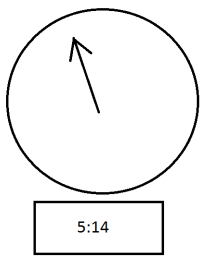
1 Preliminaries

1.1 Focus of Macroeconomics

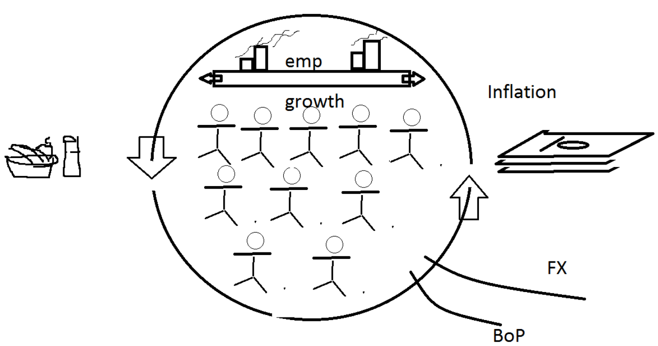
Relation between consumption, income and multiplier is key to macroeconomics.

Direction (pro/a/counter-cyclical) and timing (coincident i.e. when peaks and troughs match with those of aggregate economic indicators/leading when they lead/lagging when they lag) are important for economic variables. is



GDP is measured by - Output Income or Expenditure. $GDP\ deflator = GDP_{nominal}/GDP_{real}$.

Four goals of macroeconomic policy are - low unemployment, low inflation, stable and high growth, reduction in FX volatility and BoP deficits.



1.1.1 Equilibirum with Factors of Production

Constant returns to scale means - $zY = F(zK, zL)$ for the output production function $Y = F(K, L)$. Labour costs are WL and capital costsRK where (W is wage and R is the rental price of capital - i.e. borrowing costs).

$$Profit = P \cdot F(K, L) - WL - RK \tag{1}$$

$MPL = F(K, L+1) - F(K, L) = \frac{\partial F}{\partial L}$ and $MPK = F(K+1, L) - F(K, L) = \frac{\partial F}{\partial K}$. Using 1, Profit wrt Labour thus changes as $\Delta Profit = P \cdot MPL - W$ (labor doesn't change with respect to capital in the short run). The equilibrium is achieved when $dProfit = 0$:

$$MPL = \frac{W}{P} \tag{2}$$

Similarly, we can $dProfit = P \cdot MPK - R = 0$ implies that

$$MPK = \frac{R}{P} \tag{3}$$

Notice that only every variable except K, L is exogenous in the above model and that the equilibrium is achieved when economic profit is 0. The combined effect can be written using $dF = \frac{\partial F}{\partial L}dL + \frac{\partial F}{\partial K}dK$ as $dProfit = PdF - WdL - RdK = (P\frac{\partial F}{\partial L} - W)dL + (P\frac{\partial F}{\partial K} - R)dK = 0$ at equilibrium. Here, $MPL = W/P$ is known as the real wage - which gauges labour in term of output rather than money (price of labour).

Note that since most employers/companies own capital rather than rent it the accounting profit includes their return on capital ($MPK \cdot K$) as well.

1.2 Cobb-Douglas

The US data seems consistent with the Cobb-Douglas production function defined as:

$$F = AK^{\alpha}L^{1-\alpha} \tag{4}$$

This is a constant returns to scale function [1].

1.3 National Income and Equilibirium with Production

National Income (Y) is defined in terms of Consumption(C), Investment(I) and Government Purchases (G).

$$Y = C + I + G \tag{5}$$

Investment ($= Y - C - G$) can be seen as national saving as well.

[1] It's easy to see that $A(zK)^{\alpha}(zL)^{1-\alpha} = z^{\alpha+1-\alpha}AK^{\alpha}L^{1-\alpha} = zF$

Marginal Propensity to Consume is defined as $MPC = \frac{\partial C}{\partial Y}$

1.4 Inflation

Fisher's equation : $\pi = i - r$ where i is the nominal rate. The effect of future money on prices is explained by the Cagan model : $m_t - p_t = -\gamma \Delta p_{t+1} = -\gamma(p_{t+1} - p_t)$. Remember that money demand function is$(\frac{M}{P})^d = kY - r \Rightarrow d \times (dm/m - dp/p) = \rho dY/Y$. We know that aggregate supply curve is $Y - \bar{Y} = \alpha(P - E(P))$. Hence the Cagan Model : $m - p = -\gamma dp$.

2 Solow Model

Output is a simple (Cobb-Douglas) production function of K and L:

$$Y = F(K, L) \tag{6}$$

where $Y = output$ and K, L are capital and labour. Since Cobb-Douglas is a constant-return-to-scale function (CRS), we can simplify above as $\frac{Y}{L} = F(\frac{K}{L}, 1)$. If $y = \frac{Y}{L}$ and $k = \frac{K}{L}$, then we can rewrite 6 as follows:

$$y = F(k, 1) = f(k) \tag{7}$$

.

To introduce saving and investment in this model we consider that consumption as $C = (1 - s)Y$ where $s = savings\ rate$. If we don't have any government (investing or consuming) in the model (see 5), then we can assume that all savings are invested within the society in the state of equilibrium (society invests its savings within the society). $I = sY$. This would also mean that:

$$i = sY = sf(k) \tag{8}$$

.

