A One-Period Macroeconomic Model

How are we going to do policy analysis?

- Study the behavior of the agents in the model – consumer, firm and government.
- Determine equilibrium.
- Change an exogenous variable and let agents adjust and the find the new equilibrium

Figure 5.1 A Model Takes Exogenous Variables and Determines Endogenous Variables

Definition of a Competitive Equilibrium

- A competitive equilibrium is a set of endogenous variables C, N^S, N^D, T, Y, and w given G, z, and K such that

(1) Given T, w, and π, C and N^S satisfy the consumer's choice problem.

(2) Given w,z,and K, N^D is consistent with the firm maximizing profits.

(3) The labor market clears: $N^D=N^S$

(4) The government budget constraint holds: G = T

How come we don't write down the goods equilibrium condition?

The reason is that it is implicit in the definition of equilibrium.

(1) Start with the consumer's budget constraint.

$$C = wN^S + \pi - T$$

(2) Use Firm's profit condition

$$\pi = Y - wN^D$$

(3) Now, the budget condition is:

$C = wN^S + Y - wN^D - T$

(4) Use the government budget constraint: $G = T$

$C = Y - G$

(5) Rewrite this equation

$Y = C + G$

Goods market equilibrium is:

$C = Y - G$

Then,

$C = zF(K,h-l)-G$

This is the production possibilities frontier and describes what the technological possibilities for an economy

A Graphical Approach

- Because the consumer want to choose the optimal amount of C and l, we have to develop a picture for the firm where C and l appears rather that K and N.

The firm's production function is:

$Y = zF(K,N)$

In equilibrium,

$N = h - l$

Thus,

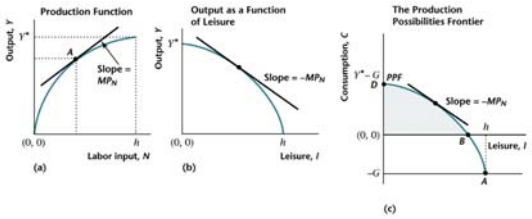
$Y = zF(K,h-l)$

Some Details on the PPF

- Suppose T>0, then with l = 0, we can produce C=zY(K,h-l)-T
- Suppose T>0, then l=h and Y=0. Also, C = -G. This possibility is possible but **not feasible**.
- Only feasible points on the PPF can be considered.

- The slope of the PPF curve is called the marginal rate of transformation(MRT)
- The $MRT_{l,C}$ is the rate at which one good can be converted technically into another good.
- $MRT_{l,C} = MP_N$ =(-the slope of PPF)

Figure 5.2 The Production Function and the Production Possibilities Frontier



Given the w, the firm's position is deterimed where:

$$w = MRT_{l,C} = MP_N$$

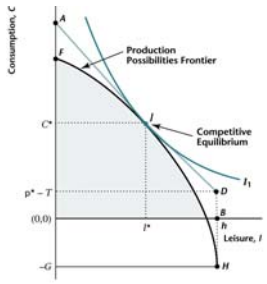
Next, add the indifference curve to the diagram so that the consumer is incorporated into the analysis. The consumers choice is:

$$w = MRS_{l,C}$$

Competitive equilibrium occurs where :

$$MRS_{I,C} = MRT_{I,C} = MP_N = w$$

Figure 5.3 Competitive Equilibrium



The Connection between a competitive equilibrium and economic efficiency

- Can markets act to arrange production and consumption activities so that the ideal efficiency arrangement results?

How can we determine the efficient allocation ?

- Economists call this the Pareto Optimum
- Suppose a social planner exists who has the job of determining the efficient allocation.
- How does the social planner determine the Pareto optimum?

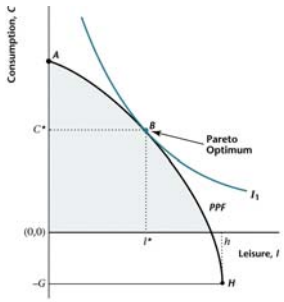
Definition: A competitive equilibrium is Pareto optimal if there is no way to rearrange production or to allocate goods so that someone is made better off without making someone else worse off

- The social planner choose C and I so that the consumer maximizes utility subject to technology as represented by the production possibilities frontier.

What could cause a competitive equilibrium to differ from a Pareto optimal?

