Wage Rigidities, Reallocation Shocks, and Jobless Recovery

R. Shimer (2010)

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Motivation

- Explain the performance of the US Economy since the onset of the financial crisis in 2008
- From the first quarter 2008 until the second quarter 2010 the employment-population ratio fell by 7 log points and average, weekly hours per capita fell by 8.3 log points
- Over the same time real GDP per capita grew 6.9 log points slower than trend and real non-durable and service consumption per capita grew 6.6 log points slower than trend
- **Aim:** Develop a model which can create simultaneous and long-lasting decline in output, employment, investment and consumption

General Environment - Households

- At the start of each period there exists a representative household (HH), which contains a unit measure of individuals with identical preferences
- HH members are infinitely lived and own k units of capital. The HH has an employment rate of n.
- The period utility function of the employed HH members is given by $\frac{c_e^{1-\sigma}(1+(\sigma-1)\gamma)^{\sigma}}{1-\sigma}$
- The period utility function of the unemployed HH members is given by $\frac{c_u^{1-\sigma}}{1-\sigma}$
- Overall consumption is given by $c = nc_e + (1-n)c_u$
- Next period capital stock is given by $k' = Ak^{\alpha}(n - \theta(1-n))^{1-\alpha} + (1-\delta)k - c$

General Environment - Production and Firms

- Firms have access to two technologies:a production and a recruiting technology
- Production technology is given by $Ak^{\alpha}(n-\theta(1-n))^{1-\alpha}$
- Recruiting technology uses only n as input factor and is given by $f(\theta)$ with $f:\mathbf{R}\rightarrow[0,1]$ and $f'(\theta)>0$
- Next period employment rate is determined by $n' = (1-x)n + f(\theta)(1-n)$
- The depreciation rate δ is assumed to be stochastic and follows a first-order Markov Chain

Planner's Problem

- The social planner's maximization problem is
$$\max_{c_e,c_u,\theta,k',n'} n\frac{c_e^{1-\sigma}(1+(\sigma-1)\gamma)^{\sigma}}{1-\sigma}+(1-n)\frac{c_u^{1-\sigma}}{1-\sigma}+\beta\sum_{\delta'}\pi(\delta'|\delta)V(k',n',\delta')$$
s.t.
$$n' = (1-x)n + f(\theta)(1-n)$$
$$k' = Ak^{\alpha}(n-\theta(1-n))^{1-\alpha} + (1-\delta)k - c$$
- FOCs are given by
$$\lambda \equiv \left(\frac{c}{1+(\sigma-1)\gamma n}\right)^{-\sigma} = \beta\sum_{\delta'}\pi(\delta'|\delta)V_k'$$
$$f'(\theta)\beta\sum_{\delta'}\pi(\delta'|\delta)V_n' = (1-\alpha)A\kappa^{\alpha}\beta\sum_{\delta'}\pi(\delta'|\delta)V_k'$$
with $\kappa \equiv \frac{k}{n-\theta(1-n)}$ the capital-producers ratio

Planner's Problem - Optimal Consumption and Recruiting

- Optimal consumption-investment decision is given by
$\lambda = \beta \sum_{\delta'} \pi(\delta'|\delta)\lambda'(\alpha A \kappa'^{\alpha-1} + 1 - \delta')$
- Optimal recruiting-production decision is given by
$(1-\alpha)A\kappa^{\alpha}\lambda = f'(\theta)\beta \sum_{\delta'} \pi(\delta'|\delta)(\lambda'(1-\alpha)A\kappa'^{\alpha}(1+\theta' + \frac{1-x-f(\theta')}{f'(\theta')}) - \gamma\sigma(\frac{c'}{1+(\sigma-1)\gamma n'})^{1-\sigma})$
- The equilibrium is described by the budget constraints and the optimal decisions
- Shimer solves the model numerically

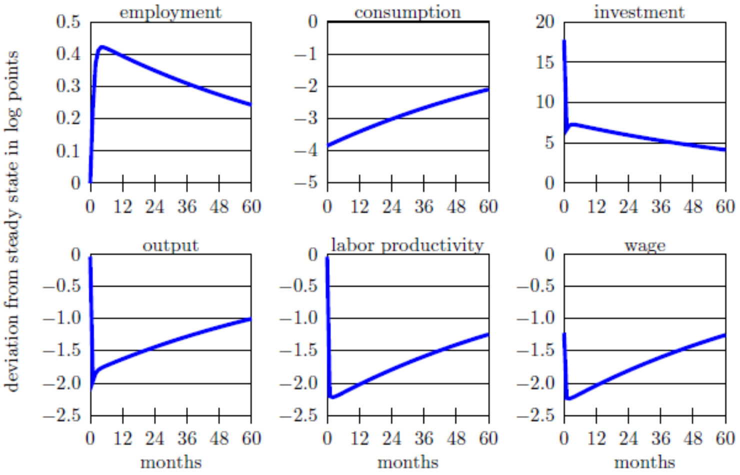
Planner's Problem - Calibration

- Time period of the model is 1 month
- β is set to .996 which implies a yearly interest rate of just below 5%
- α is set to .33 which corresponds to capital share of income in line with the NIPA
- δ is assumed to be i.i.d over time and $\log \delta = \log \bar{\delta} + \log \zeta \nu$ where ν is an i.i.d shock with $E[\nu] = 0$ and $E[\nu^2] = 1$
- $\bar{\delta}$ is set to .0046 which implies a capital-output ratio of 3.2 annually in the steady state. This corresponds to the average in the US since 1948

