Allocative and Remitted Wages: New Facts and Challenges for Keynesian Models

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Our questions

How cyclical are real wages?

Particularly in response to a nominal aggregate demand (monetary policy) shock?

Current models & price persistence

- Following a monetary policy shock, we observe low price response, and thus persistent output response
- Pricing in current medium-scale DSGE models:

$$p_t^* = \mu^* + mc_t$$

$$mc_t = \alpha r_t + (1-\alpha) w_t$$

- To keep *p* from changing much, need p^* to be insensitive to a money shock $\Rightarrow$ *mc* can't change much $\Rightarrow$ *w* can't change much

“The” Wage

What is the proper measure of marginal payments to labor inputs?

“The” Wage

Different Wage Concepts in Empirical Literature

1. Average Hourly Earnings/Hourly Compensation
    - Stock and Watson (1999)
    - Christiano, Eichenbaum and Evans (2005)
    - Smets & Wouters (2007)

“The” Wage

Different Wage Concepts in Empirical Literature

1.Average Hourly Earnings/Hourly Compensation

2.Composition-Corrected Wages

- Bils (1985)
- Solon, Barsky and Parker (1994)
- Elsby, Shin and Solon (2014)

“The” Wage

Different Wage Concepts in Empirical Literature

1. Average Hourly Earnings/Hourly Compensation
2. Composition-Corrected Wages
3. Wages of New Hires
    - Hall (2005)
    - Pissarides (2009)
    - Gertler and Trigari (2008)
    - Haefke, Sonntag and van Rens (2013)
    - Martins, Solon and Thomas (2012)

“The” Wage

Different Wage Concepts in Empirical Literature

1. Average Hourly Earnings/Hourly Compensation
2. Composition Corrected Wages
3. Wages of New Hires
4. Implicit Contracts and Long-Term Employment
    - Becker (1962)
    - Barro (1977) & Hall (1980)
    - Beaudry and DiNardo (1991, 1995)
    - Kudlyak (2014)

“The” Wage

Different Wage Concepts in Empirical Literature

1. Average Hourly Earnings
2. Composition Bias
3. New Hire Wages
4. Implicit Contracts and Long-Term Employment

Model with Different Wage Concepts

Model with Different Wage Concepts

Standard DSGE framework (CEE)

- Rep. household (with habit formation)
- Variable capital utilization
- Increasing returns to scale
- Investment adjustment costs
- Sticky prices

Model with Different Wage Concepts

Wage setting / labor supply

- Composition bias
- Potentially sticky *allocative* wage
- Remitted wage vs. allocative wage

Model with Different Wage Concepts

Composition Bias

Model with Different Wage Concepts

Composition Bias

- Extended household with continuum of agents
- Agents all enjoy leisure equally
- But some have higher productivity and wages
- $\Rightarrow$ household always sends highest-productivity members to work
- $\Rightarrow$ marginal worker has lower productivity than average worker, as in data

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Allocative wage, X_t, determines labor supply and marginal cost

X may be sticky: renegotiated with constant hazard $(1 - \theta_W)$

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Remitted wage

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Remitted wage

- periodically renegotiated (probability = *s*)
- ensures same expected nominal payment (PDV) as receiving *X* every period

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Remitted wage

$$PDV_t^W = E_t\left[\sum_{j=0}^{\infty}\left[\beta\left(1-s\right)\right]^j \frac{\lambda_{t+j}}{\lambda_t} X_{t+j}\right]$$

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Remitted wage

$$PDV_t^W = E_t\left[\sum_{j=0}^{\infty}\left[\beta(1-s)\right]^j \frac{\lambda_{t+j}}{\lambda_t} X_{t+j}\right]$$

$$= W_t^{New} E_t\left[\sum_{j=0}^{\infty}\left[\beta(1-s)\right]^j \frac{\lambda_{t+j}}{\lambda_t}\right]$$

Model with Different Wage Concepts

Allocative Wages vs. *Remitted* Wages

Average hourly earnings (all workers)

$$AHE_t = AHE_{t-1}\left(1-s\right)+H_tW_t^{New}$$

Measured Wages

Measured Wages

1. Average Hourly Earnings (AHE)
2. Composition-Adjusted Wages
3. Wages of New Hires
4. The “User Cost of Labor”

Measured Wages

1. Average Hourly Earnings (AHE)
2. Composition-Adjusted Wages
3. Wages of New Hires
4. The “User Cost of Labor”

Simplifying Assumption

Assume:

- Constant discount factor ($\lambda_t \equiv 1$)

Becker (1962): Only the NPV Matters

$$PDV_t^W = w_{t,t} + E_t\left[\sum_{\tau=t+1}^{\infty}\left(\beta(1-s)\right)^{\tau-t} w_{t,\tau}\right]$$

Becker (1962): Only the NPV Matters

$$PDV_t^W = w_{t,t} + E_t\left[\sum_{\tau=t+1}^{\infty}\left(\beta(1-s)\right)^{\tau-t} w_{t,\tau}\right]$$

$$= MRP_t^N + E_t\left[\sum_{\tau=t+1}^{\infty}\left(\beta(1-s)\right)^{\tau-t} MRP_\tau^N\right] = PDV_t^{MRP}$$

The User Cost of Labor: Kudlyak (2014)

$$PDV_t^W - \beta\left(1-s\right)PDV_{t+1}^W$$

The User Cost of Labor: Kudlyak (2014)

$$PDV_t^W - \beta(1-s)PDV_{t+1}^W = MRP_t^N$$

The User Cost of Labor: Kudlyak (2014)

$$UC_t \equiv PDV_t^W - \beta(1-s)PDV_{t+1}^W = MRP_t^N$$

$$PDV_t^W = w_{t,t} + E_t\left[\sum_{\tau=t+1}^{\infty}\left(\beta(1-s)\right)^{\tau-t} w_{t,\tau}\right]$$

Measuring the User Cost

Procedure of Kudlyak (2014), extended to longer sample

Measuring the User Cost

$$\widehat{UC}_t = \hat{w}_{t,t} + E_t\left[\sum_{\tau=t+1}^{t+7}\left(\beta(1-s)\right)^{\tau-t}\left[\hat{w}_{t,\tau} - \hat{w}_{t+1,\tau}\right]\right]$$

DATA:

NLSY79 (1978-2013, annual, panel).

Real wages (NFB deflator).

Measuring the User Cost

Estimate, using data from NLSY79 to estimate worker fixed effects/control composition bias:

$$\ln w_{t,\tau}^{i} = c + \alpha^{i} + \zeta\tau + \Psi X_{\tau}^{i} + \sum_{d_0=1}^{T}\sum_{d=d_0}^{T} \chi_{d_0,d} D_{d_0,d}^{i} + \varepsilon_{\tau}^{i}$$

Measuring the User Cost

Estimate, using data from NLSY79 to estimate worker fixed effects/control composition bias:

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$\chi_{t,\tau}$: wage paths for different cohorts

Measuring the User Cost

Estimate, using data from NLSY79 to estimate worker fixed effects/control composition bias:

$$\ln w_{t,\tau}^{i} = c + \alpha^{i} + \zeta\tau + \Psi X_{\tau}^{i} + \sum_{d_0=1}^{T}\sum_{d=d_0}^{T} \chi_{d_0,d} D_{d_0,d}^{i} + \varepsilon_{\tau}^{i}$$

Construct

$$\hat{w}_{t,\tau} = \exp\left(\hat{c} + \hat{\zeta}\tau + \hat{\Psi}\bar{X} + \hat{\chi}_{t,\tau}\right)$$

Constructing the User Cost of Labor (UCL)

