Involuntary ('Unlucky') Unemployment and the Business Cycle

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Background

- There is a class of models that has received a lot of attention in central banks.

- People have used the models to place structure on discussions about monetary policy.
  - Recent: Curdia-Woodford, Gertler-Kiyotaki.

- In recent years, there has been a push to introduce labor market variables like unemployment.

What We Do:

- We investigate a particular approach to modeling unemployment.
  - Hopenhayn and Nicolini (1997), Shavell and Weiss (1979)
- We explore the implications for monetary DSGE models.
  - Simple NK model without capital.
    - Okun's law, natural rate of unemployment.
  - Standard empirical NK model (e.g., ACEL, CEE, SW)
    - Estimate the model.
    - Does well reproducing response of unemployment and labor force to three identified shocks.

Unemployment

- To be 'unemployed' in US data, must
  - be 'willing and able' to work.
  - recently, made efforts to find a job.

- Our presumption: a person has lower utility when unemployed than when employed.
  - consumption drops typically about 10 percent upon the loss of a job (Gruber, 1997, Chetty and Looney, 2006)
  - Some indicators of happiness (suicide, subjective sense of well being) deteriorate when the unemployment rate rises (Brenner, 1979; Ruhm, 2000; Schimmack et al, 2008)

- Current monetary DSGE models with 'unemployment':
  - Utility **jumps** when you lose your job.
  - Finding a job requires **no** effort.
  - US Census Bureau employee dropped into current monetary DSGE models would find **zero unemployment**.

What we do:

- Explore the simplest possible model of unemployment, which satisfies two key features of unemployment.

- To be unemployed:
  - Must have made recent efforts to find a job.
    - To find a job, household must make an effort, *e*, which increases the probability, *p(e)*, of finding a job.
  - Unemployed worse off than employed.
    - assume household search effort, *e*, is not publicly observable.
    - full insurance against household labor market outcomes is not possible.
      - under perfect consumption insurance, no one would make an effort to find a job.

Outline

- Insert our model of unemployment into
  - Simple Clarida-Gali-Gertler (CGG) NK model.
  - CEE model: evaluate model's ability to match US macroeconomic data, including unemployment and labor force

CGG Model

- Goods Production:

$$Y_t = \left[\int_0^1 Y_{i,t}^{\frac{1}{\lambda_f}} di \right]^{\lambda_f}, \; 1 \leq \lambda_f < \infty.$$

- Monopolists produce intermediate goods
  - Technology:

$$Y_{i,t} = A_t h_{i,t}$$

  - Calvo sticky prices:

$$P_{i,t} = \begin{cases} P_{i,t-1} & \text{with prob. } \xi_p \\ \text{chosen optimally} & \text{with prob. } 1 - \xi_p \end{cases}$$

  - Enter competitive markets to hire labor.

CGG Model: Monetary Policy

- Taylor rule:

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)\left[r_\pi \hat{\pi}_t + r_y \hat{x}_t\right] + \varepsilon_t$$

- Here:
  - $\hat{x}_t$ output gap (percent deviation of output from efficient level)

- Efficient equilibrium:
  - Monopoly power and inflation distortions extinguished.

Households

- This is where the new stuff is……..

Typical Household During Period

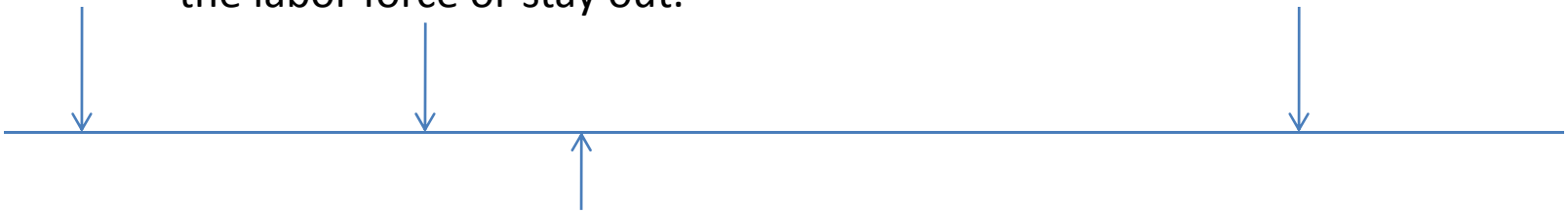
Draw privately observed, idiosyncratic shock, l, from Uniform, $[0,1]$, that determines utility cost of work:

$$F + \varsigma_t(1+\sigma_L)l^{\sigma_L}.$$

Household that stays out of labor market does not work and has utility

$$\log c_t^{\text{out of labor force}}$$

After observing l, decide whether to join the labor force or stay out.



t *t+1*

Household that joins labor force tries to find a job by choosing effort, *e*, and receiving ex ante utility

$$p(e_t)\left[\overbrace{\log(c_t^w) - F - \varsigma_t(1+\sigma_L)l^{\sigma_L} - \frac{1}{2}e_t^2}^{\text{ex post utility in case household finds a job}}\right] + (1-p(e_t))\left[\overbrace{\log(c_t^u) - \frac{1}{2}e_t^2}^{\text{ex post utility in case of unemployment}}\right]$$

$$p(e_t) = \eta + ae_t$$

Household Insurance

- They need it:
  - Idiosyncratic work aversion.
  - Job-finding effort, *e*, may or may not produce a job.

- Assume households gather into large families, like in Merz and Andolfatto
  - With complete information:
    - Households with low work aversion told to make big effort to find work.
    - All households given same consumption.
    - Not feasible with private information.
  - With private information
    - To give households incentive to look for work, must make them better off in case they find work.

Optimal Insurance

- Relation of family to household: standard principal/agent relationship.
  - family receives wage from working households
  - family observes current period employment status of household.

- For family with given *C, h*:
  - allocates consumption: $c_t^w,\ c_t^{nw}$
  - c_t^w / c_t^{nw} must be big enough to provide incentives.
  - must satisfy family resource constraint:

$$h_t c_t^w + (1 - h_t) c_t^{nw} = C_t.$$

Family Indirect Utility Function

- Utility:

$$u(C_t, h_t, \varsigma_t) = \log(C_t) - z(h_t, \varsigma_t)$$

- Where

$$z(h_t, \varsigma_t) = \log[h_t(e^{F+\varsigma_t(1+\sigma_L)f(h_t,\varsigma_t)^{\sigma_L}} - 1) + 1]$$

$$- \frac{a^2\varsigma_t^2(1+\sigma_L)\sigma_L^2}{2\sigma_L+1} f(h_t, \varsigma_t)^{2\sigma_L+1} - \eta\varsigma_t\sigma_L f(h_t, \varsigma_t)^{\sigma_L+1}.$$

- Clarida-Gali-Gertler utility function:

$$u(C_t, h_t, \varsigma_t) = \log(C_t) - \varsigma_t h_t^{1+\sigma_L}$$

Family Problem

$$\max_{\{C_t, h_t, B_{t+1}\}} E_0 \sum_{t=0}^{\infty} \beta^t [\log(C_t) - z(h_t, \varsigma_t)]$$

– Subject to:

$$P_t C_t + B_{t+1} \leq B_t R_{t-1} + W_t h_t + Transfers\ and\ profits_t.$$

- Family takes market wage rate as given and tunes incentives so that marginal cost of extra work equals marginal benefit:

$$C_t z_h(h_t, \varsigma_t) = \frac{W_t}{P_t}.$$

Observational Equivalence Result

- Because of the simplicity of the assumptions, the model is observationally equivalent to standard NK model, when represented in terms of output, interest rate, inflation:

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \frac{(1-\beta\xi_p)(1-\xi_p)}{\xi_p}(1+\sigma_z)\hat{x}_t$$

$$\hat{x}_t = E_t \hat{x}_{t+1} - \left(\hat{R}_t - \hat{\pi}_{t+1} - \hat{R}_t^*\right).$$