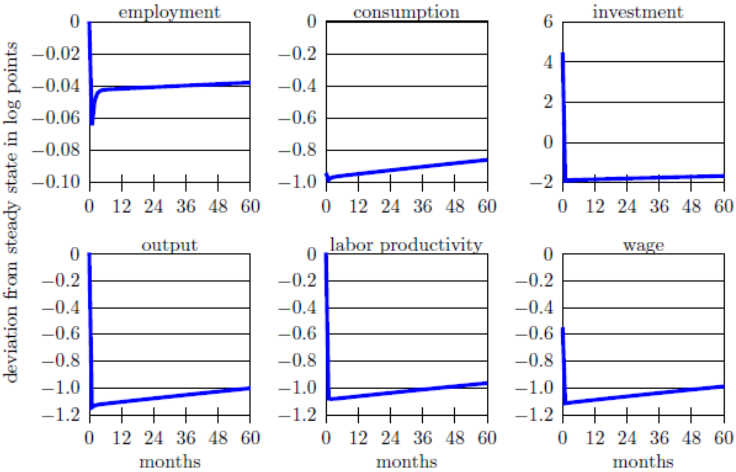
Planner's Problem - Calibration (cont.)

- x is taken from Shimer (2005) and set to 0.034
- Shimer assumes a symmetric, isoelastic matching function and uses evidence of Hagedorn/Manovskii (2008) and Silva/Toledo (2009) which implies that a recruiter can appr. hire 8.33 workers per month
- This implies $f(\theta) = .646$ in steady state and v/n of 0.004
- The "leisure" parameter γ is calibrated to obtain a 5% unemployment rate along the balance growth path and σ is set to both 1 and 10

Planner's Problem - IRFs for sigma = 1



Planner's Problem - IRFs for sigma = 10



Decentralized Economy with Rigid Wages - HH problem

- Same set up as in the centralized economy but now wages are rigid and markets are complete
- The HH maximization problem with assets a is
  $$\max_{c_e, c_u, a'(\delta')} n\frac{c_e^{1-\sigma}(1+(\sigma-1)\gamma)^\sigma}{1-\sigma} + (1-n)\frac{c_u^{1-\sigma}}{1-\sigma} + \beta\sum_{\delta'}\pi(\delta'|\delta)V(a'(\delta'), \delta', n', k')$$
  s.t.
  $$a + \bar{w}n = c + \sum_{\delta'} q(\delta'; \delta, n, k, a'(\delta'))$$
- q is the price of a security in state (δ, k, n) that pays off one unit of consumption if the next exogenous state is δ' and $a'(\delta')$ is the HH's purchase of that security

Decentralized Economy with Rigid Wages - Firm's problem

- The maximization problem of a representative firm with $\overline{n}$ employes and capital $\overline{k}$ is
  $\max_{i,v,\overline{k'},\overline{n}'} A\overline{k}^{\alpha}(\overline{n}(1-v))^{1-\alpha} - \overline{wn} - i + \sum_{\delta'} q(\delta';\delta,n,k) J(\overline{k}', \overline{n}', \delta', n', k')$
  s.t.
  $\overline{k}' = (1-\delta)\overline{k} + i$
  $\overline{n}' = (1 - x + v\mu(\theta))\overline{n}$
- v is the fraction of employees going to recruiting and $\mu(\theta) \equiv f(\theta)/\theta$ the numbers of hires per recruiter

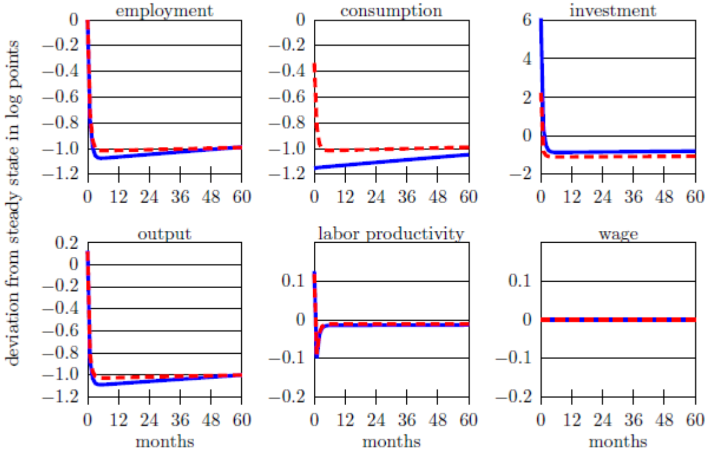
Decentralized Economy with Rigid Wages - Steady State

- In the steady state κ and θ is given by
  $1 = \beta(\alpha A\kappa^{\alpha-1} + 1 - \delta)$
  $\overline{w} = (1-\alpha)A\kappa^{\alpha-1}(1 - \frac{x+(1/\beta)-1}{\mu(\theta)})$
- If $\overline{w} \geqq \frac{\gamma\sigma c}{1+(\sigma-1)\gamma n}$ workers do not want to quit the job
- If $\overline{w} \leqq (1-\alpha)A\kappa^{\alpha}(1+\theta)$ firms are willing to hire workers
- An increase in δ decreases κ and profitability of recruiting is reduced when w is fixed

Decentralized Economy with Rigid Wages - Calibration

- Shimer calibrates the model similar to the centralized economy
- The mean depreciation rate $\overline{\delta}$ is set to .0046 as in the centralized case
- Shimer fixes the wage at the social optimal level, given the mean depreciation rate

Decentralized Economy with Rigid Wages - IRFs



Conclusion

- Shimer develops a model which can generate simultaneous, roughly proportional, and long-lasting decline in output, employment, consumption, and investment
- Underlying assumptions are an unanticipated destruction of a fraction of the capital stock, search frictions and rigid wages
- The model can account for the major observed facts in the US