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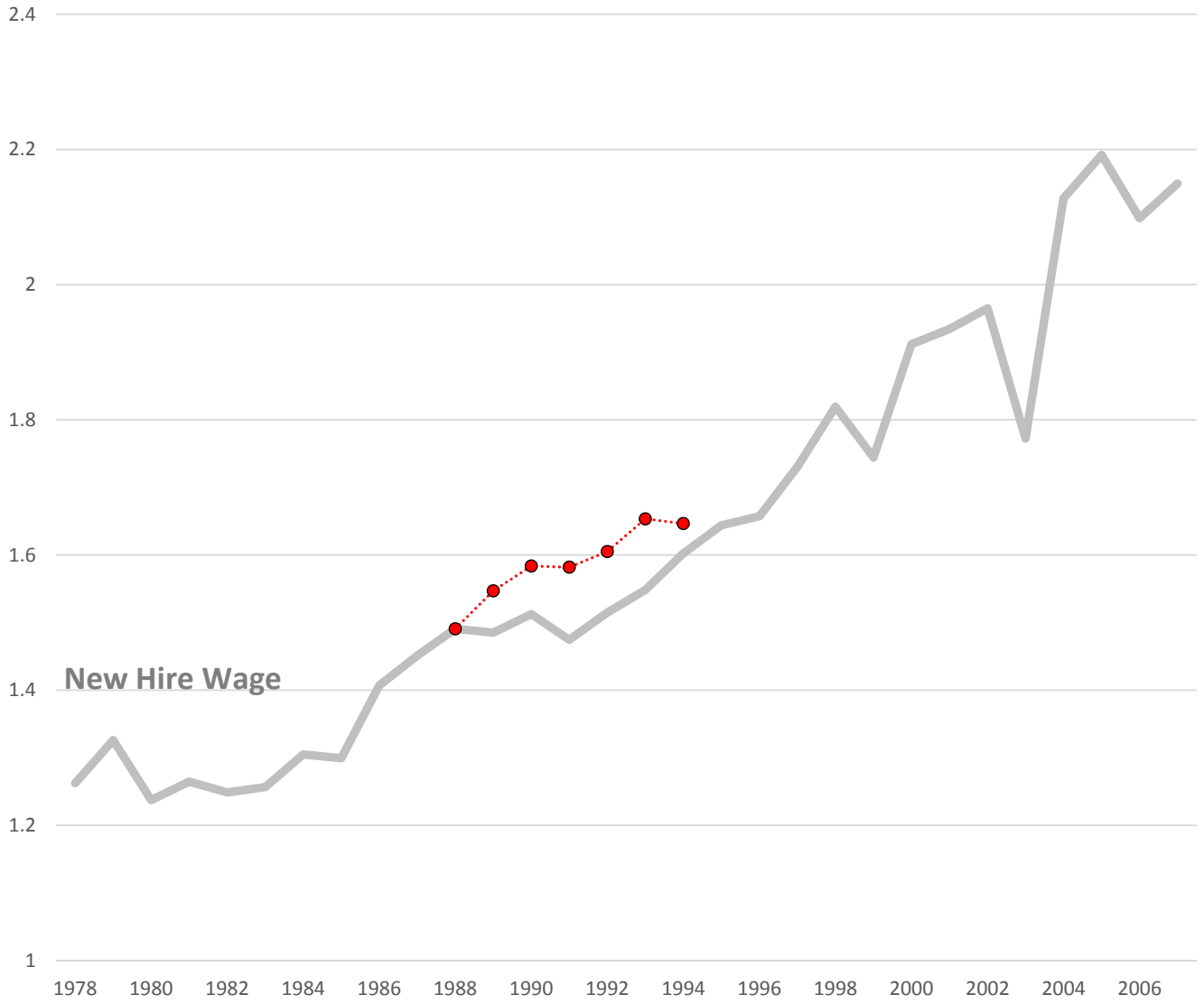

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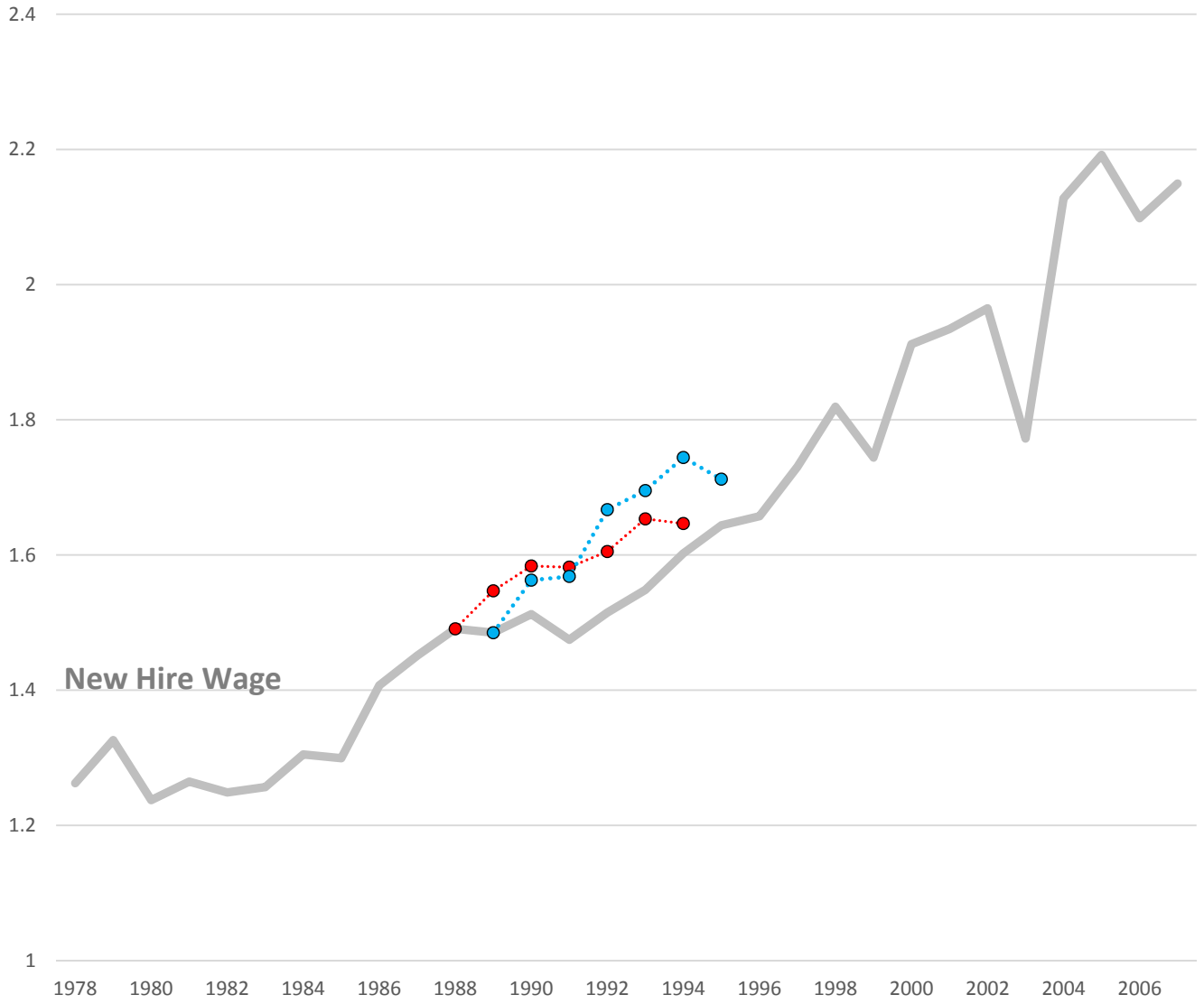

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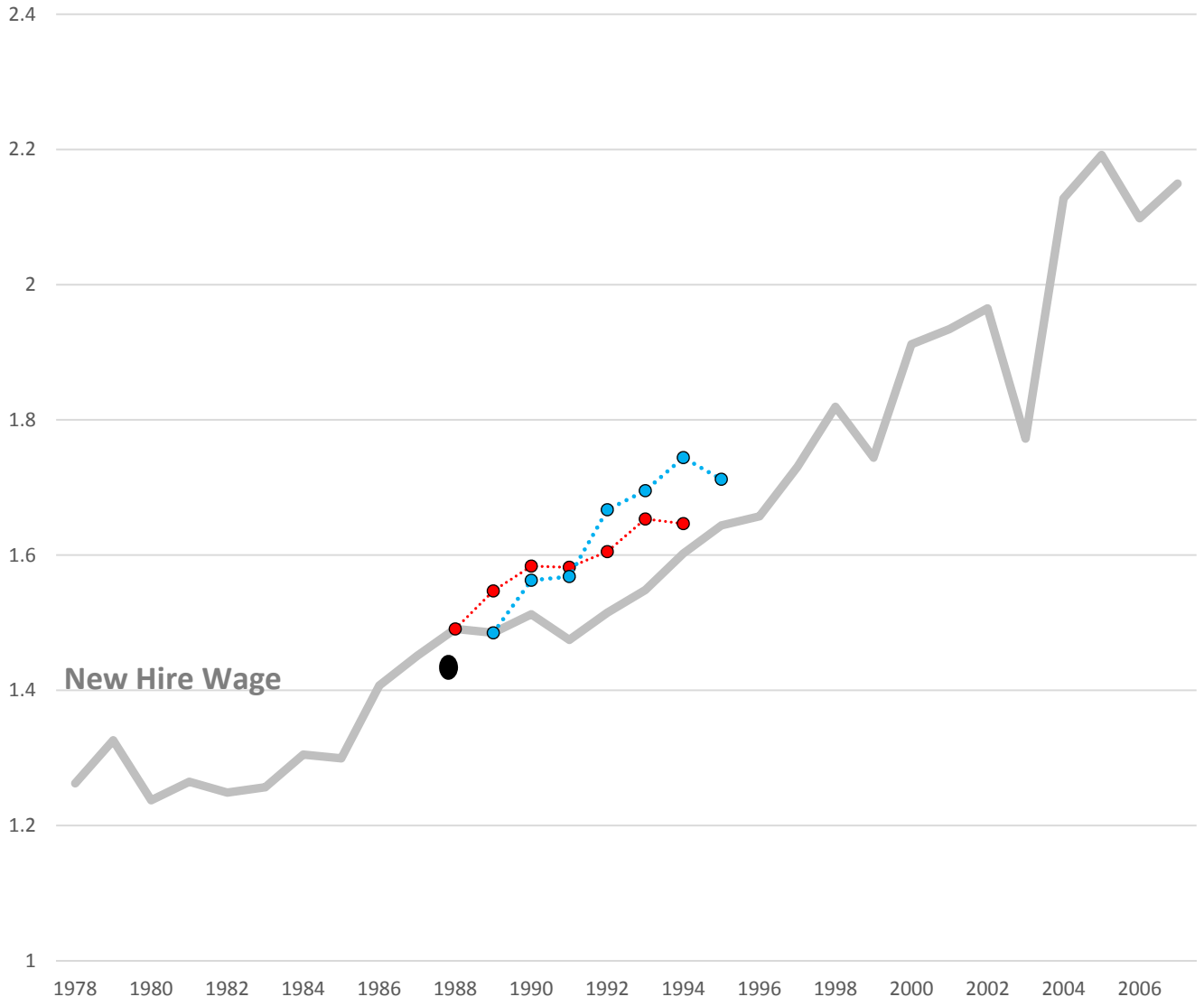