Assuming that capital depreciates at a constant rate δ, we have net change in capital at any (sparse) time point as$\Delta K = I - \delta K$ (e.g. change in capital over an year). Note that this condition is independent of whatever production function is chosen. This is useful in deriving steady state conditions. Using 8, one can write the following:

$$\Delta k = sf(k) - \delta k \tag{9}$$

One can argue that in steady state i.e. capital doesn't depreciate any more (no capital is really saved when all of it is reinvested). This would mean $\Delta k = 0$ and lead to:

$$i = sf(k^*) = \delta k^* \tag{10}$$

.

This can be interpreted as $k' = 0$ and is a useful identity to use in problems. Notice that there is a key assumption in the theory - <u>all savings are reinvested</u> (so that $sY = I$). In steady state,δk equals investment ($i = sy$). Therefore, it should not be assumed that the economy gravitates towards golden rule i.e. $MPK = \frac{\partial F}{\partial K} = \delta$ (it's not part of the steady state assumption).

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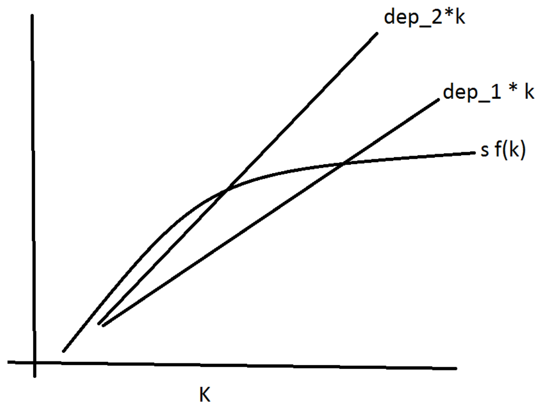
With the relation 10, a couple of observations can be made:

1. Loss of capital would mean the output would fall. But if savings rates stay high, then the loss is limited and capital would grow back up.

2. When savings rate increases in a steady-state economy, the curve $i = s \cdot f(k)$ shifts upwards while capital and depreciation stay the same. Hence the income increases.

Remember that in such cases, we don't jump to the next steady state immediately. Instead we talk about the transitory period. When savings decrease, we use $s_0 f(k^*) = (n+\delta)k^*$. If new savings rate $s_1 < s_0$, then right off we'll have $s_1 f(k) < s_0 f(k) = (n + \delta)k$. $\Delta k = s_1 f(k) - (n + \delta)k < 0$. The immediate effect is therefore $\Delta k < 0$.

In general policies that raise income per individual are said to have a growth effect while the policies that increase saving rates are said to have a level effect (as only the level of income per person is affected by savings rate). Note that investment and depreciation are both represented on the y-axis of the plot.



3 Consumption in Solow Model

$C = (1 - s)Y = Y - sY$

Using 8, we can write $c = y - i = y(1 - s) = f(k) - sf(k)$. In steady state, one can use 10 to write $c = f(k^*) - \delta k^*$. Maxium consumption would be achieved by setting $f'(k) = \delta$.

4 Introducing population growth

With population growth, 9 can be rewritten as:$\Delta k = s \cdot f(k) - (\delta + n)k$ for population growth rate n. The golden rule becomes $c^* = f(k^*) - (\delta + n)k^*$ which is optimized at $\frac{\partial F}{\partial K} = \delta + n$.

5 Introducing technology

Introducing technology changes the output function as $Y = F(K, L \cdot E)$ where E is the efficiency of labour. A better technology would have a higher E and would require less labour (number of workers) for the same output level. Changing definition of k as $k = \frac{K}{L \cdot E}$ and $y = \frac{Y}{L \cdot E}$,we maintain the equation 7 and write the following:

$$\Delta k = s \cdot f(k) - (\delta + n + g) \cdot k \tag{11}$$

The golden rule thus becomes $c^* = f(k^*) - (\delta + n + g)k^*$which is optimized at $\frac{\partial F}{\partial K} = \delta + n + g$.

With technology and population, the Solow model. Y/L would be yE in the steady state $(s \cdot f(k) = \delta + g + n)$

There are 3 ways to model technology.

5.1 Hick Neutral Technological Progress

$Y = AF(K, L)$ - where A is a measure of productivity.

5.2 Harrod Neutral (Labour augmenting) Form

$Y = F(K, AL)$ This model fits best. If a Cobb-Douglas function is assumed, then $Y = K^\alpha (AL)^{1-\alpha} \Rightarrow \frac{Y}{AL} = (\frac{K}{AL})^{1-\alpha} \Rightarrow \hat{y} = f(\hat{k}) = \hat{k}^\alpha$.

5.3 Solow Neutral

$Y = F(AK, L)$

6 Solow model checklist

1. production function
2. consumption qinv
3. evolution of capital
4. how to get to steady state
5. the golden rule level of capital
6. convergence and solow growth model

The paper also uses conditional and unconditional convergence (some textbooks use term absolute vs non-absolute).

Seminar : What happens when g increases.

