The NAIRU, Involuntary Unemployment and the Business Cycle

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Background

- Much progress building DSGE models for the purpose of analyzing monetary policy.

- Benchmark model: basic goods, labor markets, monetary policy.

- Extensions:
  - financial frictions.
  - unemployment, labor force.

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 three equation NK model
    - NAIRU, Okun's gap, natural rate of unemployment.
  - Standard empirical NK model (e.g., 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
  - want a job.
  - make efforts to find a job.

- Empirical evidence: losing your job is a bad thing.
  - consumption drops typically about 10 percent upon the loss of a job (Chetty and Looney, 2006)
  - Much discussion in the press about the hardship experienced by the unemployed in the current recession.

- 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 the two key features of unemployment.

- To be unemployed:
  - Must have made recent efforts to find a job.
    - Assume households choose effort, *e*, which increases the probability, *p(e)*, of finding a job.
  - Transition from unemployment to employment makes you better off.
    - 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 natural output)
- Natural equilibrium:
  - Monopoly power and inflation distortions extinguished.

Households

- This is where the new stuff takes place…..

Typical Household During Period

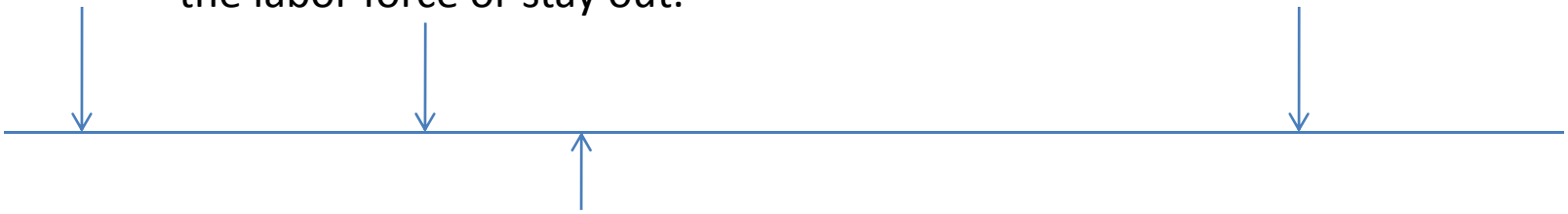
Draw privately observed, idiosyncratic shock, l, from Uniform, $[0,1]$, that determines utility cost of work:

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

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 no private information:
    - Households with low work aversion make big effort to find work.
    - All households have the same consumption.
    - Not feasible with private information.
  - With private information
    - To give low work aversion households the incentive to look for jobs, 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^u
  - c_t^w / c_t^u must be big enough to provide incentives.
  - must satisfy family resource constraint:

$$h_t c_t^w + (1 - h_t) c_t^u = C_t.$$

Family Indirect Utility Function

- Utility:

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

- Where

$$z(h_t, \varsigma_t) = \log[h_t(e^{F+\varsigma_t(1+\sigma_L)f(h_t,\varsigma_t)^{\sigma_L}} - 1) + 1]$$
$$- \frac{a^2\varsigma_t^2(1+\sigma_L)\sigma_L^2}{2\sigma_L+1} f(h_t, \varsigma_t)^{2\sigma_L+1} - \eta\varsigma_t\sigma_L f(h_t, \varsigma_t)^{\sigma_L+1}.$$

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:

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

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

Different from household curvature with respect to leisure.

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

Unemployment Gap

- Can express everything in terms of unemployment gap:

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

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

Non-accelerating inflation rate of unemployment, NAIRU

Unemployment Gap

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} - \kappa u_t^g$$

$$u_t^g = \kappa^{okun} E_t u_{t+1}^g + \kappa^{okun}\left(\hat{R}_t - \hat{\pi}_{t+1} - \hat{R}_t^*\right)$$

