

Econ 223
Lecture notes 2:
Determination of output and income
Classical closed economy equilibrium

The classical model assumes that prices and wages etc. are fully flexible. Output is at the equilibrium level—all markets clear. Since this includes labour and other factor markets, the classical equilibrium is a *full employment* equilibrium. Aggregate demand is equal to *potential* output.

The classical model is relevant to the long run, since in the long run all prices can adjust; contracts can be re-negotiated, etc. For the short run, the classical model shows not necessarily where economy is, but where it is heading; and it indicates the nature of the adjustment from one equilibrium to another.

We will consider first the supply side of the economy, and second the demand side.

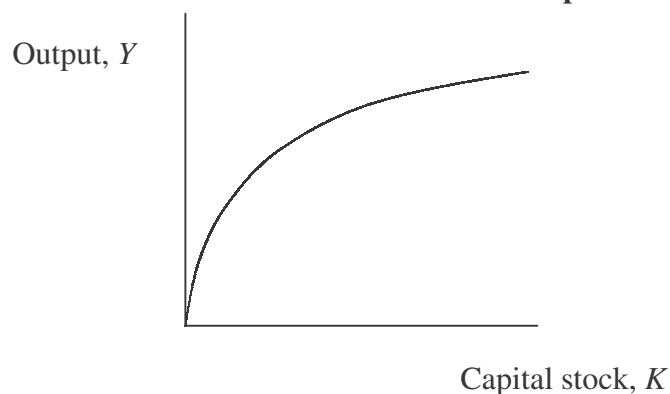
1. Supply or output

Production function

$$Y^{FE} = F(K^{FE}, L^{FE}).$$

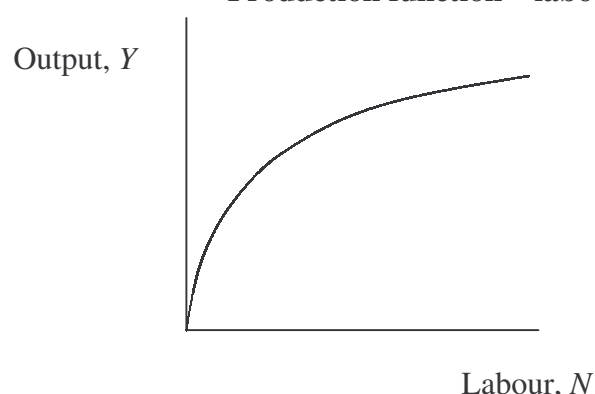
The supply side of the economy. At any point in time it describes production as a function of factor inputs, for a given level of technology.

Figure 1
Production function—capital



Output is an increasing function of both capital and labour. Thus, figure 1 shows a positive relation for capital, figure 2 for labour.

Figure 2
Production function—labour



The *marginal product of capital* (MP_K) is the additional output from a unit increase in capital— $\Delta Y/\Delta K$. In figure 1, this is the *slope* of the production function.

Likewise, MP_L is $\Delta Y/\Delta L$, the *slope* of the production function in figure 2.

In both cases

- the relation is positively sloped (positive MP_N)
- the slope is diminishing.

These are key features of the standard (neo-classical) macroeconomic production function. The diminishing slope implies *diminishing MP* as the input of a single factor increases, with the other held constant.

A third feature of the standard production function is

- constant returns to scale—as employment of all factors increases by a given percentage, output increases by the same percentage

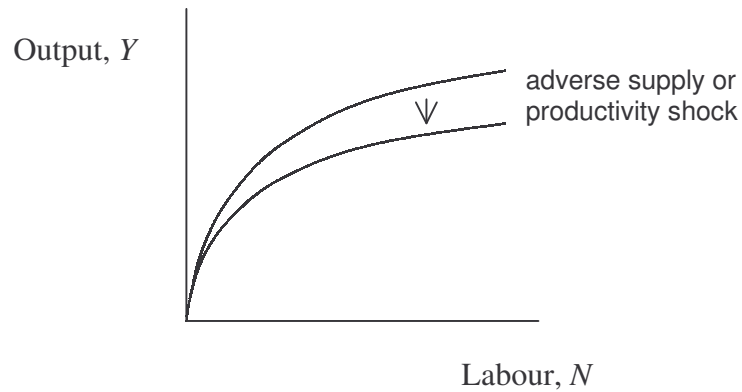
i.e. if the level of output from input levels (K_0, L_0) is Y_0 , then the output from input levels (mK_0, mL_0) is mY_0 , where m is any number. That is, with constant returns to scale,

