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
  – be ‘willing and able’ to work.
  – 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 (Gruber, 1997, 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:

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

• 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:

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

• 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 is........
Typical Household During Period

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

\[
F + \zeta_t (1 + \sigma_L) l^{\sigma_L}.
\]

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

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

\[
\log c_t
\]

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

\[
p(e_t) \left[ \log(c_t^w) - F - \zeta_t (1 + \sigma_L) l^{\sigma_L} - \frac{1}{2} e_t^2 \right] + (1 - p(e_t)) \left[ \log(c_t^u) - \frac{1}{2} e_t^2 \right]
\]

\[
p(e_t) = \eta + ae_t
\]
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 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: $c_t^w, c_t^u$
  – $c_t^w / c_t^u$ 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:

\[ u(C_t, h_t, \xi_t) = \log(C_t) - z(h_t, \zeta_t), \]

• Where

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

\[
- \frac{a^2 \xi_t^2 (1 + \sigma_L) \sigma_L^2}{2\sigma_L + 1} f(h_t, \zeta_t)^{2\sigma_L+1} - \eta \xi_t \sigma_L f(h_t, \zeta_t)^{\sigma_L+1}.
\]
Family Problem

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

— Subject to:

$$P_tC_t + B_{t+1} \leq B_t R_{t-1} + W_t h_t + \text{Transfers and profits}_t.$$  

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

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

\[
\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \frac{(1 - \beta \xi_p)(1 - \xi_p)}{\xi_p} (1 + \sigma_z) \hat{\lambda}_t
\]

\[
\hat{\lambda}_t = E_t \hat{\lambda}_{t+1} - (\hat{R}_t - \hat{\pi}_{t+1} - \hat{R}_t^*)
\]

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

• Can express everything in terms of unemployment gap:

\[ u_t^g = -\kappa^{okun} \hat{x}_t. \]

\[ \kappa^{okun} = \frac{a^2 \zeta \sigma_L^2 m^{\sigma_L} (1 - u)}{1 - u + a^2 \zeta \sigma_L^2 m^{\sigma_L}} > 0. \]

\[ u_t^g = u_t - u_t^* \]

actual unemployment - natural rate of unemployment

Non-accelerating inflation rate of unemployment, NAIRU
Unemployment Gap

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

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

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

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

- Unemployment Rate
- Labor Force

Monetary Shock

Neutral Tech. Shock

Involuntary Unemployment Model

VAR 95%  VAR Mean  Involuntary Unemployment Model
Questions Raised by Analysis

• Is consumption (utility) inequality between employed and non-employed bigger in booms?
  – what evidence we have is on the cross-section variance of consumption, not consumption premium across employed and unemployed.

• Does higher unemployment in recessions reflect reduced search intensity?
  – discouraged workers: people ‘available to work’ but are not currently looking because they think there are no jobs.
    – number jumped 70 percent, 2008Q1 to 2009Q1.
Conclusion

• Integrated a model of ‘involuntary unemployment’ into monetary DSGE model.

• Results:
  – Obtained a theory of the NAIRU
  – Able to match responses of unemployment and labor force to macro shocks.