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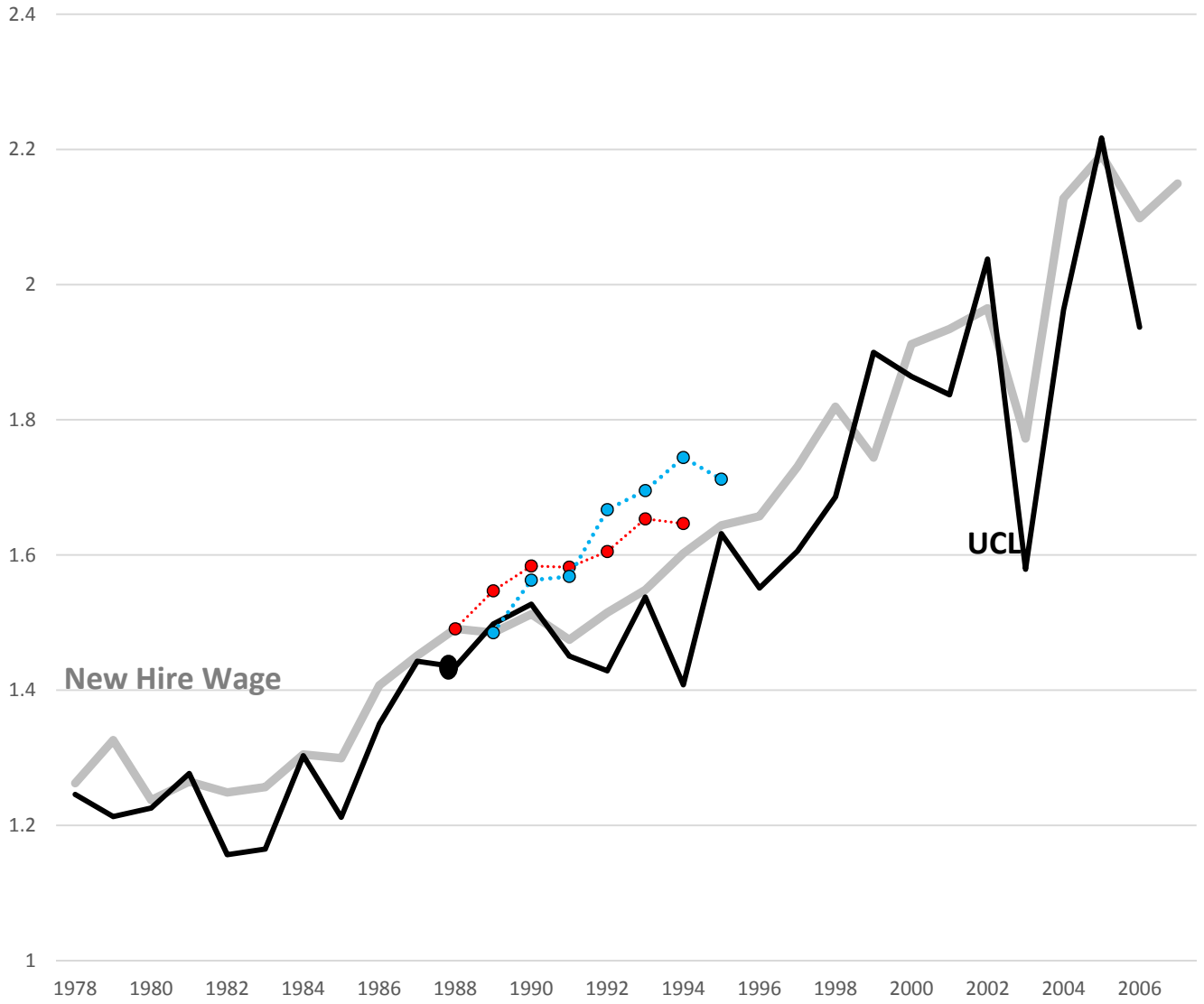

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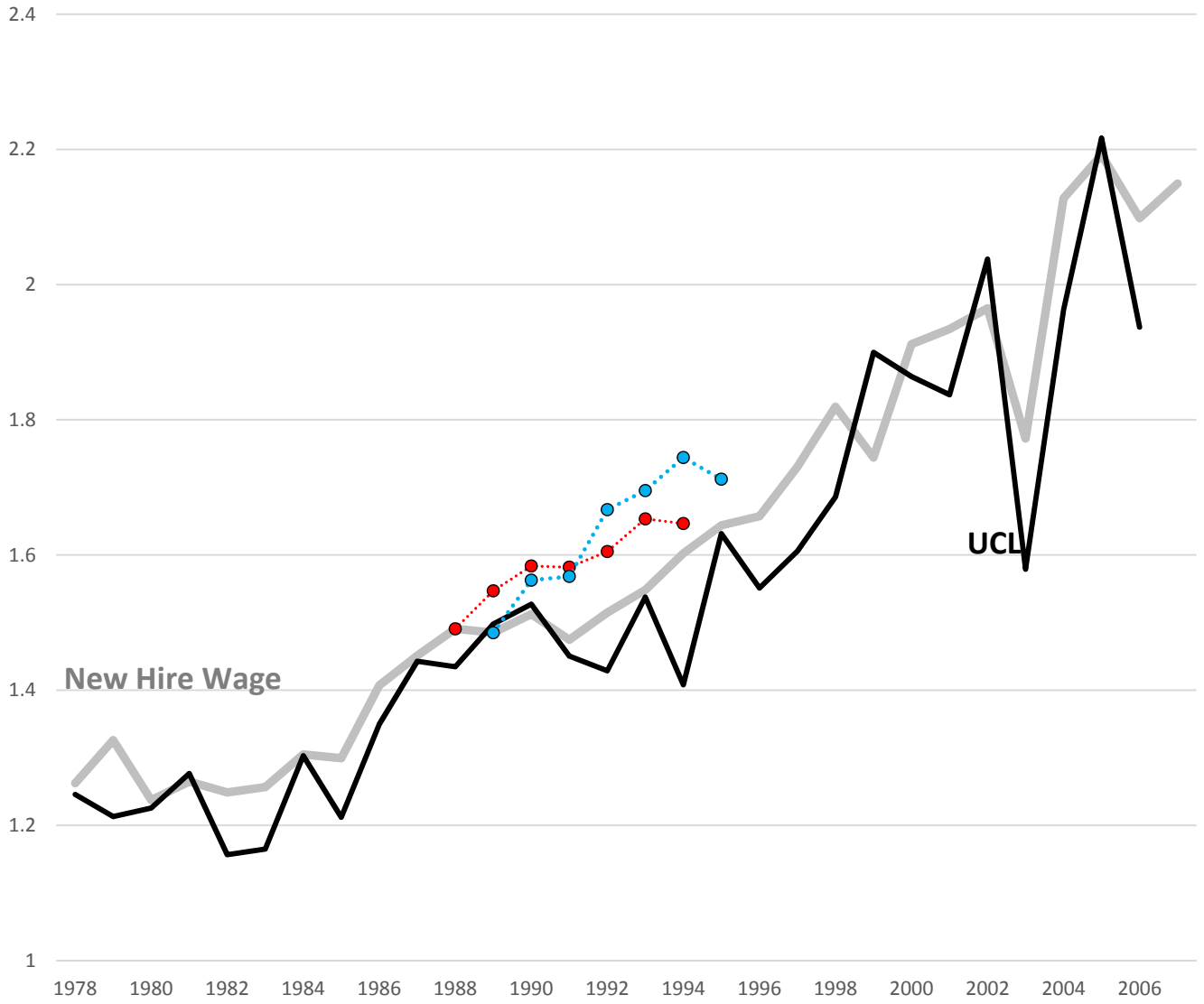


Log wage cyclicality, 1978-2013

	AHE	NLSY	NLSY + Controls	NLSY+ Controls + FE	New Hire	UCL
HP-Filtered GDP	0.311	0.984	0.960	1.165	1.325	3.122**
	(0.353)	(1.093)	(1.082)	(1.161)	(1.287)	(1.351)

OLS standard errors in parentheses.

** $p < 0.025$

Annual data. All regressions include constant and trend. Dependent variables are time fixed effects from a first-stage regression.

Wages and Monetary Shocks

Wages and Monetary Shocks

Semi-Structural VAR Shocks (Bernanke-Blinder / CEE)

$$Y_t = A(L)Y_{t-1} + B\varepsilon_t$$

B is lower triangular.