$$F(mK_0, mL_0) = mY_0.$$

In contrast, a production function for which the level of output increases *more* than proportionately to increases in all inputs has *increasing* returns to scale (If $m > 1$, then $F(mK_0, mL_0) > mY_0$.) Conversely, a production function for which the level of output increases *less* than proportionately has *decreasing* returns to scale.

Negative supply shock

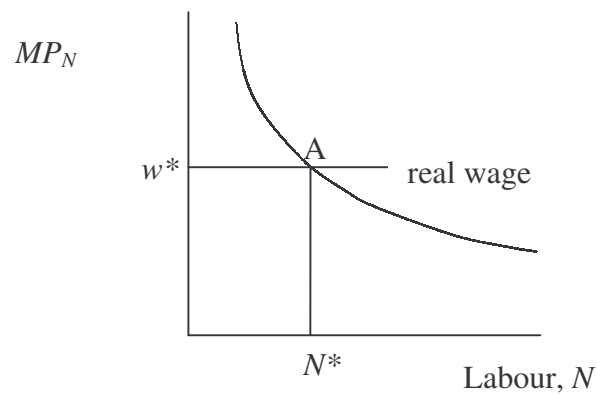
Figure 3
Shock to production function—labour



2. Labour market

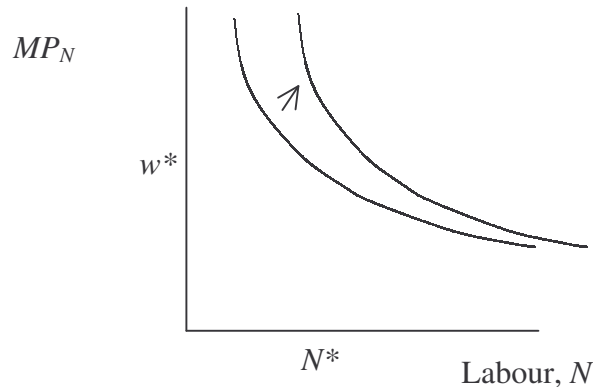
Marginal product of labour and demand curve for labour

Figure 4
Marginal product of labour:
demand curve for labour



The profit maximizing level of employment at real wage w^* is N^* . The same reasoning applies for any real wage. Therefore the curve for the MP_N traces out the demand for labour as a function of the real wage. It is the demand function for labour in a competitive economy.

Figure 5
Technological improvement:
demand curve for labour



Factors that might shift the MP_N and hence the demand curve for labour:

- technological improvement (figure 5)
- shocks to other input prices (e.g. intermediate goods)
- capital accumulation

Movement along the demand curve results only from real wage changes.

Supply of labour

A change in real wage has 2 effects on labour supply

- substitution effect
- income effect

Substitution effect

Reward for work is the opportunity cost of leisure. An increase in the real hourly pay rate would provide increased incentive to work longer hours, take less leisure. If the opportunity to earn a higher rate is expected to be brief, the substitution effect would be relatively strong, and the income effect weak. The worker might e.g. work now, and take leisure later, after the expected return to the old wage rate.

Income effect

As income rises, people usually want more leisure time to enjoy the extra things they can buy. Example: a large windfall gain. An expected increase in future lifetime earnings would also cause a drop in the incentive to work today.