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)[r_\pi \hat{\pi}_t + r_y \hat{x}_t] + \varepsilon_t,$$

Observational Equivalence Result

z function: disutility of labor for family

'curvature of disutility of labor': $\sigma_z \equiv \frac{z_{hh}h}{z_h}$

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \frac{(1-\beta\xi_p)(1-\xi_p)}{\xi_p}(1+\sigma_z)\hat{x}_t$$

$$\hat{x}_t = E_t \hat{x}_{t+1} - \left(\hat{R}_t - \hat{\pi}_{t+1} - \hat{R}_t^*\right).$$

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)[r_\pi \hat{\pi}_t + r_y \hat{x}_t] + \varepsilon_t,$$

Unemployment Gap

- Can express everything in terms of unemployment gap:

$$u_t^g = -\kappa^{okun}\hat{x}_t. \qquad \kappa^{okun} = \frac{a^2\varsigma\sigma_L^2 m^{\sigma_L}(1-u)}{1-u+a^2\varsigma\sigma_L^2 m^{\sigma_L}} > 0.$$

$$u_t^g = \overbrace{u_t}^{\text{actual rate of unemployment}} - \overbrace{u_t^*}^{\text{efficient level of unemployment}}$$

Non-accelerating rate of inflation level of unemployment, NAIRU

Properties of the Model

- Calibrated model first….

Calibration of the Model

Parameter	Value	Description
β	$1.03^{-.25}$	Discount factor
g_A	1.0047	Technology growth
ξ_p	0.75	Price stickiness
λ_f	1.2	Price markup
ρ_R	0.8	Taylor rule: interest smoothing
r_π	1.5	Taylor rule: inflation
r_y	0.2	Taylor rule: output gap
η_g	0.2	Government consumption share on GDP

To parameterize preference and search function, set:

labor force participation rate: *m=0.67*
employment rate: *h=0.63*
unemployment rate: *u=0.056*

Properties

- Replacement ratio

$$\frac{c^{nw}}{c^{w}} = 0.18$$

  - Very low! In model with habit persistence in preferences, replacement ratio = 0.80.

- Cost of business cycles (in % of consumption)…

	Limited Information Model	Full Information Model
Technology Shock Only	0.52%	0.57%
Government Spending Shock Only	0.11%	0.13%
Monetary Policy Shock Only	0.07	0.10

Put this all into a medium-sized DSGE Model

- Habit persistence in preferences
- Variable capital utilization.
- Investment adjustment costs.
- Wage setting frictions as in Erceg-Henderson-Levin.
- Parameterization:
  - prices reoptimized on average every 2.7 quarters
  - wages reoptimized on average every 4 quarters.

Finding

- Model with unemployment fit to VAR-based impulse responses turns in same performance as CEE model without unemployment.

- When we add unemployment and labor force, model matches estimated responses in labor force and unemployment.

Figure 1: Dynamic Responses of Non−Labor Market Variables to a Monetary Policy Shock