4 lags as in CEE 1999, 2005

Wages and Monetary Shocks

Semi-Structural VAR Shocks (CEE)

$$Y_t = \begin{bmatrix} Y_t^I & r_t^{ff} & Y_t^{II} \end{bmatrix}'$$

Y^I includes GDP, C, I, P, AHE/P, and Y/N

Y^{II} includes Real Corp. Profit and Money Growth

Wages and Monetary Shocks

Semi-Structural VAR Shocks (CEE)

Additional variables Y^{III} new wage series (UCL, NH)

$$Y_t = A(L)Y_{t-1} + B\varepsilon_t$$

Wages and Monetary Shocks

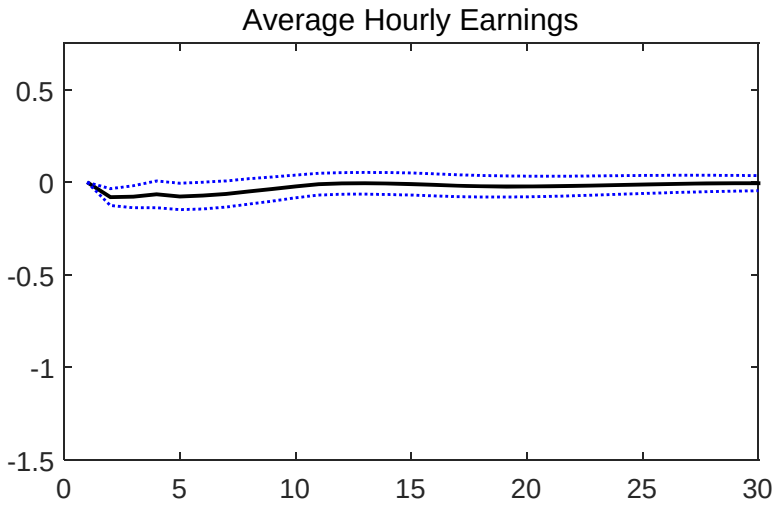
Semi-Structural VAR Shocks (CEE)

Additional variables Y^{III} new wage series (UCL, NH)

$$\begin{bmatrix} Y_t \\ Y_t^{III} \end{bmatrix} = \begin{bmatrix} A(L) & 0 \\ a(L) & b(L) \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ Y_{t-1}^{III} \end{bmatrix} + \begin{bmatrix} B\varepsilon_t \\ e_t \end{bmatrix}$$

To include in quarterly VAR, we interpolate annual data. CEE sample starts before NLSY data. We splice an extrapolated series for 1965-77.

Response of Wages to Monetary Shocks



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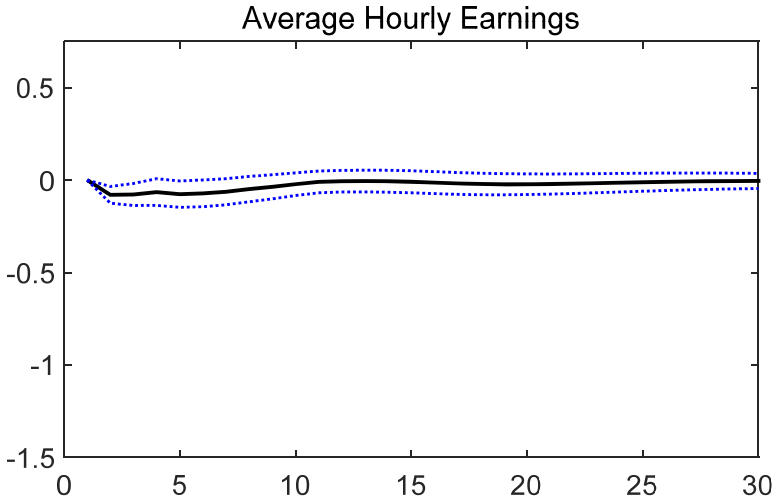
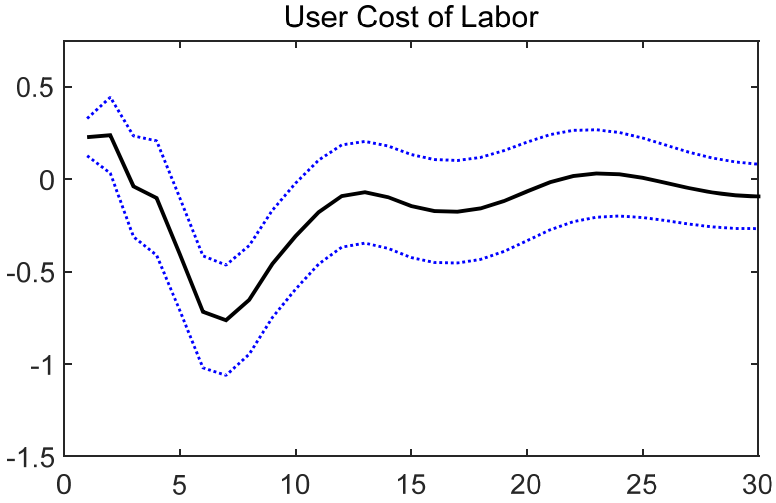




Wage Dynamics in DSGE Models

Calibrated Model

- Christiano *et al*. (2005)
- Del Negro *et al*. (2013)

Wage Dynamics in DSGE Models

Calibrated Model

Parameter	Baseline Value
Frisch Labor Supply Elasticity	1.00
Intertemporal Elasticity of Sub.	1.00
Habit Weight	0.65
Avg. Duration of Prices (qtr)	10.00
Avg. Duration of Wages (X, qtr)	10.00
Investment Adjustment Cost	4.00
Utilization Elasticity	1.00

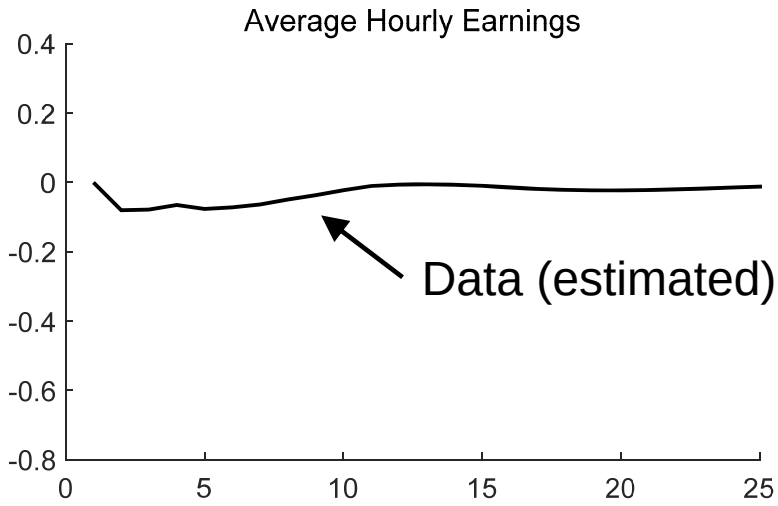
Wage Dynamics in DSGE Models

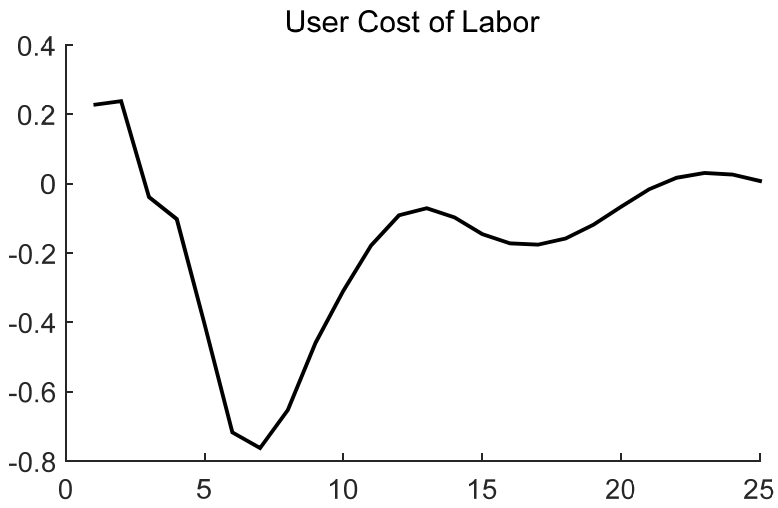
Wage Dynamics in DSGE Models

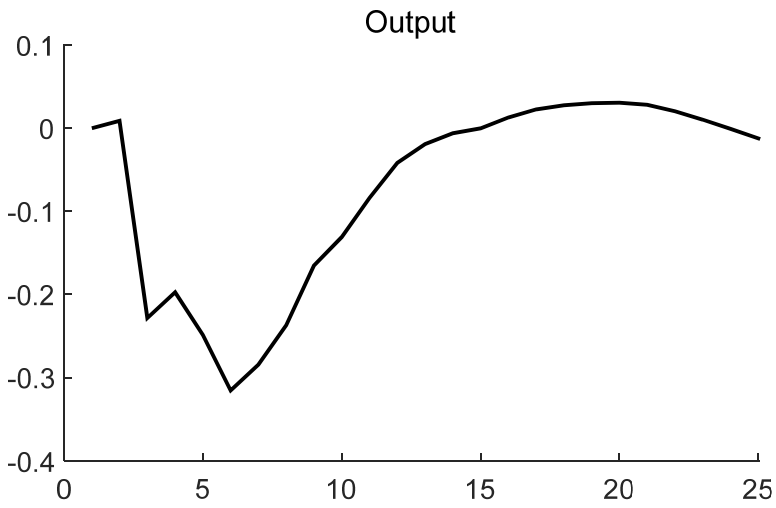
Benchmark Specification

- No composition bias : $L/N = 1$ and $\varphi(1)^{-1} = 0$
- Constant renegotiated remittances : $s = 1.00$
- Price and wage rigidity only