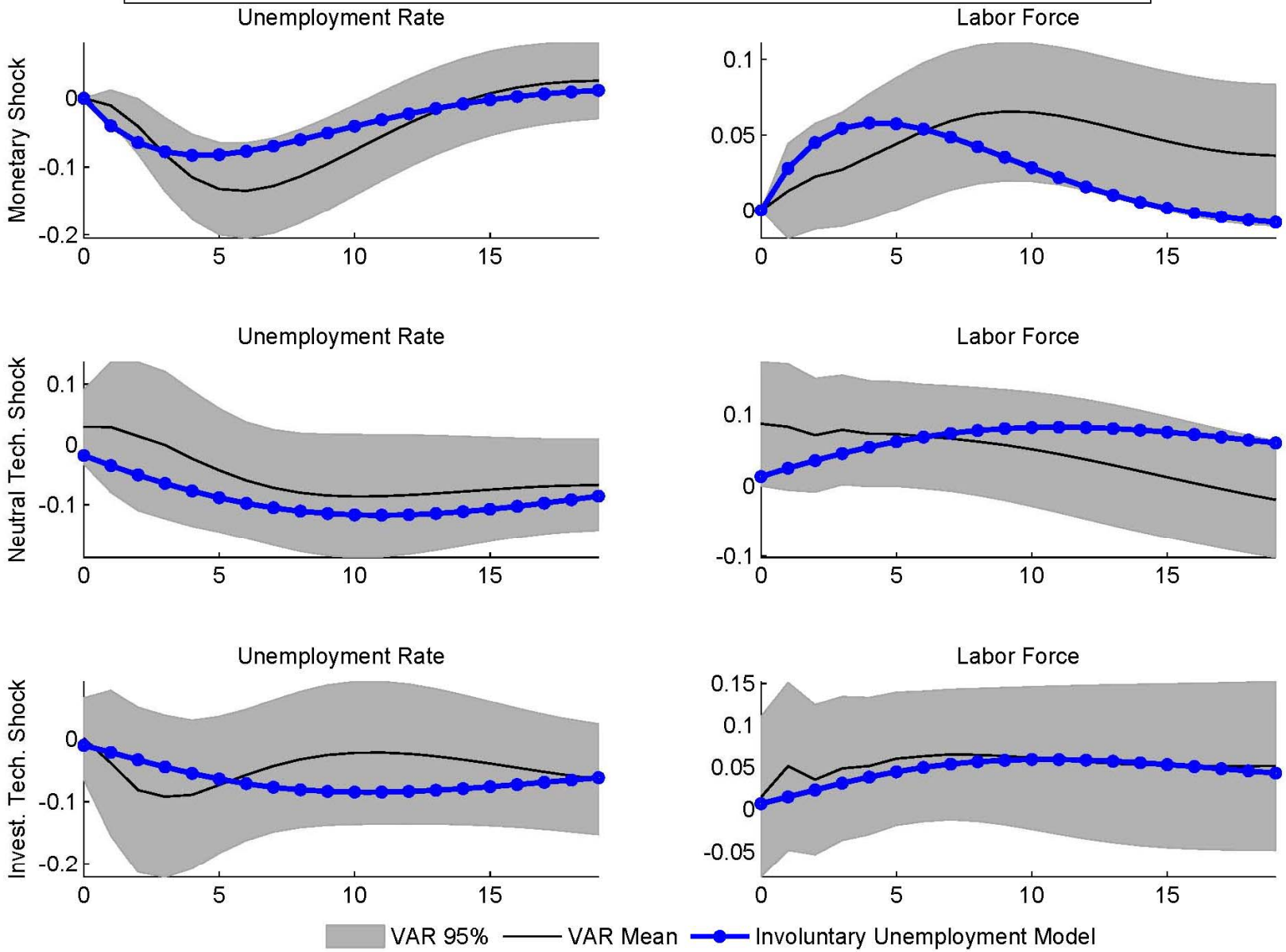
$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)[r_\pi \hat{\pi}_t - \frac{r_y}{\kappa^{okun}} u_t^g] + \varepsilon_t$$

$$\kappa \equiv \frac{(1-\beta\xi_p)(1-\xi_p)}{\xi_p}\frac{1+\sigma_z}{\kappa^{okun}}$$

Put this all into a big DSGE Model

- Habit persistence in preferences
- Variable capital utilization.
- Investment adjustment costs.
- Wage setting frictions as in Erceg-Henderson-Levin.

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



Conclusion

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

- Findings:
  - Obtained a theory of the NAIRU
  - Able to match responses of unemployment and labor force to macro shocks.
  - Observational equivalence result:
    - useful for pedagogic purposes
    - unlikely to satisfy more empirically grounded specification.

- Questions raised by the analysis:
  - Model prediction: consumption inequality bigger in booms.