$\Delta k = sf(k) - (n + \delta)k$

For a Cobb-Douglas production function $Y = K^\alpha L^{1-\alpha} \Rightarrow \frac{Y}{L} = (\frac{K}{L})^\alpha \Rightarrow y = k^\alpha$, we have the following condition at the steady state - $\Delta k = 0 \Rightarrow sk^\alpha = (n + \delta)k \Rightarrow k^* = (\frac{s}{n+\delta})^{\frac{1}{1-\alpha}}$ which allows us to explain higher saving (investment) and lower population as drivers of capital growth. Notice that the transition dynamics here for the Cobb-Douglas case is $\Delta k = sf(k) - (\delta + n)k = sk^\alpha - (\delta + n)k \Rightarrow \frac{\Delta k}{k} = sk^{\alpha-1} - (\delta + n)$.

A useful fact to derive $dY/Y, dK/K, dy/y$ etc. is the steady state condition $k' = 0$. With technological progress, one considers $k' = \frac{ALK' - K(AL' + A'L)}{(AL)^2} = \frac{K'}{AL} - \frac{KL'}{AL^2} - \frac{KA'}{A^2L} = \frac{K'}{AL} - \frac{K}{AL}(n + g)$. Therefore, we know that $dK/K = n + g$. This can also be arrived at by obsverving at $dk/k = d(K/AL)/(K/AL) = 0$. This is because $d(K/AL)/(K/AL) = d(ln(K/AL)) = d(lnK - lnA - lnL) = dK/K - n - g$. The bottom line is that $dk = k' = 0 \Rightarrow dK/K = n + g$. Similarly, we use steady state condition of $y' = 0$ as well.

7 Endogenous Model

7.1 The AK Model

$Y = AK$ where $A = (output\ /capital)$. $\Delta K = sY - \delta K \Rightarrow \frac{\Delta Y}{Y} = \frac{\Delta K}{K} = sA - \delta$.

A combined model would be given by:

$Y = F(K, (1-u)LE)$

$\Delta E = g(u)E$

$\Delta K = sY - \delta K$

8 Lucas Model

Effective labour (since the productivity/efficiency of labour improves) can be written as $L_e = uhL$ where u =allocation, $h = human\ capital$

With production function as

$$Y = AK^{\alpha}(uhL)^{1-\alpha}.$$

dividing by L_e yields $\frac{Y}{L_e} = A(\frac{K}{L_e})^{\alpha}(\frac{uhL}{L_e})^{1-\alpha} \Rightarrow \bar{y} = A\bar{k}^{\alpha}$. The human capital grows as following:

$$\Delta h = G(1-u)h^{\gamma}$$

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$\frac{\Delta h}{h} = G(1-u)h^{\gamma-1}$ is constant for $\gamma = 1$ i.e. $\frac{\Delta h}{h} = G(1-u)$ is independent of h and implies that human capital (and thus the economy) can grow unbounded. In fact, for $\gamma \geq 1$, the per-capita income would grow without technological progress. Notice also that $u = 1$ (no allocation to human capital) means the human capital would not grow. It also means that $u = 0$ would result in human capital growing at the maximal rate G. Since $\bar{y} = \frac{Y}{uhL}$and $\bar{k} = \frac{K}{uhL}$, a policy implication is that increasing time in acquiring skills $(1-u)$ has a permanent impact on human capital (h) and output per capita (y).

9 Human capital accumulation

Output per worker and output per head is not the same in the capital accumulation model because of work-hours.

10 Romer Model

$Y = A((1-a_K)K)^\alpha \cdot ((1-a_L)L)^{1-\alpha}$ and $\Delta A = (a_K K)^\beta (a_L L)^\gamma A^\theta$where $\beta, \gamma \geq 0$. If $\theta > 0$, then further R&D is results from current R&D whereas if $\theta < 0$, then R&D returns become difficult.

If we ignore capital, then the model simplifies as $Y = A(1-a)L \Rightarrow \frac{Y}{L} = A(1-a)$ (since $\alpha = 0$) and $\Delta A = (aL)^\gamma A^\theta$. A grows at rate $g = \frac{\Delta A}{A} = (aL)^\gamma A^{\theta-1}$. Taking logs, $\frac{\Delta g}{g} = \gamma \frac{\Delta L}{L} + (\theta - 1)\frac{\Delta A}{A}$. If $\frac{\Delta L}{L} = n$ then we can write

$$\frac{\Delta g}{g} = \gamma n + (\theta - 1) g$$

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Since the empirical evidence suggests $\theta < 1$, then for small values of g, growth in A would be smaller and for larger g, the growth would be higher.

11 Balance of Payments (Foreign Currency)

The balance of payments are of two subtypes - current account and financial account.

Current account is exports - imports and capital account is inflows - outflows.

Credit entry = change in **F**oreign ownership of any UK asset (real or financial)

Debit entry = change in UK ownership of the rest of the world assets

Credit and Debit entries must exactly cancel out.

The categories that matter are listed below.

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1. Current Account

   (a) Goods (export and import) and Services (IT, Travel)

(b) Income (pay to employees, investment income and interest from securities)

(c) Current Transfer (Taxes, social contributions)

2. Capital Account and Financial Account

   (a) Capital Account

      i. Migrant transfers

      ii. Capital Tranfers

   (b) Financial Account

      i. International investment position

         A. Direct

         B. Portfolio

         C. Derivatives

         D. Other

12 Real Exchange Rate

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$f_{domestic/foreign} = nominal_{foreign/domestic} \cdot \frac{price_{domestic}}{price_{foreign}}$

Law of one price would imply that real exchange rate $f_{domestic/foreign} = 1$.