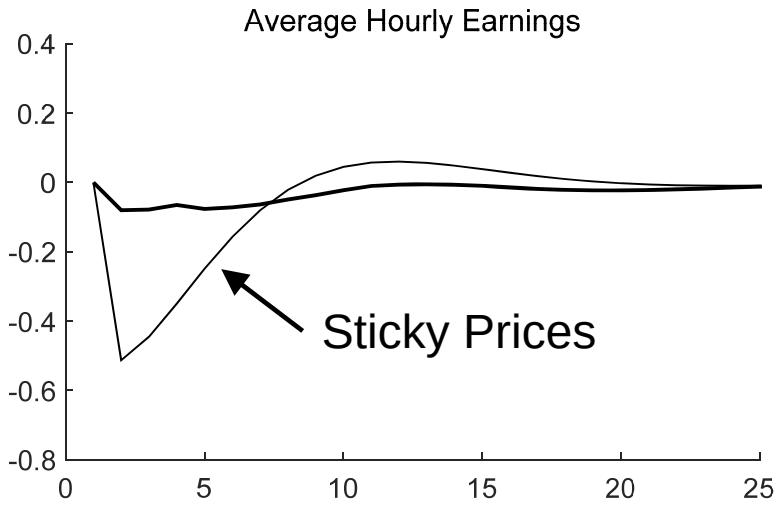
Wage Dynamics in DSGE Models

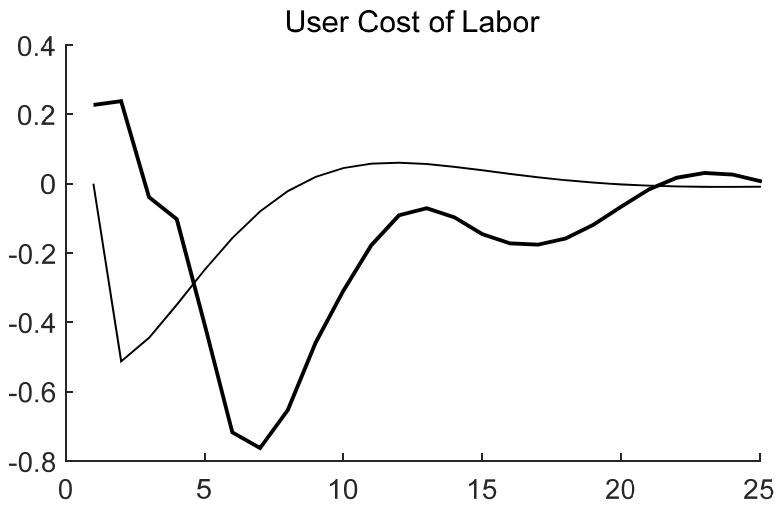


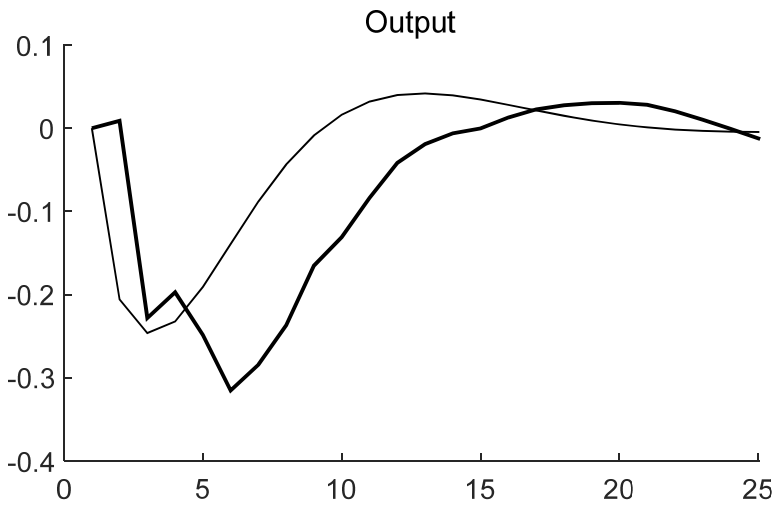




Wage Dynamics in DSGE Models







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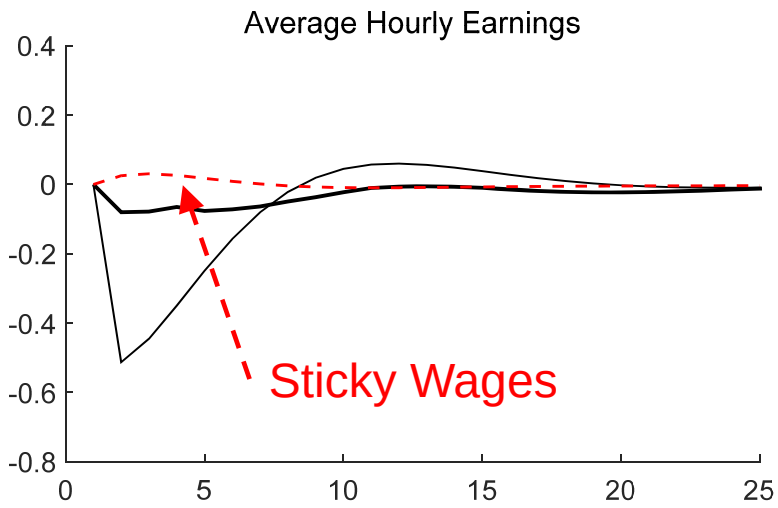
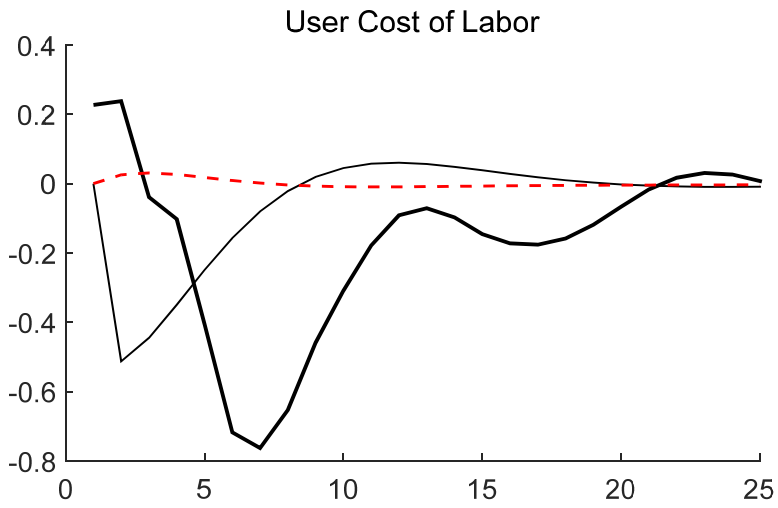
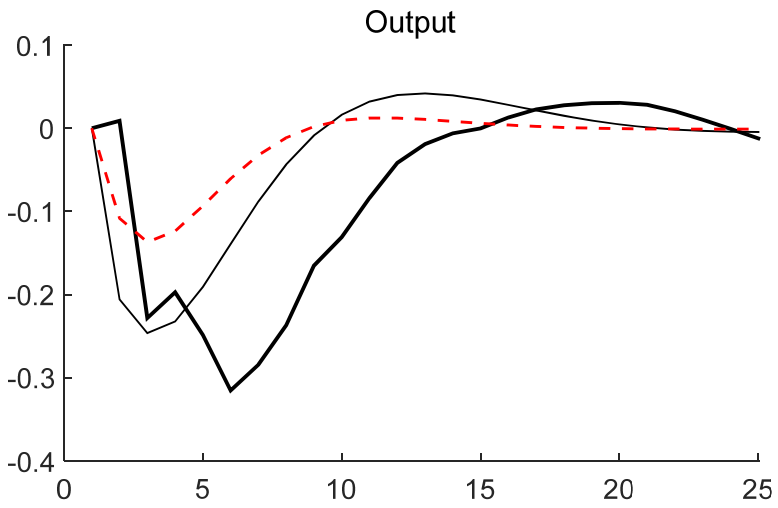
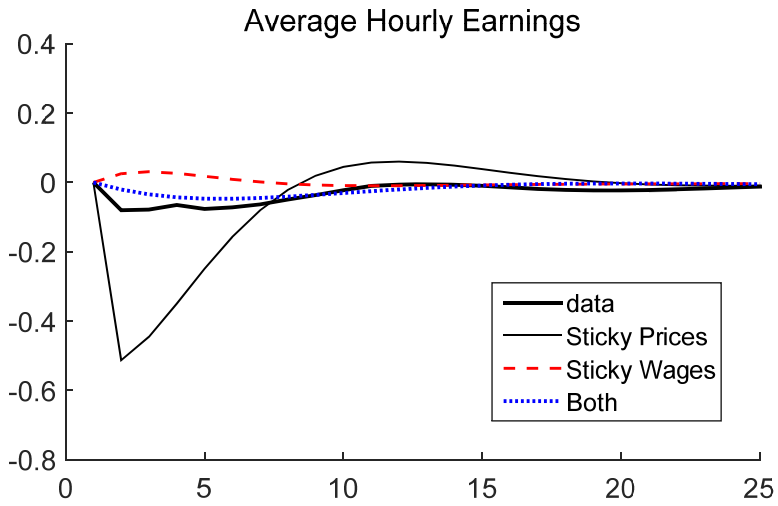
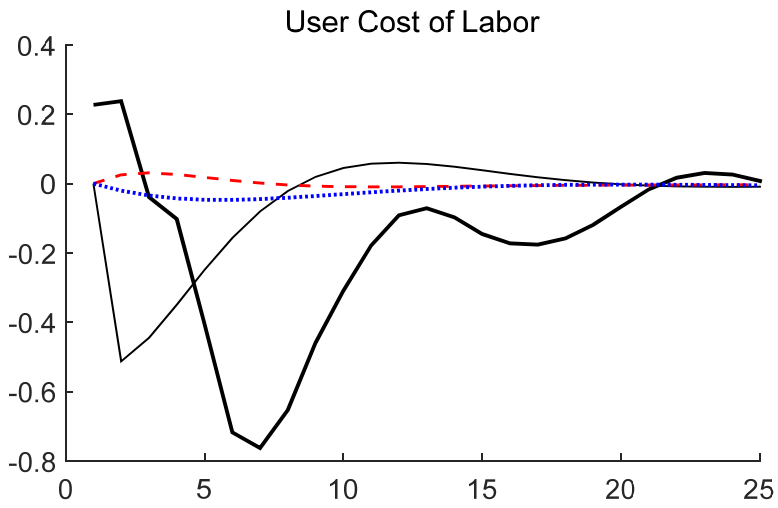


