. labor markets.
- Hold all parameters the same except rate of job destruction ρ, steady-state employment and replacement ratio.

U.S. values	$\rho = 0.10$	$\bar{N} = 0.9416$	$\phi = 0.54$
EU values	$\rho = 0.025$	$\bar{N} = 0.0.8989$	$\phi = 0.65$

Implied Phillips curves: U.S. and EU

$$\text{U.S. calibration: } \pi_t = \beta \mathrm{E}_t \pi_{t+1} - 0.087 \tilde{u}_{t+1} + 0.103 \tilde{r}_t + 0.081 \hat{b}_t$$
$$\text{EU. calibration: } \pi_t = \beta \mathrm{E}_t \pi_{t+1} - 0.065 \tilde{u}_{t+1} + 0.845 \tilde{r}_t + 0.099 \hat{b}_t$$

- Two differences are apparent.
  - Interest rate channel is much larger with EU calibration.
  - Inflation is less sensitive to the unemployment gap with EU calibration.
- These differences reflect the higher persistence of unemployment under the EU calibration ($\rho_u = 0.798$ for EU versus 0.345 for U.S.)
  - When ρ_u is large, both current and future labor market conditions move together; impact of current unemployment offset to some degree by the co-movement of expected future unemployment.
- EU faces better trade off.

Search frictions, wedges, and price stability

- Why do many models with frictions imply price stability is close to optimal?
- Tax interpretation. Suppose economy characterized by sticky prices, search frictions in the labor market, and monopolistic competition.
- Ravenna and Walsh (JME 2012) show that the first best allocation can be supported using three taxes and monetary policy.
  - Price stability that ensures the retail price markup μ_t is constant.
  - A steady-state subsidy τ^{μ} to retail firms to eliminate distortion due to imperfect competition to ensure the markup is constant at 1.
  - A tax (subsidy) τ_t^f on intermediate firms to ensure vacancy posting is efficient.
  - A tax on household labor consumption τ_t^C to ensure hours choice is optimal.