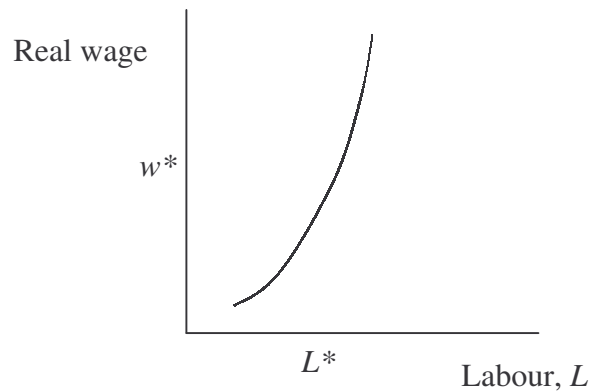
Empirical findings

According to a number of estimates, the overall effect of real wage increases on hours worked in rich countries is probably not large. It appears the 2 effects almost offset.

Evidence of a substitution effect is that temporary increases in the real wage do lead to increases in hours worked. But permanent increases (and hence long-run increases over time) do not. Across samples of countries, hours worked tend to be negatively correlated with real incomes.

Aggregate labour supply

Figure 6
Supply curve for labour



Reflecting the evidence, this curve is quite steep (inelastic).

Labour market equilibrium

Figure 7
Labour market equilibrium

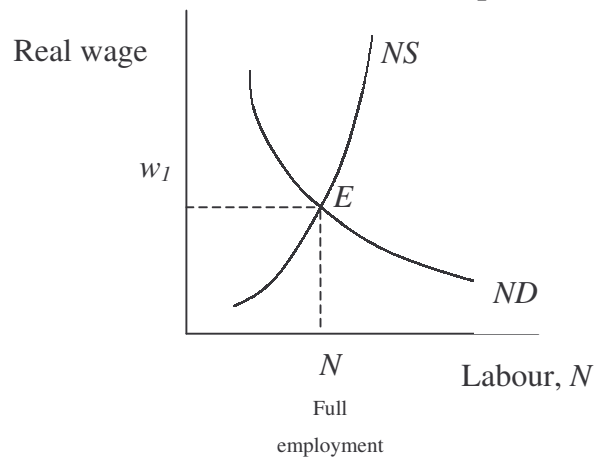
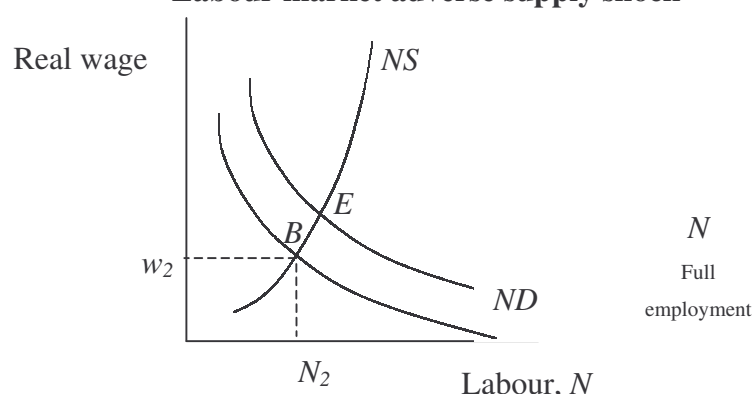


Figure 8
Labour market adverse supply shock



Example: sharp increase in price of oil. Negative oil shocks reduce potential output in Ontario by reducing productivity at any given level of employment, and by reducing the equilibrium level of employment. For the Canada as a whole, the net effect on output may not be so bad, as Canada is a net exporter of oil (and other energy). Complicated issue.

Wage inequality—table 3.4, p85.

Unemployment

StatCan survey classification for monthly household survey, person over 15:

- employed
- unemployed—looking and available
- not in *labour force*—not looking (e.g. students, retirees)

The *labour force* is the sum of employed & unemployed. The *unemployment rate* is the fraction of the labour force unemployed.

The *participation rate* is the fraction of the working-age population in the labour force. The employment ratio is the fraction of the working age population that is employed.

Discouraged workers would like to work but give up. They find that the probability of finding work is very low.

Unemployment duration:

- most UE spells are short—2 months or less—in Canada
- a lot of the unemployed are long-term UE

Unemployment is never zero:

- *frictional*—economy changes, search for skill-vacancy matches takes time
- *structural*—chronic—lack of skills, shrinking sectors (note geographical concentration)

- *cyclical*—business cycle

The *natural rate of UE* (Friedman) is the UE rate associated with the equilibrium level of employment in section 4. Equivalent for all intents and purposes to full employment.