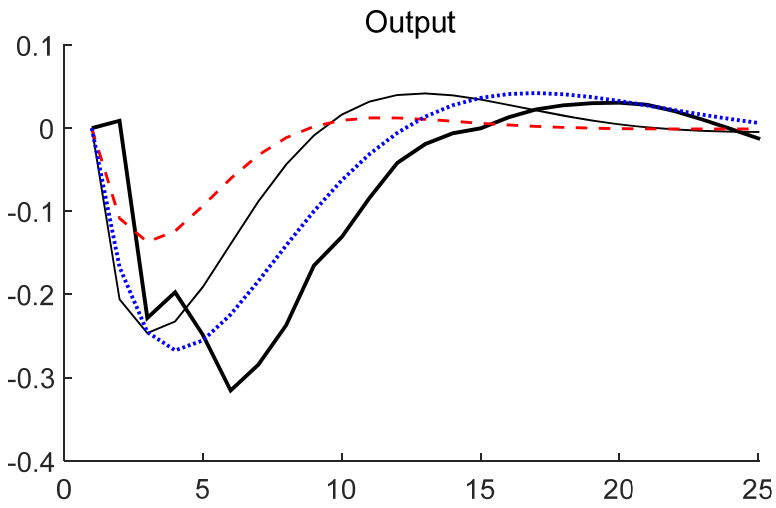




Wage Dynamics in DSGE Models





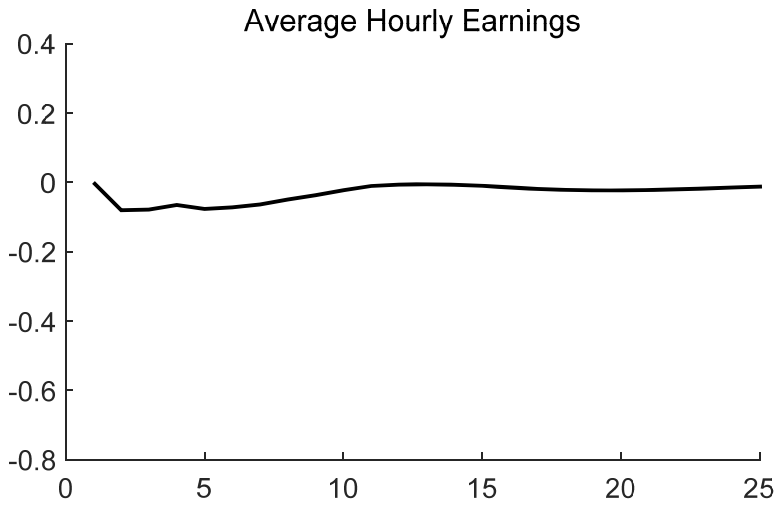


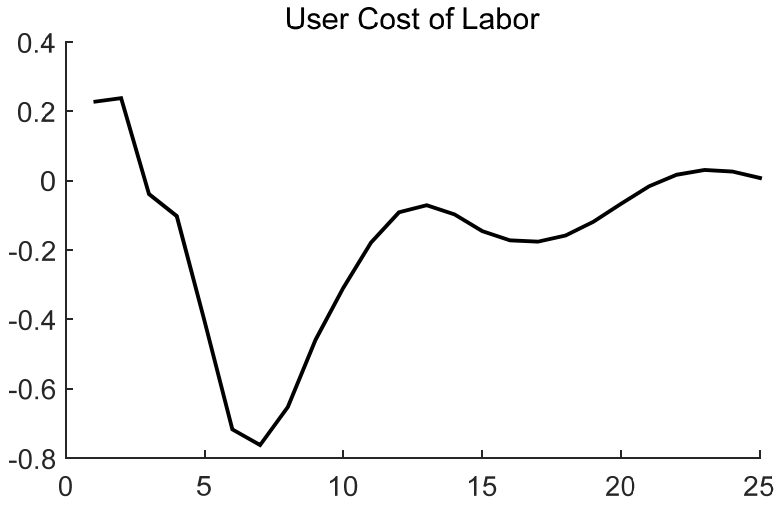
Wage Dynamics in DSGE Models

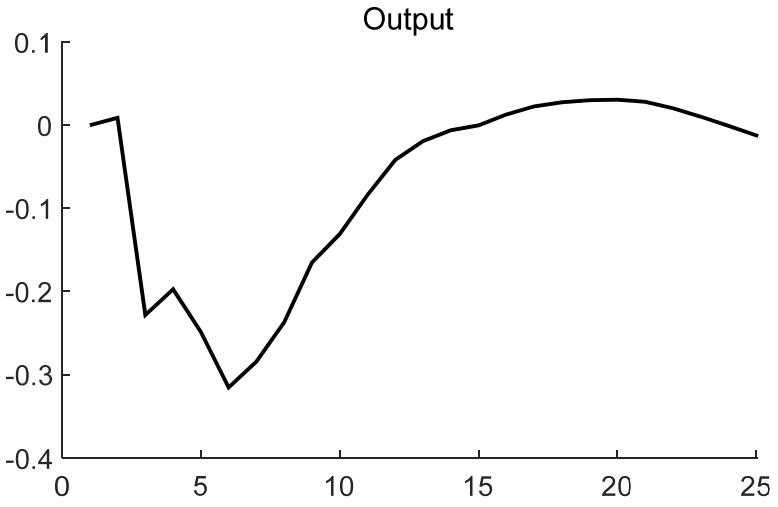
Implicit Contracting

- No composition bias : $L/N = 1$ and $\varphi(1)^{-1} = 0$
- Remitted wage is reset at : $s < 1.00$
- Barattierri, Basu & Gottschalk (2014) find s = 0.21
- Price rigidity but NO wage rigidity

Wage Dynamics in DSGE Models







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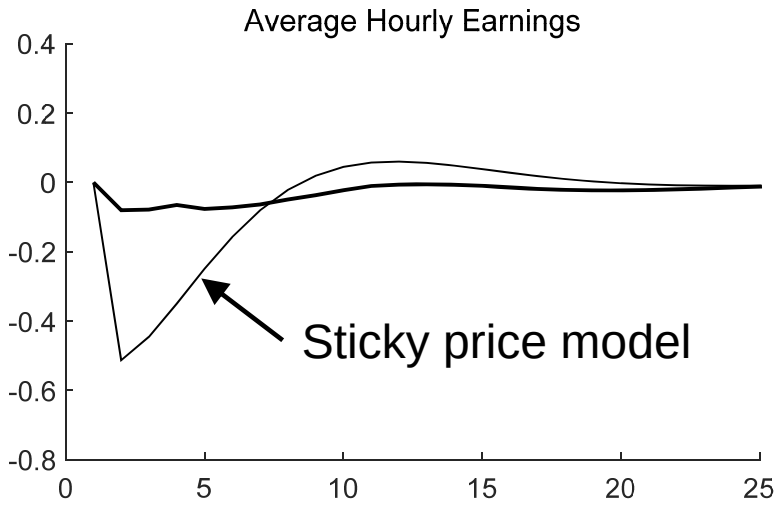

