Economics 2301

Lecture 10

Solving Simultaneous Equations

Comparative Statics

- Economic analysis often considers the effect of a change in an exogenous variable on one or more endogenous variables.
- **Comparative Statics** compares the value of endogenous variables in one equilibrium to their value in another equilibrium.
- "**Statics**" refers to the fact that the analysis is not concerned with the way in which the new equilibrium is reached.

Comparative Statics

- Usually we vary one exogenous variable at a time in order to isolate the effect of that particular variable.
- The effort looks at the effect of a change in a variable, *ceteris paribus*, that is other things being equal.

Comparative Statics for IS-LM

Ask ourselves the question of how a change in the nominal money supply effects equilibrium income.

$\Delta\ln(M) = \ln(M_1) - \ln(M_0)$ For the ceteris paribus condition,

assume $\Delta\ln(G) = \ln(G_1) - \ln(G_0) = 0$, $\Delta\ln(P) = \ln(P_1) - \ln(P_0) = 0$

$$\Delta\ln(Y) = \ln(Y_1) - \ln(Y_0)$$

$$= \frac{\alpha-\lambda}{\phi+\beta} + \frac{\gamma}{\phi+\beta}\ln(G_1) + \frac{\theta}{\phi+\beta}\ln(M_1) - \frac{\theta}{\phi+\beta}\ln(P_1)$$

$$-\left[\frac{\alpha-\lambda}{\phi+\beta} + \frac{\gamma}{\phi+\beta}\ln(G_0) + \frac{\theta}{\phi+\beta}\ln(M_0) - \frac{\theta}{\phi+\beta}\ln(P_0)\right]$$

$$= \frac{\gamma}{\phi+\beta}\Delta\ln(G) + \frac{\theta}{\phi+\beta}\Delta\ln(M) - \frac{\theta}{\phi+\beta}\Delta\ln(P)$$

$$= \frac{\gamma}{\phi+\beta}(0) + \frac{\theta}{\phi+\beta}\Delta\ln(M) - \frac{\theta}{\phi+\beta}(0) = \frac{\theta}{\phi+\beta}\Delta\ln(M)$$

Interest Rate Comparative Statics

Simple way to do comparative statics is to write the difference equation for the reduced form equation. For interest rate in the IS - LM model, we get

$$\Delta \ln(i) = \frac{\phi \ \gamma}{\phi + \beta} \Delta \ln(G) - \frac{\beta \ \phi}{\phi + \beta} \Delta \ln(M) + \frac{\beta \ \phi}{\phi + \beta} \Delta \ln(P)$$

Now set all the changes in the exogenous variables equal to zero except the change of interest (i.e. change in money) then our comparative static result is

$$\Delta \ln(i) = -\frac{\beta \ \phi}{\phi + \beta} \Delta \ln(M)$$

Difference equations: Demand and Supply

For the demand and supply model, the difference equations for the equilibrium price and quantity are

$$\Delta P = \frac{\gamma}{\phi + \beta}\Delta I + \frac{\theta}{\phi + \beta}\Delta P^{S} + \frac{\varphi}{\phi + \beta}\Delta W$$

$$\Delta Q = \frac{\phi\ \gamma}{\phi + \beta}\Delta I + \frac{\phi\ \theta}{\phi + \beta}\Delta P^{S} - \frac{\varphi\ \beta}{\phi + \beta}\Delta W$$

Incidence of a Tax

We are going to look at the distribution of the burden of a excise tax on a good.

$$P_C = P_P + T$$

$$Q^D = \alpha - \beta P_C + \gamma G$$

$$Q^S = \theta + \lambda P_P - \phi N$$

$$Equilibrium: Q^D = Q^S = Q$$

$$\theta + \lambda P_P - \phi N = \alpha - \beta\left(P_P + T\right) + \gamma G$$

$$\left(\lambda + \beta\right) P_P = \left(\alpha - \theta\right) - \beta T + \gamma G + \phi N$$

$$P_P = \frac{\alpha - \theta}{\lambda + \beta} - \frac{\beta}{\lambda + \beta} T + \frac{\gamma}{\lambda + \beta} G + \frac{\phi}{\lambda + \beta} N$$

Incidence of a Tax Continued

$$P_C = P_P + T = \frac{\alpha - \theta}{\lambda + \beta} - \frac{\beta}{\lambda + \beta} T + \frac{\gamma}{\lambda + \beta} G + \frac{\phi}{\lambda + \beta} N + T$$

$$= \frac{\alpha - \theta}{\lambda + \beta} + \frac{\lambda}{\lambda + \beta} T + \frac{\gamma}{\lambda + \beta} G + \frac{\phi}{\lambda + \beta} N$$

Comparative Statics of a change in the Tax

$$\Delta P_P = -\frac{\beta}{\lambda + \beta} \Delta T$$

$$\Delta P_C = \frac{\lambda}{\lambda + \beta} \Delta T$$