Monetary Economics

Lecture 11: monetary/fiscal interactions in the new Keynesian model, part one

Chris Edmond

2nd Semester 2014

This class

- Monetary/fiscal interactions in the new Keynesian model, part one

- Fiscal policy and multipliers

- Reading

  ◇ Woodford "Simple analytics of the government expenditure multiplier" *AEJ: Macroeconomics*, 2011

Available from the LMS

This class

1- Benchmark fiscal multipliers

– long-run multiplier (neoclassical case)
– short-run multiplier (for constant real rate)

2- Detailed new Keynesian example

– illustrates how multiplier depends on monetary policy reaction, price stickiness, etc

Neoclassical benchmark

- Household utility function

$$U(C) - V(N)$$

- Goods market

$$C + G = Y = F(N)$$

- Standard optimality conditions

$$\frac{V'(N)}{U'(C)} = \frac{W}{P} = F'(N)$$

- Utility cost of producing Y output

$$\tilde{V}(Y) \equiv V(F^{-1}(Y)), \qquad \tilde{V}'(Y) = \frac{V'(N)}{F'(N)}$$

Neoclassical benchmark (cont)

- Key optimality condition can then be written

$$U'(Y-G) = \tilde{V}'(Y)$$

- Implicitly differentiating and using $U'(C) = \tilde{V}'(Y)$ gives

$$\frac{dY}{dG} = \frac{U''(C)}{U''(C) - \tilde{V}''(Y)} = \frac{-\frac{U''(C)}{U'(C)}Y}{-\frac{U''(C)}{U'(C)}Y + \frac{\tilde{V}''(Y)}{\tilde{V}'(Y)}Y}$$

$$= \frac{\eta_u}{\eta_u + \eta_v} \in (0,1)$$

where $\eta_u > 0$ and $\eta_v > 0$ are elasticities of $U'(C)$ and $\tilde{V}'(Y)$ with respect to Y

Imperfect competition

- Not much changes with constant markup

$$P = \mathcal{M}\frac{W}{F'(N)}, \qquad \mathcal{M} \equiv \frac{\varepsilon}{\varepsilon - 1}$$

- Key condition can then be written

$$U'(Y - G) = \mathcal{M}\tilde{V}'(Y)$$

- Again, implicitly differentiating and using $U'(C) = \mathcal{M}\tilde{V}'(Y)$ gives

$$\frac{dY}{dG} = \frac{\eta_u}{\eta_u + \eta_v} \in (0, 1)$$

- Constant markup reduces *level* of Y, but does not affect multiplier

Aside: countercyclical markups?

- Suppose markup depends on output, $\mathcal{M}(Y)$. Multiplier formula then generalises to

$$\frac{dY}{dG} = \frac{\eta_u}{\eta_u + \eta_m + \eta_v}$$

  where η_m is elasticity of markup with respect to output

- Multiplier > 1 if markups *sufficiently countercyclical*, $\eta_m < -\eta_v$

- Large literature provides microfoundations for countercyclical markups. More generally, key is for endogenous decline in gap between real wage and household MRS

Short-run vs. long-run effects

- This neoclassical benchmark determines *long-run* multiplier

$$\frac{d\bar{Y}}{d\bar{G}} = \frac{\eta_u}{\eta_u + \eta_v} \equiv \Gamma \in (0, 1)$$

  [i.e., effects of permanent changes in government purchases]

- Consider government purchases $\{G_t\}$ with permanent value $\bar{G}$

- What are the effects of transitory or *short-run* changes in G_t?

Transitory change in G_t

- Multiplier effects *depends on assumed monetary policy response*. If we want to "keep monetary policy unchanged", what should we hold constant?

- Suppose monetary policy seeks to maintain a constant real interest rate $r_t = \rho = -\log \beta > 0$. Household consumption Euler equation then implies

$$C_t = C_{t+1} = \bar{C}$$

for some level of consumption determined by the permanent level $\bar{G}$

- Hence for a purely transitory change

$$Y_t = \bar{C} + G_t, \qquad \frac{dY_t}{dG_t} = 1$$

independent of details of wage or price stickiness!

Summary

- Long-run/neoclassical multiplier

$$\frac{d\bar{Y}}{d\bar{G}} = \frac{\eta_u}{\eta_u + \eta_v} \equiv \Gamma \in (0,1)$$

- Short-run multiplier, *holding real interest rate constant*

$$\frac{dY_t}{dG_t} = 1$$

- What if policy cannot maintain constant real rate?

  – depends on details of monetary policy reaction, price stickiness etc
  – next, a simple new Keynesian example

Simple new Keynesian example

- Intertemporal consumption Euler equation

$$c_t = -\frac{1}{\sigma}(i_t - \mathbb{E}_t[\pi_{t+1}] - \rho) + \mathbb{E}_t[c_{t+1}]$$

- Goods market, constant productivity

$$c_t + g_t = y_t = a + (1-\alpha)n_t$$

- Labor supply

$$w_t - p_t = \sigma c_t + \varphi n_t$$

- Static markup (with flexible prices)

$$p_t = \mu + w_t + n_t - y_t - \log(1-\alpha)$$

Flexible price equilibrium

- Natural output, in log deviations

$$\hat{y}_t^n = \Gamma \hat{g}_t$$

- If measure G_t relative to $\bar{Y}$, that is $\hat{g}_t \equiv (G_t - \bar{G})/\bar{Y}$, then this elasticity is the long-run multiplier, as above

$$\Gamma = \frac{\eta_u}{\eta_u + \eta_v} = \frac{\sigma}{\sigma + \left(\frac{\varphi+\alpha}{1-\alpha}\right)}$$

Flexible price equilibrium (cont).