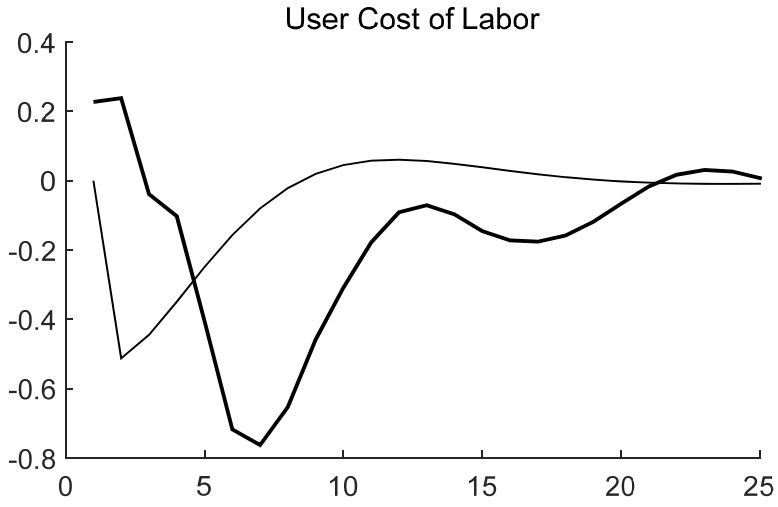

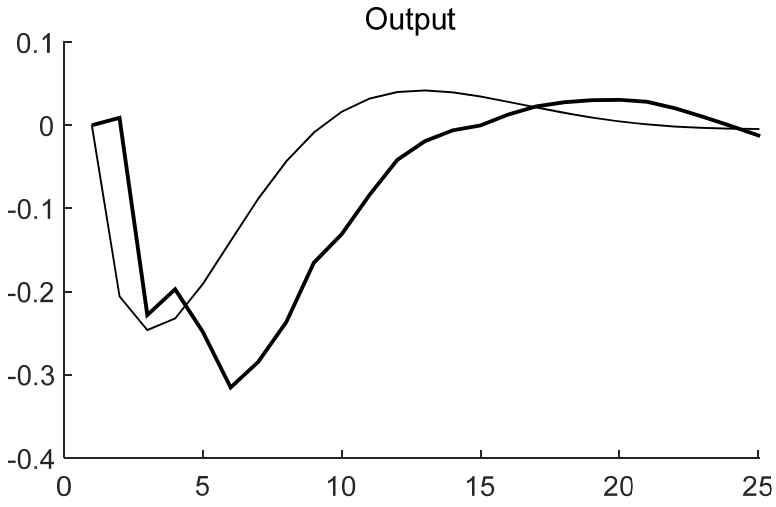

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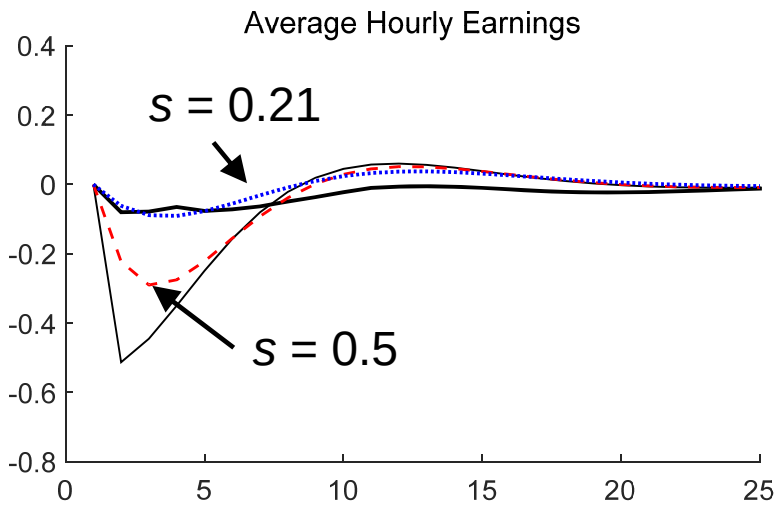
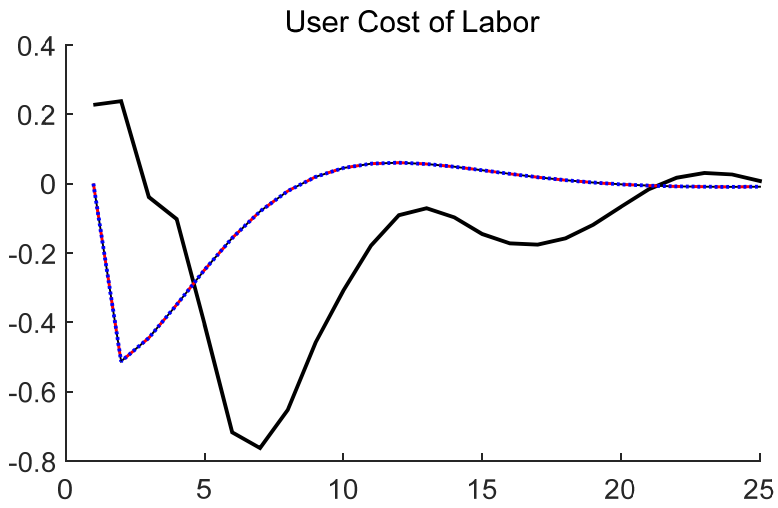
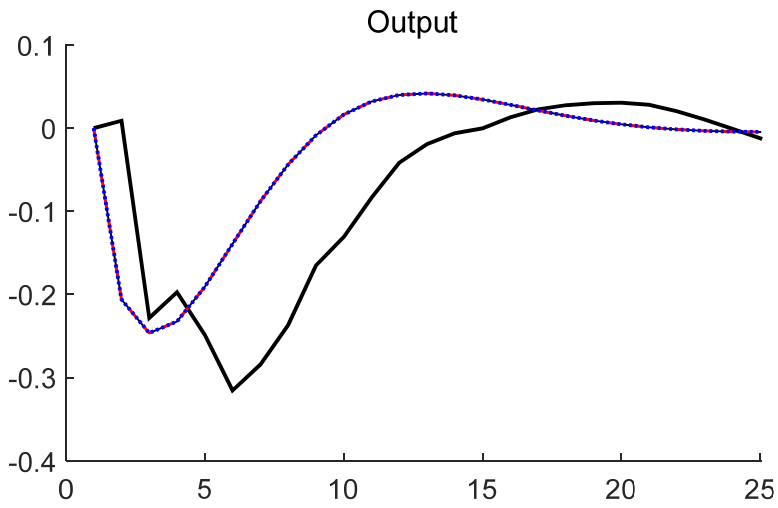




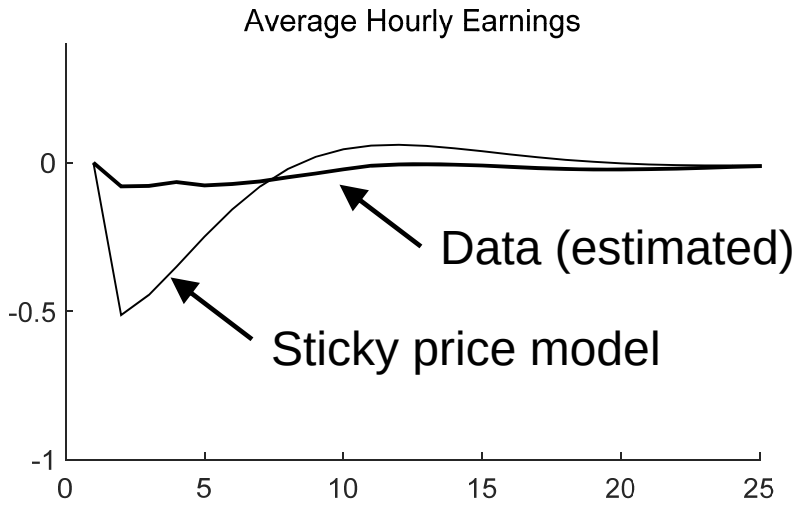


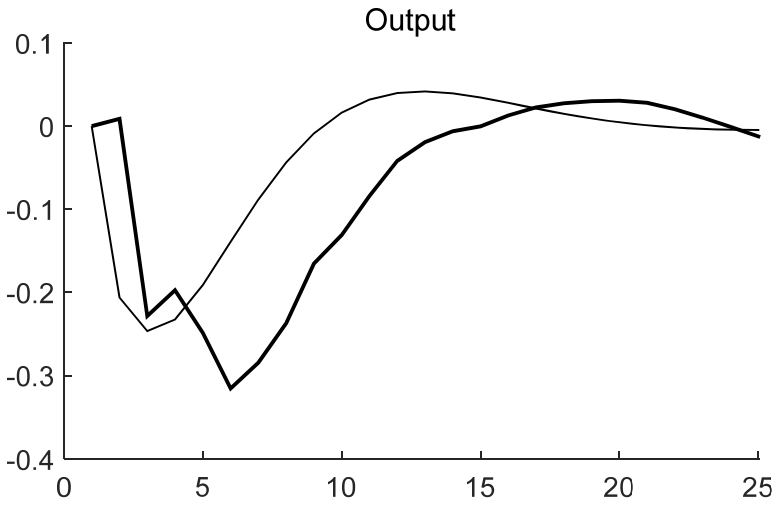
Wage Dynamics in DSGE Models

Composition Bias

- No composition bias : $L/N = 1$ and $\varphi(1)^{-1} = 0$
- "Med." composition bias : $L/N = \varphi(1)^{-1} = 2$
- "High" composition bias : $L/N = \varphi(1)^{-1} = 4$