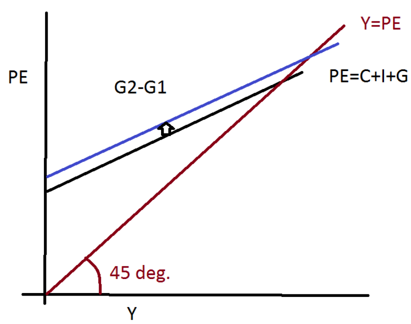
13 IS-LM model

13.1 Keynesian Cross

The preliminary model for IS-LM is the Keynesian cross. Planned expenditure (same as output when planned expenditure is the same as actual expenditure) $PE = C + I + G = Y$. This equilibrium is achieved due to inventories (when $PE < Y$, inventories go up and labour goes down thus reducing production. Further government spending $\Delta G = G_2 - G_1$ would shift the planned expenditure upward - causing the new equilibrium to be achieved at a higher output. The equilibrium involves multiple cycles of consumption increasing income (by ΔG indirectly) and income increasing consumption (by $MPC \cdot \Delta G$). Thus we have the total change in output $\Delta Y = \Delta G(1 + MPC + MPC^2..)$ or

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - MPC} \tag{12}$$

A decrease in tax ΔT would similarly increase the output by $\frac{1}{1-MPC}$. Thus $\frac{1}{1-1/(1-MPC)} = \frac{1-MPC}{1-MPC-1} = -\frac{MPC}{1-MPC}$



13.2 Money Supply theory

The quantity equation is $MV = PY$ where M =money in the economy, V =transactions velocity (# of times a dollar bill changes hands in a given time period), P =price of the good(s) Y =total goods

Money demand function $L(r) = (\frac{M}{P})^d = kY$ where k =factor indicating the fraction of income consumers intend to hold

Under assumption of constant velocity $\bar{V}$, $M(\frac{1}{k}) \sim M\bar{V} = PY$

13.3 IS-LM model form Keynes

Keynes said that low economic demand was responsible for depression. A simple goods market model requires the following assumptions:

1. Single good
2. Price fixed
3. No inventory management
4. Inventory doesn't depend on output
5. Closed economy

6. Bonds and Money are the only financial assets

7. No interest on money

Conditions - ekachassamnir - ekavastu-achalamuulya-asamgraahya-samvritaartha-nirvRiddhasvamiiRNam

IS-LM is explained by Keynesian cross. When income curve shifts output increases (as explained by the cross) and then based on the money supply theory. The IS-LM model was developed by John Hick and Alvin Hansen.

13.4 Deriving the IS Curve

Demand can be seen as total output as well.

$$Y = C + I + G + NX \tag{13}$$

Here C can be written as $C = C(Y_D) = c_0 + c_1 Y_D$ where disposable $Y_D = Y - T$ is the disposable income. $c_0 > 0$ is considered the autonomous consumption and $0 < c_1 < 1$ is the MPC marginal propensity to consume.

Decomposing taxes, this can be rewritten as $Y_D = Y - T = Y - t_0 - t_1 Y$ (where t_1 is the income tax rate) and

$$C = c_0 + c_1(1 - t_1)Y - c_1 t_0 \tag{14}$$

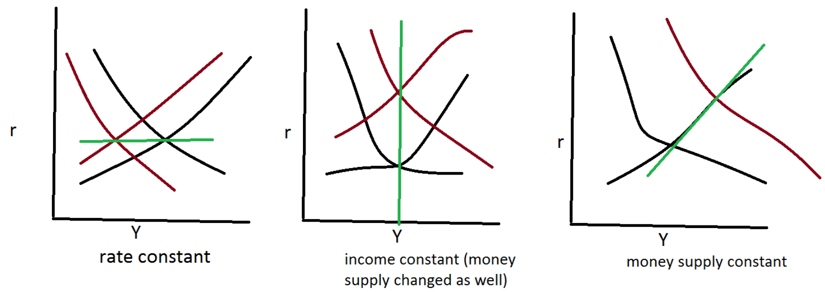
From Equation 13, $I = Y - C - G$ (ignoring NX). We know that r has an inverse relationship with planned investment I_p. Thus lower r increases I_p which then increases Y and thus increases I. This would result in an upward sloping Y vs I curve and a downward sloping Y vs r curve (the latter called the IS curve). The investment function (aka planned investment or physical capital) can be written as $I = I_0 - br$ where $b > 0$ is the sensitivity to investment to interest rate. Using Equation 14 we have $Y = C + I + G = c_0 + c_1(1 - t_1)Y - c_1 t_0 + I_0 - br + G$ or

$$Y = \frac{1}{1 - c_1(1 - t_1)} \times (c_0 - c_1 t_0 + I_0 - br + G) \tag{15}$$

Here, $\frac{1}{1-c_1(1-t_1)} > 1$ is the Keynesian multiplier (since we multiply it to c_0 - the autonomous consumption). Equation 15 can be rewritten as as an equation between r and Y as

