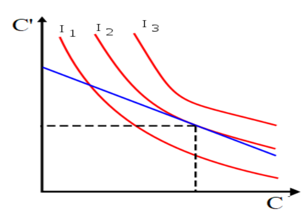
EC210 Macroeconomic Principles MT Material for Summer Exam

December 2018

1 Consumption (MT wks 6-7)

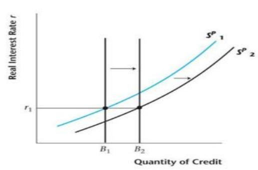
- Keynes: $C = a + bY$, $\therefore$ APC $= C/Y = \frac{a}{Y} + b$ .. clearly APC is decreasing in Y
- Kuznets consumption puzzle:
  - Household cross-section data shows ... falling APC ($a > 0$)
  - Time series in a country data shows ... stable APC ($a = 0$)
- Modigliani life cycle: $C = \alpha W$. So change to Y barely changes consumption as has little effect on total wealth
- Friedman permanent income hypothesis: $C = \frac{\alpha Y^P}{Y}$ where $Y = Y^P + Y^T$. Permanent income is defined as expected long-term average income, think of Y^T as transitory, temporary deviations.
- At point of tangency between indifference curve and budget constraint we have slopes are equal so : $MRS_{C,C'} = 1 + r$



  - $1 + r$ = price of c in terms of c'. $MRS_{C,C'}$ = value consumer places on c in terms of c'. Consumer will consumer s.t these are equated, meaning MB=MC (a standard equilibrium result).
  - $MRS_{C,C'} = \frac{U_C}{U_{C'}}$, where U_C is the derivative of U(C) with respect to C

  - $U(C) = ln(C)$ often chosen as inter-temporal elasticity of substitution = 1 which gives nice results. Means a 1% increase in r reduces current consumption by exactly 1%

- $G = T + B, G' = T' - B(1 + r)$ ... eliminate B $\therefore$ $G + \frac{G'}{1+r} = T + \frac{T'}{1+r}$
  - Hence, we can show that consumer lifetime wealth is a function of only Y and T... Lifetime wealth $= C + \frac{C'}{1+r} - T + \frac{T'}{1+r} = C + \frac{C'}{1+r} - G + \frac{G'}{1+r}$ by the above result
  - This is **Ricardian Equivalence**. Debt financed tax cuts will not affect consumption at all because households make consumption decisions based on lifetime wealth. So, if they will instead be taxed later - lifetime wealth is unchanged. Thus, all households will not change current consumption.
  - Assumes: government spending is fixed; rational households that know govt budget constraint
  - Ricardian Equivalence fails if
    * Taxes are not lump-sum, i.e distortionary
    * Tax burden not equally shared (we assume T=Nt)
    * Consumers have a shorter life than govt, as lifetime wealth does change if your children not you pay for tax cut
    * Credit market imperfections, see Sheedy diagrams



  - Can see from the diagram r does not change. Govt issues more bonds to finance tax cut, but demand for bonds (private saving) increases exactly enough to perfectly offset this.

- Social Security PAYG model has N'=(1+n)N, tax = t and benefit = b. Agents only work and earn Y when young.

  System requires $N't = Nb$ holds, so the N' population of young contribute enough to fund N old people. $\therefore$ $t = \frac{bN}{N'} = \frac{b}{1+n}$
  - Substitute $t = \frac{b}{1+n}$ into budget constraint: $W = Y - \frac{b}{1+n} + \frac{b}{1+r}$
  - Without the PAYG system, we have $W = Y$. Thus, there is a benefit to the system $\iff$ n > r
  - Govt can force this intra-generational transaction that nobody would privately agree to... why pay each old person more than they put into the system?

  - Intuition is tax base growing faster than rate of return on privately saving with n > r so able to offer better returns

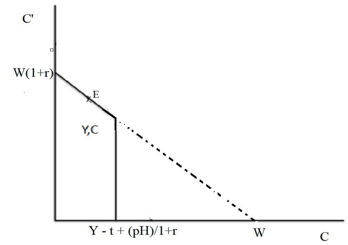
- Fully funded social security. Mandated, forced savings programme is at best ineffective if forces consumer to save where they would choose to when optimising anyway. Otherwise decreases utility.