Wage Dynamics in DSGE Models





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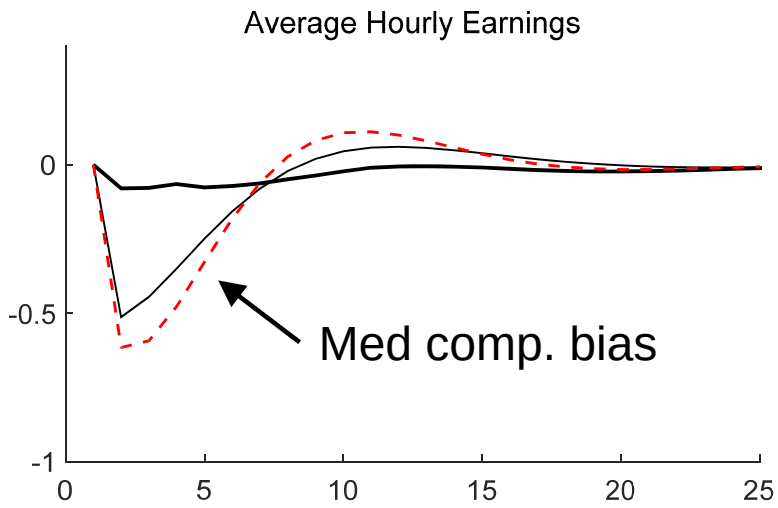
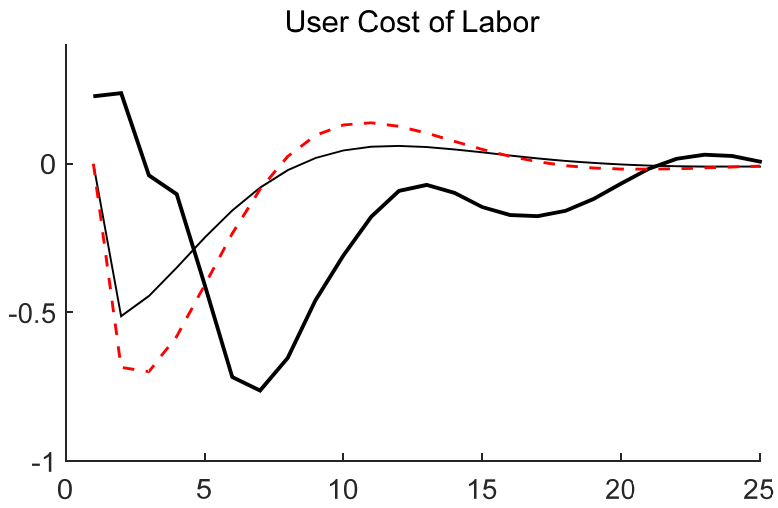
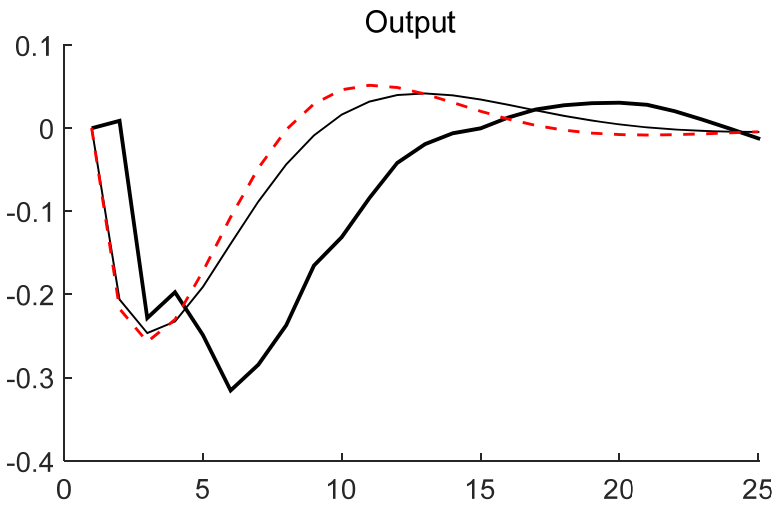
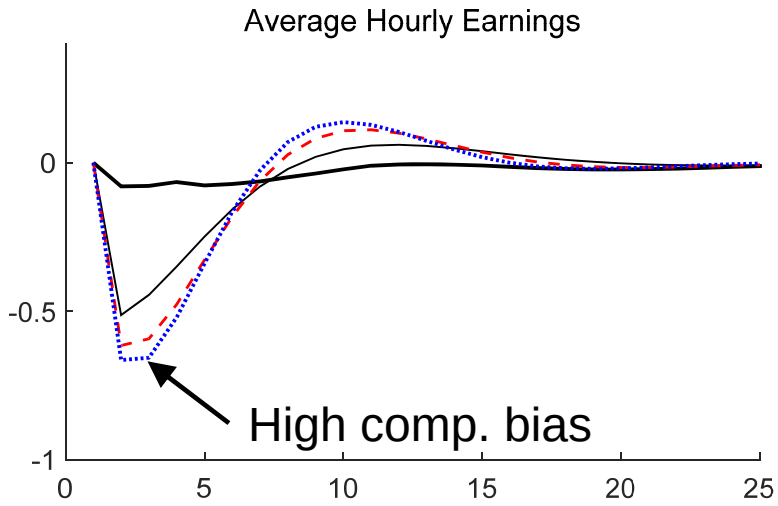
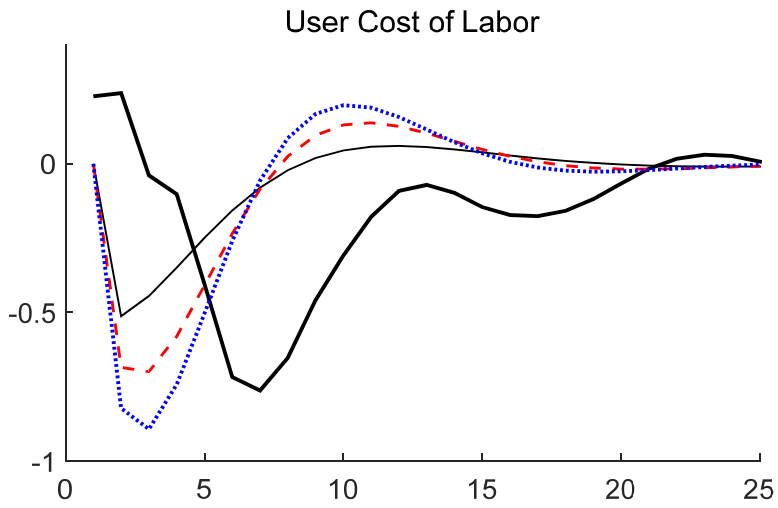


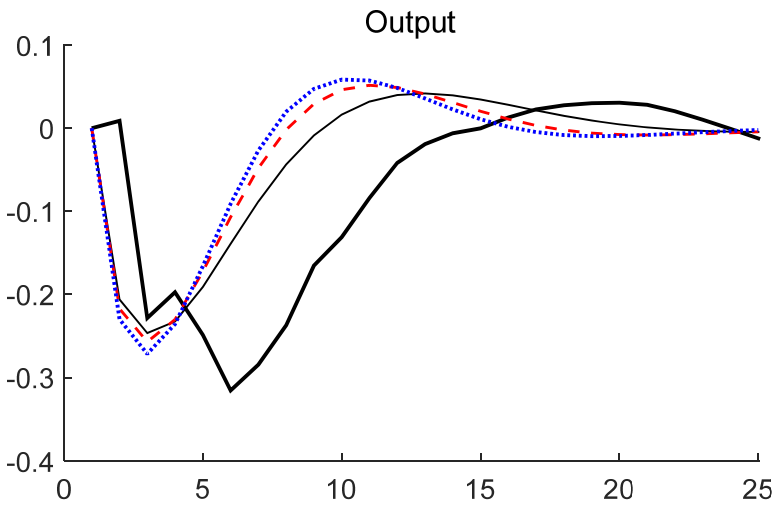




Wage Dynamics in DSGE Models







Conclusions from DSGE Experiments

Model wants only modest composition bias

Model finds flexible allocative wages with implicit contracts helpful for matching all three wage series

With allocative wages flexible, model unable to match persistence of output response to monetary shock

Persistence

- Following a monetary policy shock, wage component of marginal cost changes sharply
- But we still observe little price response, and persistent output response
- How to reconcile the two facts? A suggestion:

$$p_t^* = \mu_t^* + mc_t$$

$$\frac{\partial \mu_t^*}{\partial Y_t} < 0$$

Summing Up

Tension between micro wage data and business cycle mechanisms.

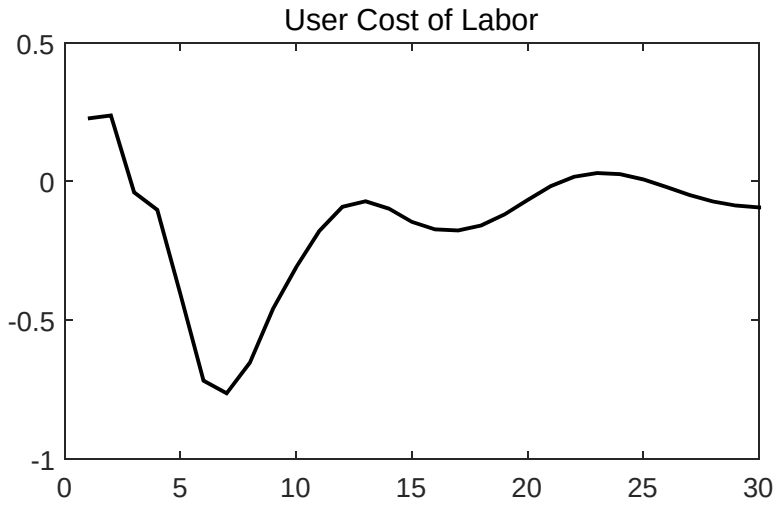
Shadow wage seems to be much more responsive than is conventionally assumed in standard DSGE models.

Greater emphasis on sources of price rigidity rather than wage rigidity required to match VAR evidence.

Critique based on job ladders

- Hagedorn-Manovskii (2013) suggest that history dependence in wages is only apparent, not real
- They present a search model where wages depend on match quality, determined by cumulative labor market tightness in an “employment cycle”
- Match quality is higher if workers have been employed while labor markets were tight, giving the impression of history dependence in wages
- We construct the H-M measure of match quality and add it as a control to the wage regression

Adjusting for Match Quality



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