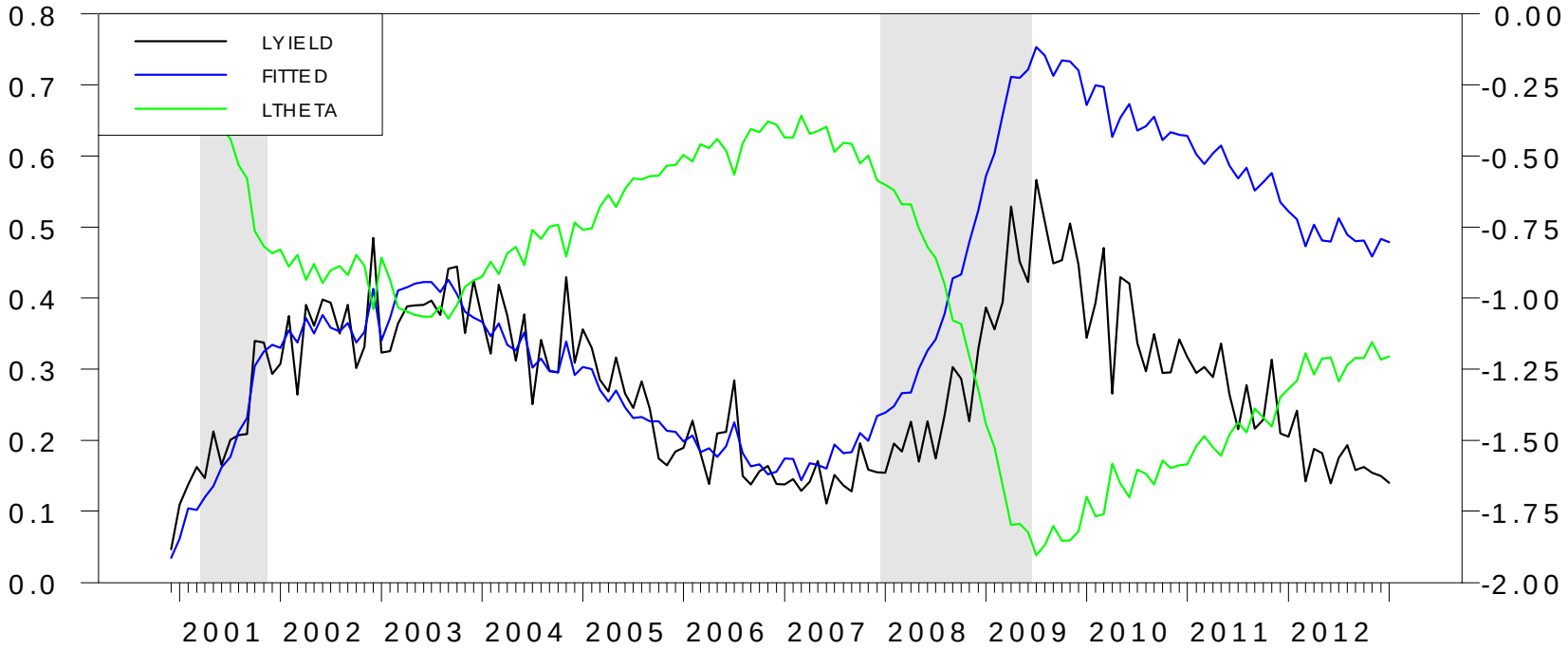
Tax instruments

- If the Hosios condition is satisfied, then the first best can be achieved with a steady-state subsidy to retail firms to eliminate distortion due to imperfect competition plus a policy of price stability. The other two taxes are not needed.
- If the Hosios condition is not met, then
  - τ_t^f can be used to ensure the markup varies to ensure efficient vacancy posting.
  - This distorts the choice of hours so τ_t^C is needed to ensure hours are efficient.
  - Monetary policy ensures price stability to eliminate the distortion created by price dispersion.
  - τ^μ ensures $\mu = 1$.

Using only monetary policy

- If wage bargaining is Nash but fails the Hosios condition, the intermediate sector tax that corrects firms' incentive to post vacancy is large but basically acyclical.
- Monetary policy can replicate this but doing so requires little movements in markups, so price stability is close to optimal.
- With a wage norm at an inefficient level, the required intermediate sector tax must vary significantly to achieve efficient vacancy posting.
- Replicating this using only monetary policy would require large deviations from price stability and distort the hours choice, so the cost of trying to eliminate inefficient vacancy postings is large. Optimal policy improves only a little relative to price stability.

Decline in vacancy yield (log hires/openings)



Skill heterogeneity

Ravenna and Walsh (JMCB 2012, WP 2013)

- Low skill and high skill workers.
- Low skill worker more likely to experience job separation.
- In a recessions, the skill mix of the unemployed shifts towards low skill workers:
  - Reduces the vacancy yield rate as firms see more job applicants they don't want to hire;
  - Reduces incentive for firms to post vacancies;
  - Job finding rate falls because probability of finding a job for a low-skill worker falls *and* because low-skill workers become a larger share of the total unemployed.

Preview of results

- Productivity-heterogeneity generates a *composition effect* within a single labor market that affects the persistence of unemployment;
- We show that average productivity of the pool of unemployed workers varies endogenously over the business cycle, and it varies in such a way that delays the recovery of employment after a persistent fall in demand;
  - The composition effects acts to compound the effects of a negative aggregate demand shock by generating an endogenous negative TFP shock that only affects the pool of unemployed workers.
  - Can help explain why a recession can bring about a persistent decline in the outflow rate from unemployment;
- Effects on output and employment are amplified if monetary policy is constrained by the zero lower bound on nominal interest rates, but without worker heterogeneity, the ZLB would generate little unemployment persistence.

Results

- Compared to a model with homogeneous workers, worker heterogeneity in a persistent downturn results in:
  - (1) a much larger increase in unemployment;
  - (2) a similar output recovery but a delayed and much slower recovery of unemployment (a jobless recovery);
  - (3) little downward wage pressure despite considerable slack in the labor market;
  - (4) a fall in measured match efficiency and a long-lived shift in the Beveridge curve.
- These results arise in a model with flexible wages.

