Monetetary Economics

Large Scale DSGE Models for Policy Analysis

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Discussion of New Keynesian Models

- The basic New Keynesian model generates some implausible results, such as:
  - No inflation persistence
  - No output persistence
  - No comovement between consumption and public spending

Discussion of New Keynesian Models

- Lack of inflation persistence: in this forward looking model current inflation is a jump variable, but actual inflation displays highly serially correlated behavior. Possible solutions:
  - Indexation (see e.g. Christiano et al., 2005)
  - Deviations from the assumption of full-information in price setting
  - Rule of thumb firms (Galí and Gertler, 1999) - each firm is able to adjust its price in any given period with a fixed probability $1-\theta$. A fraction $1-\omega$ of the firms set prices optimally. The remaining fraction of firms, ω, instead use a simple rule of thumb that is based on the past aggregate price behavior.
  - Wage rigidities
  - Variable capital utilization (marginal costs less sensitive to output variations). See Christiano et al. (2001)

Discussion of New Keynesian Models

- Lack of output persistence: the response of output to shock is hump shaped. Possible solutions:
  - Adjustment costs on labor and investments
  - Price and wage staggering
  - Habit formation
  - Diminishing returns
- No comovement between private consumption and public consumption. Possible solutions:
  - Rule of thumb consumers (Galí et al. 2007).
  - Wealth effects and accommodating monetary policy.

Smets and Wouters Model

Frank Smets and Raf Wouters (2003) An estimated DSGE model of the euro area - Journal of the European Economic Association

- Analyse whether the current generation of micro-founded sticky price-sticky wage DSGE models can explain the main features of the data: important for monetary policy makers;
- Investigate the sources of business cycle fluctuations; e.g. the role of productivity shocks
- Analyse implications for optimal monetary policy

Basic Structure

- Households maximise expected utility flow subject to budget constraint
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    - optimal consumption-savings decision
    - optimal labour supply-wage setting
    - optimal capital accumulation decision
- Firms minimise costs s.t. prod.function
  - Final goods : homogenous good
  - Intermediate goods: monopolistic competition
    - optimal production factor demand
    - optimal capital utilisation
    - optimal price setting

Frictions

- A relatively large number of frictions:
  - Monopolistic competition in goods and labour markets with sticky nominal prices and wages (Kollman, 1997; Erceg et al, 2000)
  - Partial indexation of prices and wages
  - Variable capital utilisation (Greenwood et al, 1988; King and Rebelo, 1999; CEE, 2001) and fixed costs in the CD-production function
  - Costs of adjustment in capital accumulation as a function of change in investment (CEE, 2001)
  - External habit formation (Abel, 1990; Fuhrer, 2000)

Shocks

- Introduction of a full set of structural shocks:
  - two "supply" shocks: productivity and labour supply shock;
  - three "demand" shocks: a preference shock, a shock to the investment adjustment cost function, a government consumption shock
  - three "cost-push" shocks: price mark-up, wage mark-up and equity premium shock;
  - two monetary policy shocks: temporary interest rate shock and persistent inflation target shock

Linearized Model

- Consumption equation:

(31) $$\hat{C}_t = \frac{h}{1+h}\hat{C}_{t-1} + \frac{1}{1+h}\hat{C}_{t+1} - \frac{1-h}{(1+h)\sigma_c}(\hat{R}_t - \hat{\pi}_{t+1}) + \frac{1-h}{(1+h)\sigma_c}(\hat{\varepsilon}^b_t - \hat{\varepsilon}^b_{t+1})$$

- Investment equation:

(32) $$\hat{I}_t = \frac{1}{1+\beta}\hat{I}_{t-1} + \frac{\beta}{1+\beta}\hat{I}_{t+1} + \frac{\varphi}{1+\beta}\hat{Q}_t + \beta\hat{\varepsilon}^I_{t+1} - \hat{\varepsilon}^I_t$$

- Q equation:

(33) $$\hat{Q}_t = -(\hat{R}_t - \hat{\pi}_{t+1}) + \frac{1-\tau}{1-\tau+\bar{r}^k}\hat{Q}_{t+1} + \frac{\bar{r}^k}{1-\tau+\bar{r}^k}\hat{r}^k_{t+1} + \eta^Q_t$$

- Capital accumulation equation:

(34) $$\hat{K}_t = (1-\tau)\hat{K}_{t-1} + \tau\hat{I}_{t-1}$$

Linearized Model

- Inflation equation:

$$\hat{\pi}_t = \frac{\beta}{1+\beta\gamma_p}\hat{\pi}_{t+1} + \frac{\gamma_p}{1+\beta\gamma_p}\hat{\pi}_{t-1} + \frac{1}{1+\beta\gamma_p}\frac{(1-\beta\xi_p)(1-\xi_p)}{\xi_p}\left[\alpha\hat{r}_t^k + (1-\alpha)\hat{w}_t - \hat{\varepsilon}_t^a + \eta_t^p\right]$$

- Wage equation:

$$\hat{w}_t = \frac{\beta}{1+\beta}\hat{w}_{t+1} + \frac{1}{1+\beta}\hat{w}_{t-1} + \frac{\beta}{1+\beta}\hat{\pi}_{t+1} - \frac{1+\beta\gamma_w}{1+\beta}\hat{\pi}_t + \frac{\gamma_w}{1+\beta}\hat{\pi}_{t-1}$$
$$- \frac{1}{1+\beta}\frac{(1-\beta\xi_w)(1-\xi_w)}{(1+\frac{(1+\lambda_w)\sigma_L}{\lambda_w})\xi_w}\left[\hat{w}_t - \sigma_L\hat{L}_t - \frac{\sigma_c}{1-h}(\hat{C}_t - h\hat{C}_{t-1}) - \hat{\varepsilon}_t^L - \eta_t^w\right]$$

- Labour demand:

$$\hat{L}_t = -\hat{w}_t + (1+\psi)\hat{r}_t^k + \hat{K}_{t-1}$$

Linearized Model

- Goods market equilibrium:

$$\hat{Y}_t = (1-\tau k_y - g_y)\hat{C}_t + \tau k_y \hat{I}_t + g_y \varepsilon_t^G = \phi\hat{\varepsilon}_t^a + \phi\alpha\hat{K}_{t-1} + \phi\alpha\psi\hat{r}_t^k + \phi(1-\alpha)\hat{L}_t$$

- Monetary policy reaction function:

$$\hat{R}_t = \rho\hat{R}_{t-1} + (1-\rho)\{\bar{\pi}_t + r_\pi(\hat{\pi}_{t-1} - \bar{\pi}_t) + r_Y(\hat{Y}_t - \hat{Y}_t^p)\} +$$
$$r_{\Delta\pi}(\hat{\pi}_t - \hat{\pi}_{t-1}) + r_{\Delta y}(\hat{Y}_t - \hat{Y}_t^p - (\hat{Y}_{t-1} - \hat{Y}_{t-1}^p)) + \eta_t^R$$

Linearized Model

- In sum:
  - Nine endogenous variables:

    $\hat{\pi}_t \quad \hat{w}_t \quad \hat{K}_{t-1} \quad \hat{Q}_t \quad \hat{I}_t \quad \hat{C}_t \quad \hat{R}_t \quad \hat{r}_t^k \quad \hat{L}_t$

    - Seven state variables, two flow variables
  - Ten exogenous shock variables:

    $\varepsilon_t^a \quad \varepsilon_t^I \quad \varepsilon_t^b \quad \hat{\varepsilon}_t^L \quad \varepsilon_t^G \quad \eta_t^w \quad \eta_t^p \quad \eta_t^Q \quad \bar{\pi}_t \quad \eta_t^R$
  - Seven observable variables:

    $\pi_t \quad w_t \quad Y_t \quad I_t \quad C_t \quad R_t \quad L_t$