$r = Y(1 - c_1(1 - t_1)) - (c_0 - c_1 t_0 + I_0 + G)$

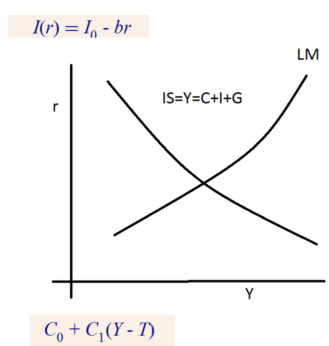
Explanations using IS curve: when the interest rate is increased, the investment would fall $\Rightarrow$planned expenditure falls $\Rightarrow$income falls. With government expenditure or tax cuts, Keynesian cross is slightly above i.e. Planned expenditure meets actual expenditure at a higher point and the output/income increases. With increase in output, the IS curve shifts right (by $\frac{\Delta G}{1-MPC}$).



13.5 LM curve

The quantity theory: $MV = PY$. More generally, $\frac{M}{P} = (\frac{M}{P})^d = kY$ $(k = 1/V)$. ($kY - rh$ in the extension). An elastic money demand curve means high sensitivity to r (not Y) - high h and flatter LM.

The most important factor for LM (money demand) is the money supply. LM curve is based on liquidity which increases when I increases since people want to have more cash when they're richer. Thus r (price of money) rises as Y rises as more money is needed in circulation. This causes and upward sloping LM curve. The relationship between r and Y is : $(\frac{M}{P})^d = \frac{\bar{M}}{\bar{P}} = kY - rh$ or $r = \frac{1}{k} \cdot \frac{\bar{M}}{\bar{P}} + \frac{k}{h} Y$. Money supply M changes as monetary policy measures are adopted. IS-LM curve is derived by setting money demand equal to money supply.



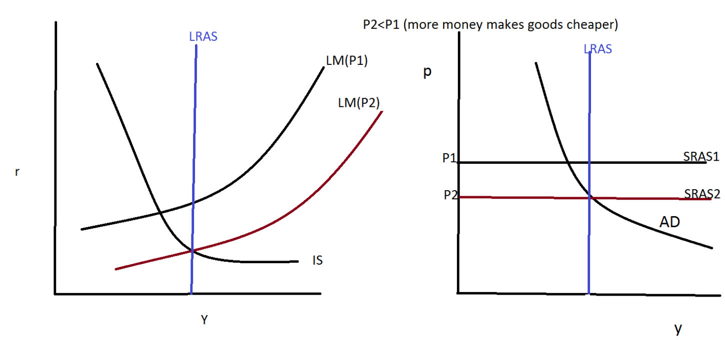
13.6 Aggregate supply curve and Aggregate Demand Curve

In terms of prices, **short-run is where prices are sticky** and long-run is where prices change. Note that aggregate demand and supply curves are different from the IS LM curves (even though they move together).

In the long-run, output is determined by the supply. Demand shocks change prices only. Output is fixed at the natural (full employment) level. In the short-run, output is determined by the demand. Demand shocks causes output fluctuations. These temporary deviations of output from its natural level represent the booms and busts of the business cycle

13.6.1 Aggregate Demand Curve

Aggregated demand curve is depicts movement of price with output (p vs y). It is downward - since when price is low, then the demanded quantity is high. The curve can change in response to money supply (from central bank). Aggregate demand curve can be derived from the IS-LM curve - when money supply increases (the LM moves downwards), the prices would go down(more money for same quantity or moving down the IS curve). Aggregated demand curve can be directly derived from $MV = PY$. In the short-run, the aggregate supply curve is flat because wages and prices are sticky - and hence changes in aggregate demand affect output (y) and employment (l). Reduction in money supply would shift the curve inward (downward) since the reduction in money supply would suppress the output for a given (constant) price (producers would produce less because more production wouldn't get any more than what's left). Likewise, when the supply of money is more production would be higher because until the limits to profit are reached (imposed by limited money supply) the profit can be increased by increasing production (price staying the same). When IS shifts, price stays the same but AD moves right with higher Y and when LM shifts, both price and Y change shifting AD to right.



13.6.2 Aggregate Supply Curve

In the long-run the efficient (or maximum) amount of output would be achieved and would remain insensitive to the price fluctuations. Thus the curve would be vertical. In the short-run the prices are sticky by definition and hence the curve would be flat. When a new equilibrium is achieved, only the short-term demand curve.

$Y = \bar{Y} + \alpha(P - E(P))$ where $\alpha > 0$, $\bar{Y}$ is the natural output, $E(P)$ =expectation of Price (P).

14 Phillips Curve

Phillips curve is the inverse relationship between inflation and unemployment (high inflation means less unemployment). The inverse relationship between output and unemployment (1% increase in the cyclical unemployment rate corresponds to 2% points of negative growth in real GDP) . Phillips curve can be written as :

$\pi = E(\pi) - \beta(u - u'') + \nu$ where $E(\pi)$ is the expected inflation π, β is response of inflation to cyclical unemployment and ν is supply shock. This can be derived from the supply curve - $P = E(P) + \frac{1}{\alpha}(Y - \bar{Y}) + \nu$ (supply shock can be added to the price level). Subtracting last year's price P_{-1}, we get $\pi = E(\pi) + \frac{1}{\alpha}(Y - \bar{Y}) + \nu$. Using Okun's law which states that deviation from natural rate of output is inversely related to deviation from natural rate on unemployment, $\frac{1}{\alpha}(Y - \bar{Y}) = -\beta(u - u'')$. This leads to the Phillips curve. Phillips curve and Aggregate supply curve both relate the unexpected movements to the price level with output.