The labor market

- High skill workers always produce positive surplus when in a match. Their matches separate at rate ρ^x.
- Low skill workers' productivity depends on match-specific shock $a_{i,t}$. They experience the same exogenous separation rate ρ^x but may also endogenously separate.
- Firms post vacancies; vacancies generate interviews.
- At the interview, high-skill workers are hired, but low-skill workers may be screened out if $a_{i,t}$ is too low.

The hiring process

- The number of new interviews is determined by a standard matching function $m(S_t, V_t)$:

$$m(S_t, V_t) = \psi V_t^{1-\alpha} S_t^{\alpha} = \psi \theta_t^{1-\alpha} S_t, \qquad 0 < \alpha < 1,\ \psi > 0,\ \theta_t \equiv \frac{V_t}{S_t}.$$

- Idiosyncratic productivity shocks $a_{i,t}$ are observed in the interview process or, if worker is employed, by the firm.
- The probability an unemployed worker obtains an interview, $k_t^w = \psi \theta_t^{1-\alpha}$, is the same for all job seekers.
- Only low-skill workers with productivity that exceeds $\bar{a}_t$ will be hired (or retained); ρ_t^n is the fraction of type I workers with idiosyncratic productivity below cutoff value $\bar{a}_t$.

Job filling and job finding

- The job finding probability is identical to the interview rate for high-skill workers, while it is lower, and equal to

$$k_t^{w,l} = k_t^w \left(1 - \rho_t^n\right) < k_t^w$$

  for low-skill workers.
- If γ_t is the share of low-efficiency workers among unemployed, the overall job finding probability is

$$k_t^w \left[\left(1 - \gamma_t\right) + \gamma_t \left(1 - \rho_t^n\right)\right] = k_t^f \left(1 - \gamma_t \rho_t^n\right) < k_t^f$$

Vacancies

- Wages are determined by Nash bargaining with the worker receiving a constant share η of the match surplus.
- If κ is the cost of posting a vacancy, and firms receive a share $1-\eta$ of the surplus from a match, the job posting condition is

$$k_t^f(1-\eta)\left[(1-\gamma_t)s_t^h+\gamma_t\int_{\bar{a}_t}^{1}s_{i,t}^l f(a_i)da_i\right]=\kappa$$

- Since the expected surplus from a high skill worker is greater than that from an employed low skill worker, a fall in the quality of the unemployment pool (a rise in γ_t) reduces the incentive to post vacancies.