- Externalities
- Distorting Taxes
- Monopoly power

Figure 5.4 Pareto Optimality



Summary

- Given G, the tangency of the indifference curve and the PPF curves determines C and l
- Given l and h = N +l, we know N
- Given K and N, we know Y
- Given the C and l, we can determine w.

The Pareto Optimum has the property that

$$MRS_{I,C} = MRT_{I,C} = MP_N$$

We see that for this model the competitive equilibrium is identical to the Pareto optimum.

- Definition: The **first welfare theorem of welfare economics** states that, under certain conditions, a competitive equilibrium is Pareto optimal.

- Definition: The **second fundamental theorem of welfare economics** states that, under certain conditions, a Pareto optimum is a competitive equilibrium.

How do we use the planning approach to determine the competitive equilibrium result?

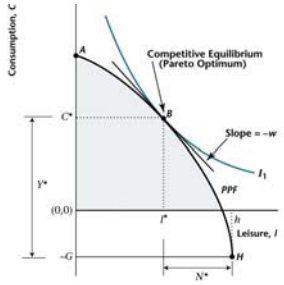
Solution Strategy

Step 1: Find equilibrium for the initial level of government expenditures.

Step 2: Change Curves that are impacted by an increase in G.

Step 3: Find equilibrium for the economy with the new level of government expenditures.

Figure 5.5 Using the Second Welfare Theorem to Determine a Competitive Equilibrium



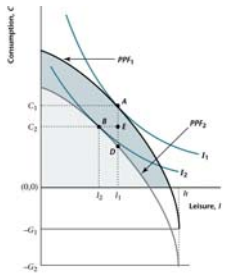
Application: What happens if Government Spending Increases?

STEP 1:The original equilibrium is denoted by a subscript 1. Consumption is C_1 and leisure l_1.

STEP 2: The increase in government spending to G_2 means taxes must increase to T_2. The PPF shifts inward to PPF_2. As a result, the indifference that is relevant is $\mathbf{I}_2$.

- The new tangency is at point B. Consumption fall to C_2 and leisure l_2. If leisure falls, then N increases and thus Y increases. Also, the real wage must fall (the only way firms hire more N is if costs fall).

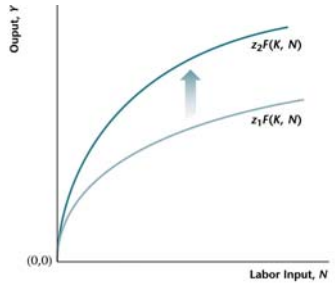
Figure 5.6 Equilibrium Effects of an Increase in Government Spending



What are the implications of this approach compared to the old approach that tells us that consumption is a constant fraction of after tax income?

Application: What happens if Total Factor Productivity Increases?

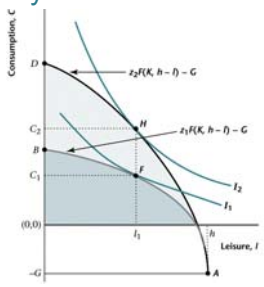
Figure 5.8 Increase in Total Factor Productivity



STEP 1:The original equilibrium is denoted by a subscript 1. Consumption is $C_{1,}$, leisure l_1, and output Y_1.

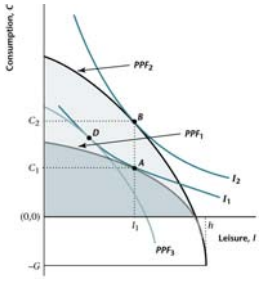
STEP 2: The increase in TFP to z_2 shifts the production function upward. The PPF shifts upward to PPF_2, although the h intercept does not change. As a result,the relevant indifference curve is $\mathbf{I}_{2.}$

Figure 5.9 Competitive Equilibrium Effects of an Increase in Total Factor Productivity



- STEP 3 Consumption increases to C_2. Output increases to Y_2. The real wage is greater. What happens to leisre depends on the income and substitution effects.

Figure 5.10 Income and Substitution Effects of an Increase in Total Factor Productivity



Summary: If income and substitution effects are equal, the model is consistent with the fact that hours worked per person have remained roughly constant over the post-war period in US, as well as consumption and real wages being pro-cyclical.

Figure 5.12 The Relative Price of Energy