Note

Focusing on real wage adjustment does not yield useful policy implications for dealing with recessions. For example, even though it is a property of long-run, FE equilibrium, that wage is equal to the marginal product of labour, you don't today hear economists suggesting that wage cuts might solve a cyclical unemployment problem. They are more likely to suggest lower interest rates, or even a lower US\$. This is because they take into account the implications of the circular flow of income and spending—a cut in wages represents a cut in income...

2. Aggregate demand or spending

$$Y = C + I + G.$$

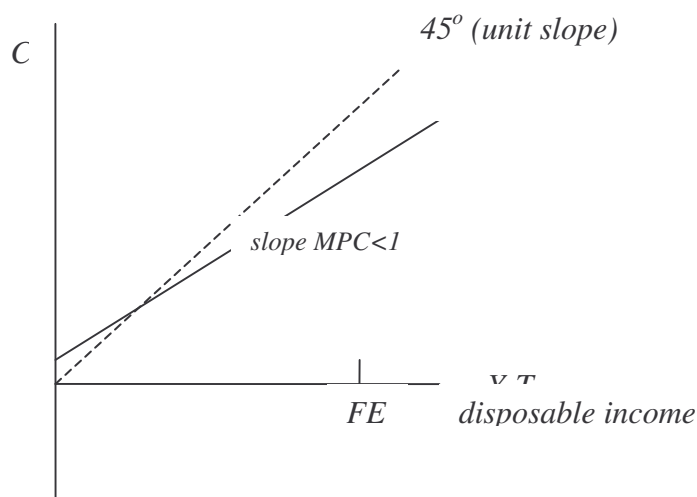
We will consider G exogenous—set by policy (transfers, which include unemployment insurance, etc., are clearly endogenous—they vary with the business cycle (i.e. with Y itself)—but are not in G since these are not demand for final output).

Consumption function

$$C = C(Y - T).$$

T = taxes – government transfers

Figure 9



Saving function

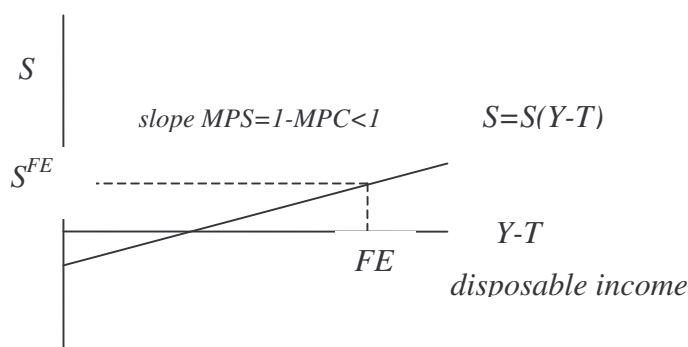
We can write an identity for private saving, recognizing that it is residual income after consumption and taxes:

$$S = Y - T - C.$$

In this definition, saving includes any household outlay that counts as investment in the previous identity. That is, purchases of a new house, or renovations, are deemed to be both saving and investment, simultaneously. They represent additions to the real assets of households, just as regular saving represents additions to financial assets.

The consumption function implies a saving function—the difference between the 45° line and the consumption line in Chart 1.

Figure 10
Saving function



Investment function

Derive from capital stock, MPL.

$$I = I(r).$$

r = real interest rate

The relationship is negative—a downward-sloping demand curve.

In practice, the most interest-sensitive components of demand are residential construction and consumer durables. Household outlays for “big ticket” items are strongly influenced by cash-flow, which is in turn negatively affected by interest payments. The outstanding example is the lower mortgage interest rates of the past 10 years, which has had a strong positive impact on household spending, as existing mortgages are refinanced at lower rates.

We will get to the open economy, the Canadian situation. First though, we look at a closed economy—you can think of it as the world (which is certainly a closed economy), or at a stretch as the US situation.

3. Equilibrium—full-employment supply and demand

$$Y^{FE} = C(Y^{FE} - T) + I(r) + G$$

In a closed economy the interest rate adjusts to equate aggregate demand to full employment output— r is the one endogenous variable in this equation.