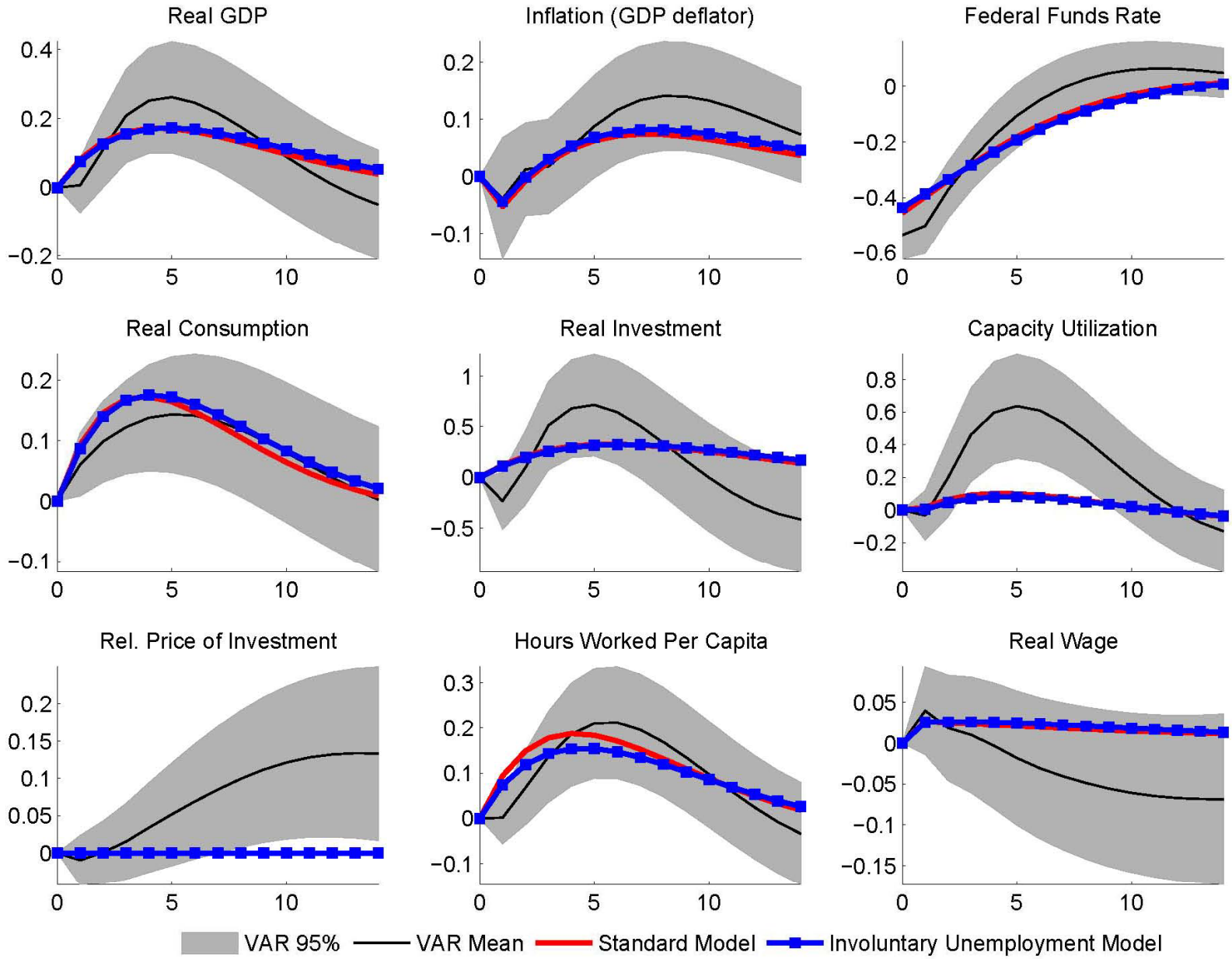


Figure 2: Dynamic Responses of Non−Labor Market Variables to a Neutral Technology Shock