The inflation rises and falls because of demand-pull (low unemployment) as well as cost-push (supply shocks).

In the long-run, Phillips curve became vertical. Friedman had cast doubts on the theory - which was replaced by NAIRU (non-accelerating inflation rate of unemployment). NAIRU assumes $E(\pi) = \pi_{-1}$ and hence $\pi = \pi_{-1} - \beta(u - u'') + \nu$.

14.1 Stability Policy

Rules vs discretion - Issues with discretionary policy

time inconsistency of the optimal policy for the Phillips curve - $\pi_t = \pi_t^e - \beta(u_t - u_n)$ where β is assumed to be 1. If the central bank announces the inflation target to be zero, then expected inflation $\pi_e = 0$ thus $u_t = u_n$ (which is not what bank may want). Instead if the bank announces the the target as 0.01, then u might change by $\leq .01$ (which may be still desirable). Central bank knows that only an unexpected inflation can change unemployment. Since private agents can predict inflation announcement rather than wait for announcement, the inflation target tends to be higher (thus creating an inflationary spiral).

15 Mundell-Fleming and Exchange rate

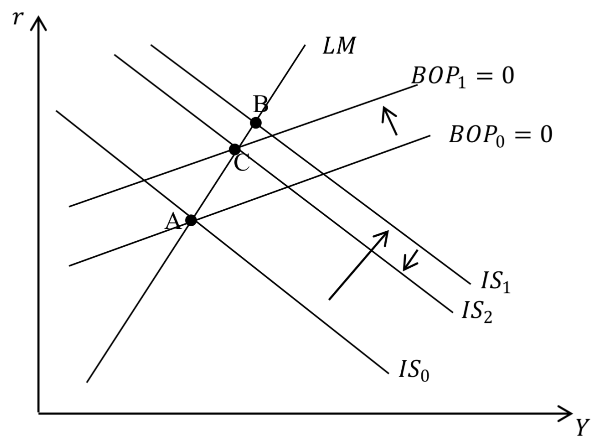
When exports fall in the floating exchange rate regime, expansionary fiscal policy (tax cuts) would move the IS curve to the right (by shifting the equilibrium). Expansionary monetary policy would move the short term equilibrium to long term equilibrium (vertical LM) through arbitrage. Notice the inverse relationship between NX and exchange rate for a floating exchange-rate regime.

The exchange rate curve can also be seen as BOP $=0$ line (flat BOP$=$0 line $\Rightarrow$perfect capital mobility and vertical BOP$=$0 line $\Rightarrow$no capital mobility) BOP$>$0 (surplus) when NX $>$ NCO and vice versa. NX$>$ NCO $\Rightarrow$**expensive currency** i.e. exports make currency more expensive (since the flow of domestic currency increases to the central bank while the demand of domestic goods remains high - the currency then needs to be **made** expensive to maintain exchange rate - by selling domestic or buying foreign currency). When output of the foreign country increases, the demand for domestic goods abroad lowers - this reduces inflow of domestic currency (NX$<$NCO) - the money is less and currency becomes more expensive in the domestic market thus currency would need to be lowered to maintain the same exchange rate. Drop in exports suggests central bank to reduce the rate (or increase money supply) thus eventually making currency cheaper in a fixed exchange rate regime.

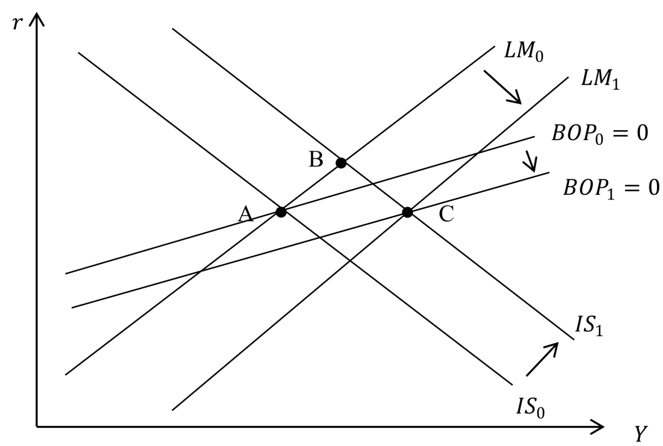
With increase in exchange rate, the domestic currency becomes more expensive immediately. Both CA and KA increase and hence the BOP$=$0 line moves up. Notice that in the short-run the economy is at IS-LM intersection (BOP$=$0 is not a condition for short-run equilibrium). Under fixed rate regime, the government would want to control inflation and maintain the same Y as well as keep the exchange rate fixed. Thus $CA + KA + \Delta R = 0$ is the BOP$=$0 line for fixed rate regime.