- Output gap

$$\tilde{y}_t \equiv \hat{y}_t - \hat{y}_t^n = \hat{y}_t - \Gamma\hat{g}_t = \hat{c}_t + (1-\Gamma)\hat{g}_t$$

  Plug back into intertemporal consumption Euler equation to get dynamic IS curve

$$\tilde{y}_t = -\frac{1}{\sigma}(i_t - \mathbb{E}_t[\pi_{t+1}] - r_t^n) + \mathbb{E}_t[\tilde{y}_{t+1}]$$

- Natural real rate [assuming $\{\hat{g}_t\}$ process is AR(1)]

$$r_t^n = \rho + \sigma(1-\Gamma)(1-\rho_g)\hat{g}_t$$

Simple new Keynesian example

- Dynamic IS curve

$$\tilde{y}_t = -\frac{1}{\sigma}(i_t - \mathbb{E}_t[\pi_{t+1}] - r_t^n) + \mathbb{E}_t[\tilde{y}_{t+1}]$$

- New Keynesian Phillips curve

$$\pi_t = \beta \mathbb{E}_t[\pi_{t+1}] + \kappa \tilde{y}_t$$

- Interest rate rule

$$i_t = \rho + \phi_\pi \pi_t + \phi_y \tilde{y}_t$$

- Natural real rate

$$r_t^n = \rho + \sigma(1 - \Gamma)(1 - \rho_g)\hat{g}_t$$

Method of undetermined coefficients

- Guess

$$\pi_t = \varphi_{\pi g}\hat{g}_t, \qquad \text{and} \qquad \tilde{y}_t = \varphi_{yg}\hat{g}_t$$

for some coefficients $\varphi_{\pi g}, \varphi_{yg}$ to be determined

- As usual, new Keynesian Phillips curve immediately implies proportional relationship

$$\varphi_{\pi g} = \frac{\kappa}{1 - \beta\rho_g}\varphi_{yg}$$

- And from dynamic IS curve

$$\varphi_{yg} = \frac{(1-\Gamma)(1-\rho_g)}{\psi + 1 - \rho_g}, \qquad \psi \equiv \frac{1}{\sigma}\left[\phi_y + \frac{\kappa}{1-\beta\rho_g}(\phi_\pi - \rho_g)\right] > 0$$

Effects of increases in government purchases

- Output gap increases

$$\frac{\partial \tilde{y}_t}{\partial \hat{g}_t} = \varphi_{yg} > 0$$

- Inflation increases

$$\frac{\partial \pi_t}{\partial \hat{g}_t} = \varphi_{\pi g} > 0$$

- Monetary policy tightens

$$\frac{\partial i_t}{\partial \hat{g}_t} = \phi_\pi \varphi_{\pi g} + \phi_y \varphi_{yg} > 0$$

Multipliers redux

- Output then given by

$$\hat{y}_t = \tilde{y}_t + \hat{y}_t^n = (\varphi_{gy} + \Gamma)\hat{g}_t = \frac{1 - \rho_g + \psi\Gamma}{1 - \rho_g + \psi}\,\hat{g}_t$$

(hence output [and employment] also increase)

- Since G_t is measured relative to $\bar{Y}$, this elasticity is also the new Keynesian multiplier

- Observe that

$$\Gamma < \frac{1 - \rho_g + \psi\Gamma}{1 - \rho_g + \psi} < 1$$

Discussion

- Sticky prices imply a larger multiplier than classical benchmark
- But multiplier still less than one
[interest rate rule here allows r_t to vary]
- Size of multiplier increasing in degree of price stickiness
[high θ reduces κ which reduces ψ and increases multiplier]
- Size of multiplier decreasing in monetary policy reactiveness
[high policy coefficients ϕ_π, ϕ_y increase ψ and reduce multiplier]
- Size of multiplier decreasing in persistence of $\hat{g}_t$ shock

Discussion

- Larger multipliers obtain when monetary policy *accommodates* fiscal expansion

- Important special case is when monetary policy is constrained by the *zero-lower-bound* (ZLB) on i_t

- Can then have multipliers (substantially) larger than one

Next class

- Monetary/fiscal interactions in the new Keynesian model, part two
- The zero lower bound. Implications for multipliers.
- Main reading:
    - ◇ Woodford "Simple analytics of the government expenditure multiplier" *AEJ: Macroeconomics*, 2011
- Further reading
    - ◇ Christiano, Eichenbaum and Rebelo "When is the government spending multiplier large?" *Journal of Political Economy*, 2011

Available from the LMS