- Credit market imperfections exist in real world. These generally mean Ricardian Equivalence will not hold.

  As suppose a household earned 2 units in period 1 and 5 in period 2, and was taxed 1 unit each period. Credit market limitations on borrowing may mean the household is unable to borrow to smooth consumption across the two periods. Here, a debt financed tax cut in period 1 would affect consumption as it would not be fully saved. This is because it would push consumers towards their optimal consumption path (which they otherwise could not get to).

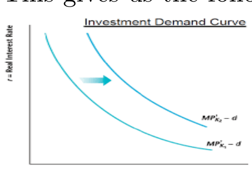
  There are two frictions to be aware of:

  - **Asymmetric information**. Model is as follows.
    * α fraction of borrowers are good, so $1-\alpha$ are bad and always default. All wish to borrow L units. Bank gets r_2 return on borrowing and pays r_1 return to depositors.
    * Perfect competition in banking market means zero profit $\therefore$ $\alpha L(1+r_2) - L(1+r_1) = 0$
    * So $1+r_2 = \frac{1+r_1}{\alpha}$, $\therefore$ if $\alpha < 1$ then $r_2 > r_1$. Idea is borrowers pay premium as may default, while bank does not have to pay premium as secure
    * $r_2 - r_1 = f(\alpha)$, this is a decreasing function in α.
      Relevant to financial crisis where added uncertainty saw α decrease and interest rate spreads rose
  - **Limited commitment**, e.g mortgage. Assume borrowers default if: value of loan $\geq$ collateral value, as no incentive to repay then. Banks set limits on what can be borrowed accordingly.
    * So with house value pH next pd, won't default if $-S \leq \frac{pH}{1+r}$, hence the bank imposes this as a borrowing constraint.
    * This means $C = Y - t - S \leq Y - t + \frac{pH}{1+r}$
    * For comparative statics just need this diagram, which comes from: $W = C + \frac{C'}{1+r} = Y - t + \frac{Y'-t'+pH}{1+r}$



2 Investment (MT wk 8)

- Investment decision depends on cost vs PV of expected profits of new machine. Can incorporate this into a 2-pd model
  - $\pi = Y - wN - I, \pi' = Y' - w'N' + (1-d)K'$, where $I = K' - (1-d)K$
  - Firm wishes to maximise value V = discounted total profits: $V = Y - wN - K' - (1-d)K + \frac{Y' - w'N' + (1-d)K'}{1+r}$
  - Firm chooses N,N' and K' to maximise V. The first two FOC give standard results ($MPN_t = W_t$ for t = 0,1)
  - While, setting the derivative of V wrt to K' to 0 is more interesting: $-1 - \frac{1}{1+r}\frac{\partial Y'}{\partial K'} + \frac{1-d}{1+r} = 0$
  - Now, $\frac{\partial Y'}{\partial K'}$ = MPK'. Hence, this FOC implies $\frac{MPK'+1-d}{1+r} = 1$. This means $\therefore$
    $MPK' - d = r$
  - This gives us the following curve:

  - Note the shape is due to diminishing marginal product of capital.
  - Intuition is firms will invest up until MB=MC of investment. Marginal cost is opportunity cost for investors financing it, as they could place their money elsewhere and earn return r $\therefore$ $r = MC$. While, firm gets return MPK' on the new capital minus the depreciation in value. Hence, $MB = MPK' - d$
- Tobin's q theory is an alternative approach that actually yields same equilibrium condition as Neoclassical approach for investment demand: $MPK' - d = r$
  - Tobin q = $\frac{\text{Mkt value of installed capital}}{\text{Replacement cost of installed capital}}$