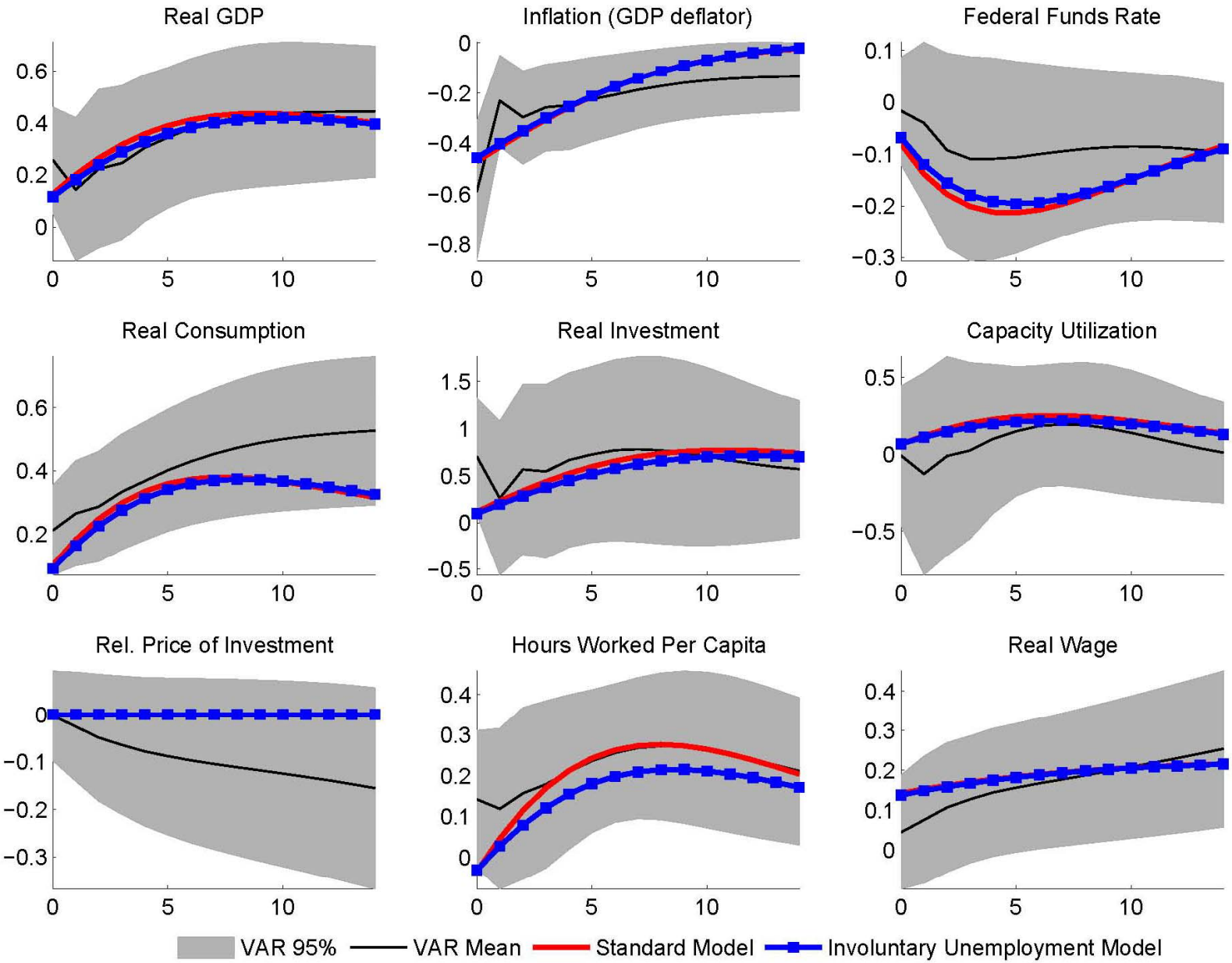
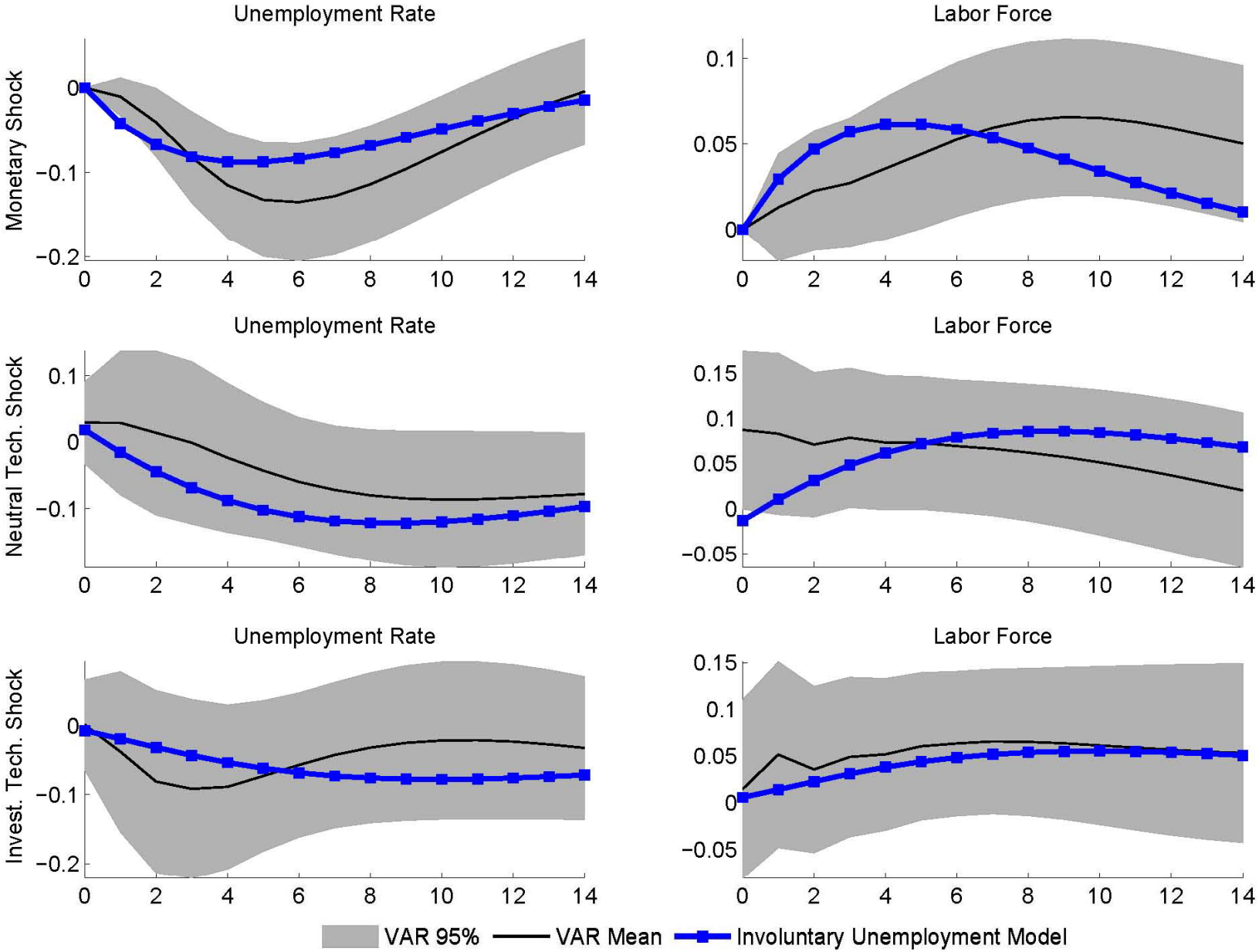


Figure 4: Dynamic Responses of Labor Market Variables to Three Shocks



Micro Implications of Model

- Model: consumption premium higher in booms.
  - Have time series evidence on cross-household variance, *V*, of log consumption.
  - Heathcote, Perri and Violante (2010) show *V* is procyclical in three of past 5 recessions.

$$V_t = (1 - h_t) h_t \left(\log \left(\frac{c_t^w}{c_t^{nw}} \right) \right)^2 .$$

- Model: search intensity lower in recessions
  - Consistent with evidence on 'discouraged workers'

Conclusion

- Integrated a model of 'involuntary unemployment' into monetary DSGE model.

- Results:
  - Obtained a theory of the Okun's gap, NAIRU
  - Able to match responses of unemployment and labor force to macro shocks.
  - Raises several empirical questions.

- Why introduce unemployment?
  - A policy variable of direct interest.
  - Can differentiate between labor markup shocks and labor supply shocks.
  - By bringing in more data, get a more precise read on output gap and 'natural interest rate' (Basistha and Startz (2004))
  - By bringing in more data, get a better read on unobserved shocks and may improve forecasts.