Any tendency for demand to be less than full employment supply would be corrected by a drop in the interest rate, and vice versa.

This mechanism can be illuminated by looking at the market for saving.

Saving equals investment

The closed-economy identity for total spending implies

$$I + G = Y - C,$$

and the identity for saving implies

$$S + T = Y - C,$$

so that

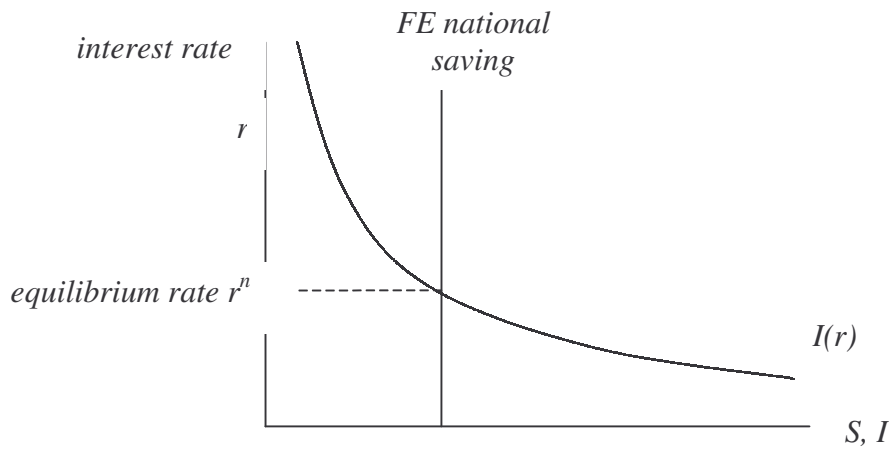
$$I + G = S + T.$$

This yields the equilibrium condition:

$$I(r) = S^{FE} + T - G = \text{full-employment national saving}.$$

In equilibrium, demand for saving (investment) equals the full-employment supply (private saving plus government saving or *budget surplus*).

Figure 11
Saving, investment equilibrium

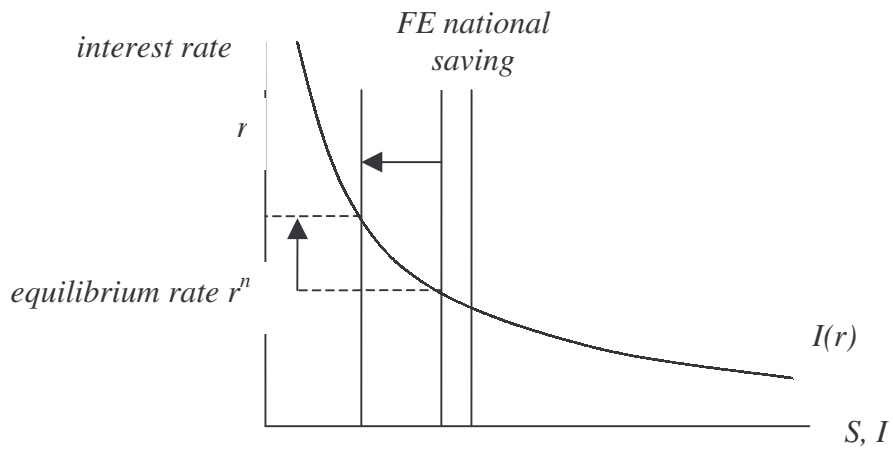


Any discrepancy between full-employment national saving and the demand for saving causes an equilibrating adjustment of the interest rate. Excess supply causes a drop in the rate which stimulates investment sufficiently to eliminate the excess. Vice versa for excess demand.

These are equivalent statements of the equilibrium position:

- the interest rate brings aggregate demand into equality with full-employment output (this is more straightforward)
- the interest rate brings investment into equality with full-employment national savings (this one is more revealing of the market adjustment)

Figure 12
Increased government spending



The increased budget deficit reduces national saving, drives up the interest rate, and “crowds out” investment spending. Comparing the second equilibrium position to the first, output is diverted from investment to government programs.