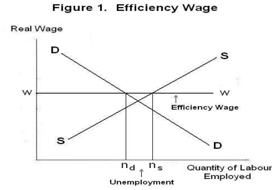
  - If $q > 1$, then expected expected value firm can generate from a unit of capital exceeds purchase price. Hence, should keep investing until q=1.
  - This can be shown more formally with mathematics:
    * Market value of Installed Capital at time 0 = MV_0
    * $MV_0 = \frac{\text{Resale value of capital next pd + Profit generated by capital}}{\text{1+r}}$
    * So, $MV_0 = \frac{(1-d)K'+Y'-w'N'}{1+r}$
    * Using that w'=MPN' in equilibrium and the assumption of constant returns to scale we may apply Euler's Theorem for homogeneous functions to give:
      Y' = (MPN')N' + (MPK')K'
    * Finally, the replacement cost of K' (denominator of q) units of capital is exactly equal to K' as we assume each unit of capital costs 1
    * $\therefore \quad q = \frac{(1-d)K'+K'(MPK')}{K'(1+r)} = \frac{MPK'+1-d}{1+r}$
    * If $q > 1$ then $MPK' > r + d$ so return on investment exceeds user cost of capital (same as Neoclassical case). Optimising firms will continue to invest until q=1 or MPK'-d=r.

- Can add credit market frictions to q-theory, specifically asymmetric information. Current profit should not affect investment decisions as does not change whether it is a good opportunity or not. But it does because of credit mkt frictions.
  - If current π is low, then investment must be financed by borrowing as opposed to retained earnings.
  - Some firms will default. Using our earlier asymmetric information model, we obtain $r^L = x + r$. Where r is return on savings and r^L is the interest rate at which firms can borrow, with $x > 0$.
  - Now when financed by borrowing investment demand becomes:
    $MPK' - d = r^L \quad \therefore \quad MPK' - d - x = r$
  - Idea is that benefits of investment are same (MPK') but more is used to pay back loan and so less accrues to the shareholders. Basically borrowing form the bank has a higher cost, due to asymmetric info, (r^L) than "borrowing" from the owners of the firm (r). We can think of financing from retained earnings as borrowing from the shareholders as instead of paying out earnings as dividends to these owners, they are retained for investment.
  - In a recession the increased uncertainty will mean greater spreads (higher x) and this will shift the investment demand curve downwards.

3 Labour Markets (MT wks 8-9)

- Efficiency wage model stems from the idea that worker effort increases with the wage paid to them.
  - Why is effort an increasing function of wages ($e'(w) > 0$)?
    1. Higher wages attract more motivated, higher quality workers
    2. Higher wages retain good quality workers
    3. Higher wages increase job value to worker. Increases the downside if caught shirking, this partly resolves any moral hazard problem.
  - From lecture notes it is clear that when firms consider effective units of labour, they will optimise s.t $e'(w) = \frac{e(w)}{w}$
  - This condition makes sense from microeconomic analysis of the theory of the firm. The minimum cost of inducing effort in terms of wages is where the MC=AC of inducing effort. This is exactly what we have.
  - The efficiency wage W* is weakly greater than the market clearing wage. Basically this is because there must be some unemployment in equilibrium for wages to work as an incentive. Or else those that shirk can seamlessly get another job if the are caught.
  - This means that if we assume firms base their labour market decisions around effective units of labour ⇒ labour market fails to clear i.e unemployment
  - There is no competition adjustment for the market to clear, as firms won't undercut as they will just attract lower quality workers who will be cheaper but will supply fewer effective units of labour

Figure 1. Efficiency Wage



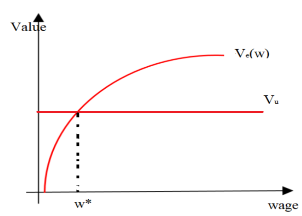
  - Note: changes to labour demand will affect unemployment but not the efficiency wage. This is somewhat implausible as eventually wages must rise to attract new labour market participants.

    Nevertheless, the model suggests for small shocks to TFP wages will be sticky and not change. The adjustment will come entirely via employment.

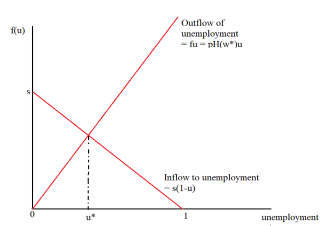
- Search theory, Mortensen–Pissarides model, can also be used to explain unemployment in the modern economy.

- $\Delta U = s(L - U) - fU \Rightarrow \Delta U = s(1 - u) - fu$,
  where U= quantity unemployed, s=separation rate, L=labr force, f= job finding rate, u= U/L= unemployment rate.
- At steady state $u_{t+1} - u_t = \Delta u_{t+1} = 0$ so $U^* = \frac{s}{s+f}$
- Expected time unemployed if lose job is 1/f
- Unemployment rates are very volatile, but the separation rate s is remarkably stable. Thus, we focus on understanding f.