Stabilization policy under flexible exchange rate regime

Expansionary fiscal policy



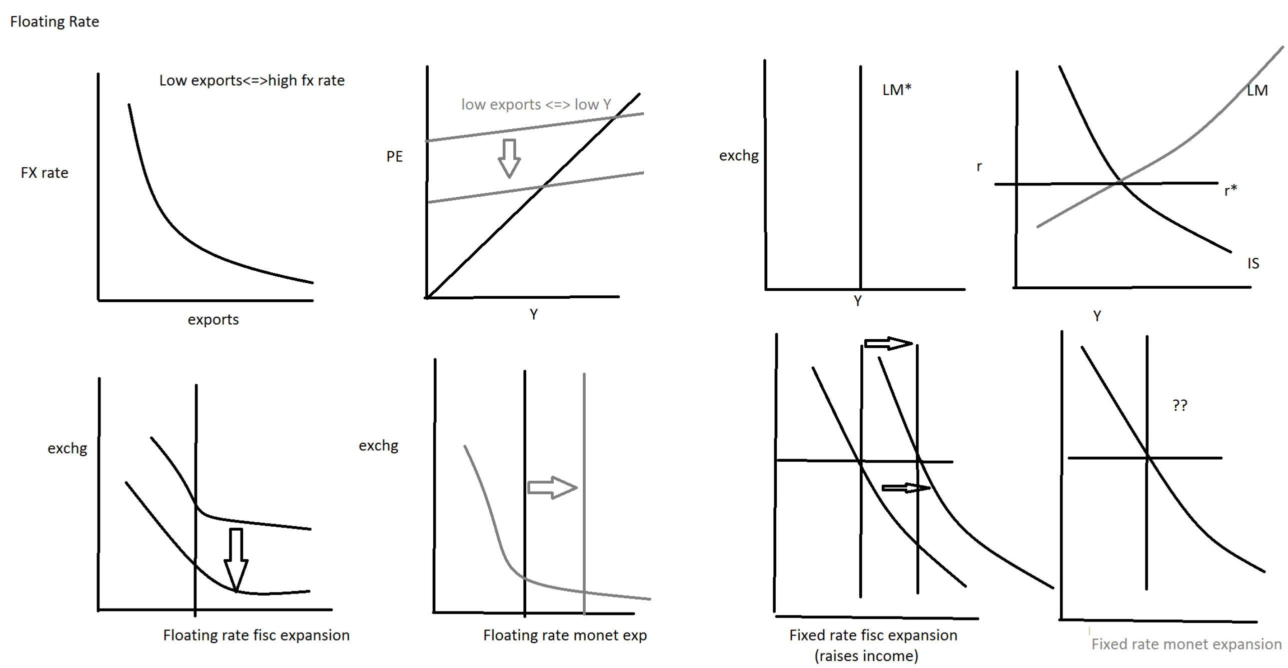
Devaluation



In fixed exchange rate regime, the long-term vertical LM curve shifts by arbitrage so that the fixed-exchange rate is the same. If domestic currency is cheaper relative to foreign (as happens by rate-cut), then there would be a sell-off and the LM (vertical curve would move right). Using BOP=0 logic, then there would be deficit and the currency would depreciate - need to be undervalued by buying domestic currency or selling foreign exchange. Devaluation is essentially a decrease in exchange rate which makes domestic currency cheaper thus there would be more domestic money coming in (NX>CO) and IS would move to the right - exports would rise and more money would be needed soon. Similarly, with fiscal expansion (tax cuts) both IS and LM curve move right (hence raising income). Remember that buying domestic money (or selling foreign money) would increase r and hence push LM upwards. Monetary expansion doesn't bring about any change in exchange rate (so not controllable through monetary policy). This happens because with increased money - domestic currency would be cheaper - but with arbitrage there would be capital outflow, domestic currency would become expensive again and bank would need to sell FX to gain back the domestic currency.

Fiscal controls and BOP in floating exchange rate

Lower Taxes => Higher Y=> IS moves right (higher r) => Higher NX => BOP surplus => currency expensive => BOP moves up. r goes up along the LM curve.



16 EURO

Degree of Trade, Labour mobility, fiscal transfers, shock control

Benefits of monetary union are cost reduction, price transparency, anti-inflationary reputation, monetary policy coordination, trade effects, European seignorage.

Costs of monetary union: sacrifice of exchange rate as a policy tool

17 Government Debt

17.1 Debt Sustenance

Too much debt cannot be a major problem. If debt-to-gdp ratio is $d = \frac{D}{Y}$ then$\Delta d/d = d(ln\ d) = d(ln\ D) - d(ln\ R) = \frac{\Delta D}{D} - \frac{\Delta R}{R} = \frac{\Delta D}{D} - g$. We also know that $\Delta D = Deficit_{primary} + rD$ (where $Deficit_{primary}$ the plain deficit and rD is the deficit depending on the rate of interest i.e. if rate of interest is 1% then we gain 1% more