Response to a negative demand shock and ZLB

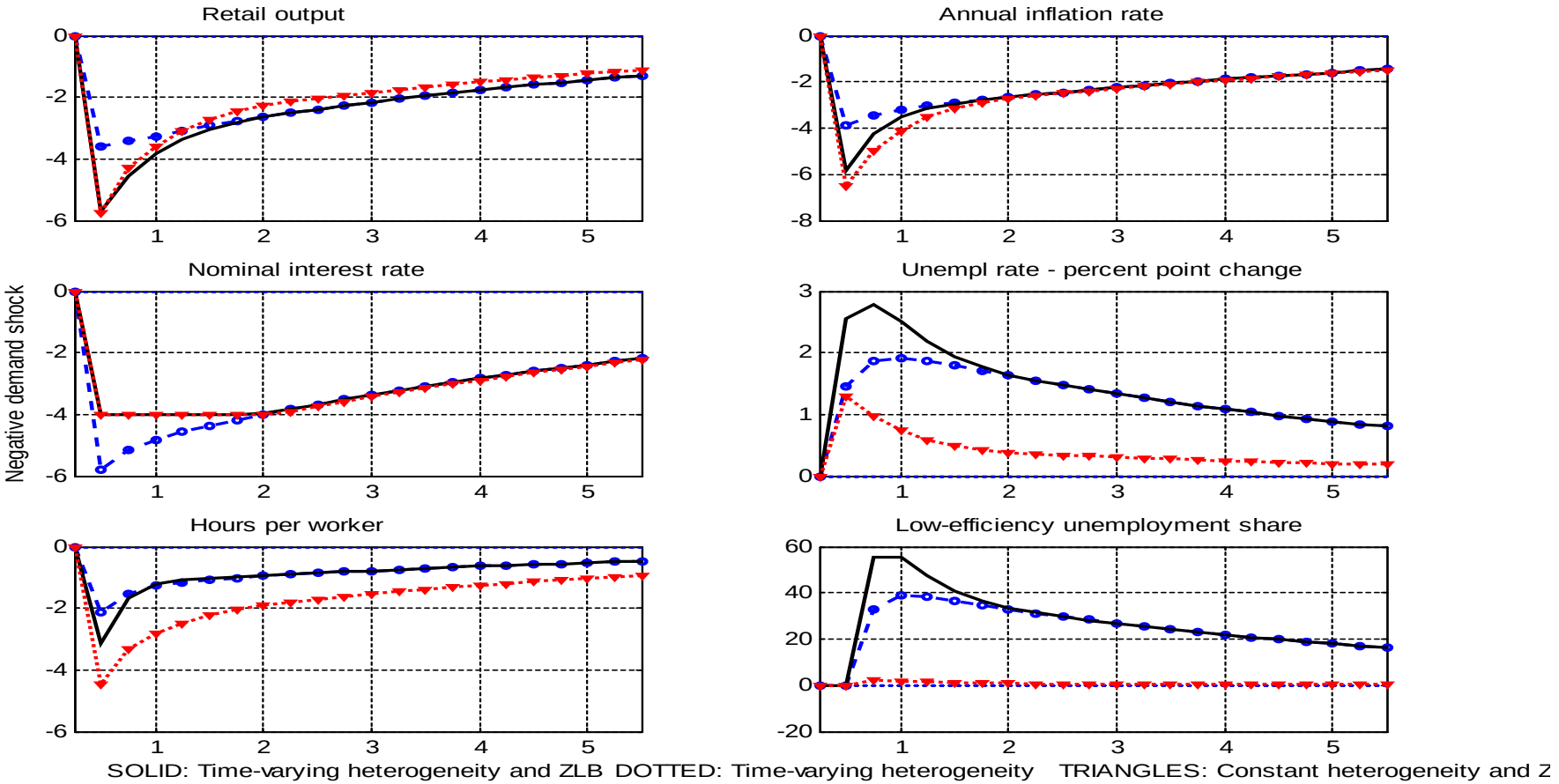


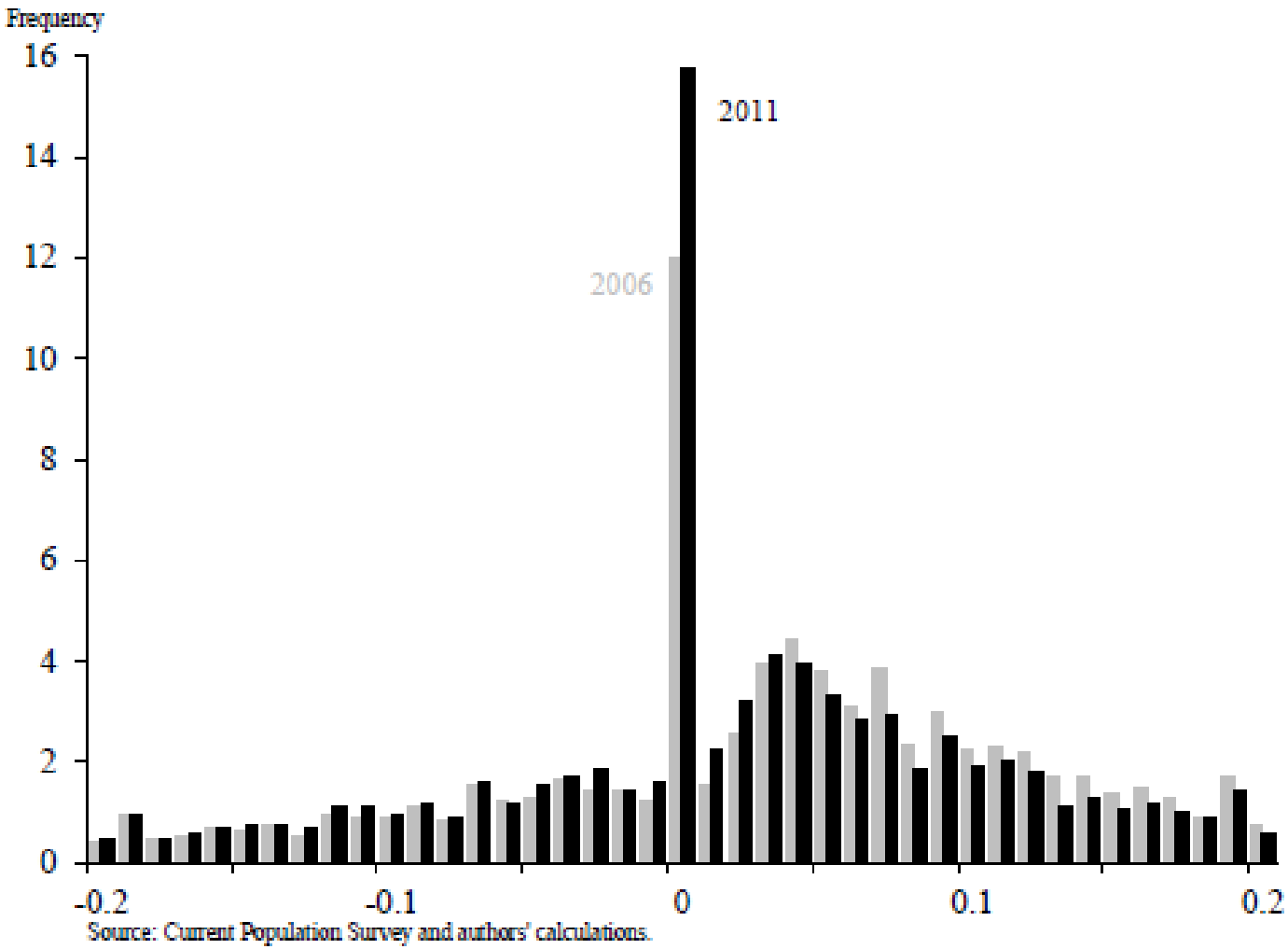
Figure: The Great Recession downturn and recovery. Impulse response to a persistent negative demand shock D_t and a discount rate shock leading to the zero lower bound for i_t. Horizontal axis in years.

Downward wage rigidity, is the long-run Phillips curve vertical?

- Akerlof, Dickens, and Perry (1996)
- Benigno and Ricca (2011)
- Coibion, Gorodnichenko, and Wieland (2011)
- Hobijn and Daly (2013)

Evidence from Daly and Hobijn (SFFRB WP 2013)

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



Summing up

Evolving views: then

- policy as systematic

  ...[equilibrium methods] will focus attention on the need to think of policy as the choice of stable rules of the game, well understood by economic agents. Only in such a setting will economic theory help predict the actions agents will choose to take. (Lucas and Sargent 1978)

- but unpredictable

  .. the government countercyclical policy must itself be unforeseeable by private agents...while at the same time be systematically related to the state of the economy. Effectiveness, then, rests on the inability of private agents to recognize systematic patterns in monetary and fiscal policy. (Lucas and Sargent 1978).

Summing up

Evolving views: now

- policy as systematic *and* predictable

> *...the central bank's stabilization goals can be most effectively achieved only to the extent that the central bank not only acts appropriately, but is also understood by the private sector to predictably act in a certain way. The ability to successfully steer private-sector expectations is favored by a decision procedure that is based on a rule, since in this case the systematic character of the central bank's actions can be most easily made apparent to the public. (Woodford 2003, p. 465)*