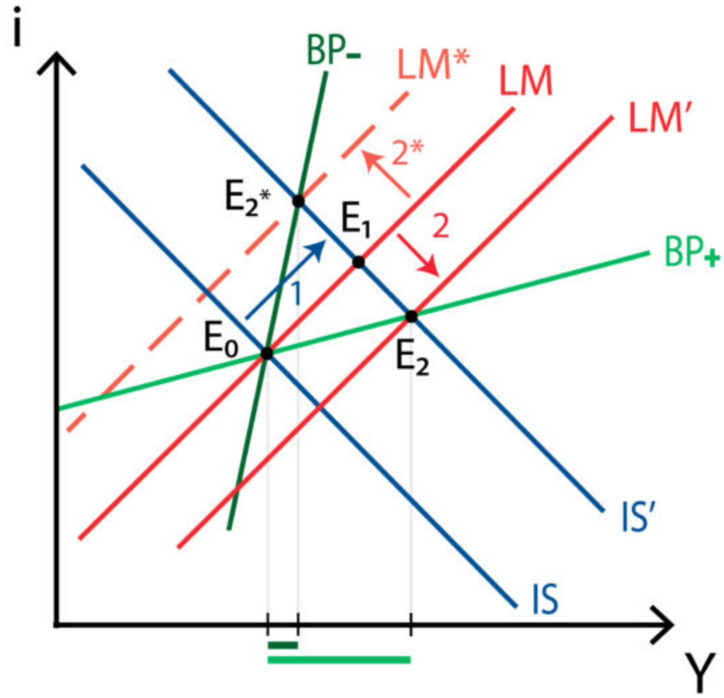


Figure 1: Fiscal Expansion Fixed Rate

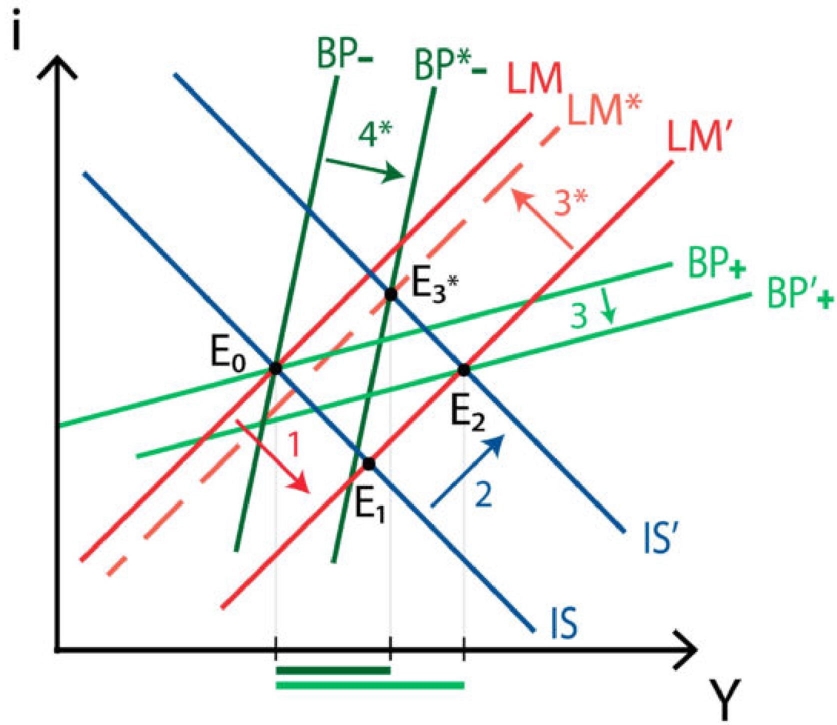


Figure 2: Monetary Expansion Floating Rate

in nominal terms on the outstanding debt). $\frac{\Delta d}{d} = \frac{Deficit_{primary}}{D} + (r - g) \Rightarrow \Delta d = \frac{Deficit_{primary}}{Y} + (r - g)\frac{D}{Y}$ - for a growing economy the ration D/Y itself would cause no major problems.

17.2 Debt Measurement errors

17.2.1 Inflation

Because of inflation the error in the debt measurement is $\Delta D = \pi \cdot D$ which arises when one doesn't adjust for expenditure which may be measure in nominal terms (revenues are in real terms). This may not matter in the current environment because of low inflation but in a high inflation environment.

17.2.2 Capital Budgeting

The value of assets changed and their book value of assets may differ a lot from the market value. Of course, weapons for defense and other such assets may never be reflected well in the calculation of debt.

17.2.3 Liability

Liabilities for employment schemes etc. are similarly not measured well either.

18 Application of Monetary Policy

The effect of monetary policy (changing supply of money) is different from how this changes is applied. A simple model is :

$M = C + D$ where $M = money\ supply$, $C = currency$ and $D = deposit$

$B = C + R$ where $B = monetary\ base$ and $R = reserve$

$\frac{M}{B} = \frac{C+D}{C+R} = \frac{C/D+1}{C/D+R/D} = \frac{c+1}{c+r}$ where $c = \frac{R}{D}$ is the reserve-deposit ratio (that banks need to maintain) and $r = \frac{C}{D}$ is the currency deposit ratio (i.e. the portion of deposits that people hold as currency). The fraction $\frac{c+1}{c+r}$ is known as the money multiplier.

Three instruments of monetary policy are:

1. Reserve requirement
2. Interest Rate (at which banks borrow from the central bank)
3. Open Market Operation

19 Questions

1. What is the fiscal policy multiplier? - The fiscal multiplier is used to measure the effect of government spending (fiscal policy) on the subsequent income level of that country.