- One sided search model treats firms (wage determination, jobs) as exogenous
  - $V_e(w)$= value of job to worker = present value of expected future wages adjusted for risk of losing job
  - V_u= value of unemployment. This has 2 components:
    1. Non-market income, e.g. benefits, value of leisure
    2. Expected market income. Being unemployed has value from retaining the chance of being offered a higher paying job. Like a time premium on a real option.
  - The reservation wage w* is the wage rate that satisfies: $V_e(w*) = V_u$, can on diagram below:

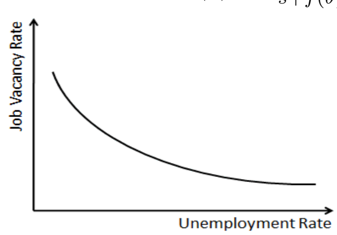


  - Now the job finding rate = f = $pH(w*)$, where p=probability of receiving a job offer and H(w*) is the probability a job offer offers a wage at least as high as the reservation wage w*.
  - So, H(w*)=1-F(w*), where F(.) is the CDF of the exogenous wage distribution.
  - This model can be best understood with the following graph:



- Example of comparative statics is what if unemployment benefits fell? Lower benefits... Lower V_u... lower W*...higher H(W*)...higher f ... lower u
- Note: some unemployment is desirable under these conditions as allows search process to ensure a good match.

- The equilibrium search model is a more sophisticated two-sided model. First we can look at the job finding side as before.
  - Matching function: $m = \mu M(u, v)$, where μ is an efficiency parameter and M(u,v) is like a production function for matches of employers and unemployed workers
  - Assume for M(.) :
    * Constant returns to scale
    * Diminishing marginal products
    * Positive marginal products
  - f = probability unemployed worker finds a match = m/u ... by CRS $m/u = \mu M(1, \frac{v}{u}) = f(\theta)$ where θ = v/u = labour market tightness. Increasing function in θ, as less competition for vacancies.
  - High θ means many vacancies per unemployed worker $\Rightarrow$ tight labour market
  - Low $\theta \Rightarrow$ slack labour market
  - We still have our steady state relationship derived earlier: u* $= \frac{s}{s+f(\theta)} = \frac{s}{s+f(v/u)}$
    * This steady state relationship gives us the **Beveridge curve**. $\uparrow$ v ... $\uparrow \theta$ ... $\uparrow f(\theta)$...$\downarrow \frac{s}{s+f(\theta)}$ ... $\downarrow$ u



- Nash bargaining determines the wage curve. Firm and worker negotiate to divide the total surplus between them according to their respective bargaining power.
  - Total surplus = Unemp. wkr surplus + Firm surplus from the match $= (w-b)+(y+cy\theta-w) = y+cy\theta-b$, where cy is the cost of holding open a vacancy so $cy\frac{v}{u} = cy\theta$ is cost of vacancy per worker
  - Assume worker has bargaining power $\gamma \quad \therefore \quad w - b = \gamma(y + cy\theta - b)$

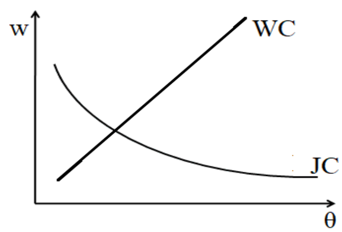
– Hence rearrange to get: $w = (1-\gamma)b + \gamma y(1 + c\theta)$. This is the **Wage Curve** (WC). Note: wages increase linearly in θ by this relationship.

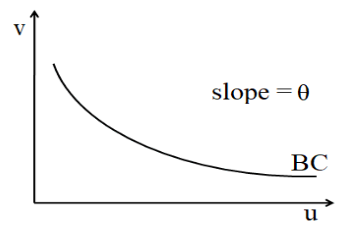
– In equilibrium, perfect competition would mean the expected profit on holding a vacancy is 0

– Expected revenue of vacancy = expected cost means:
$\frac{y-w}{r+s} = \frac{cy}{q(\theta)}$, where $q(\theta)$ = m/V is matches per vacancy. This relationship is the **Job Creation Curve** (JC)

– Clearly a negative relationship between w and θ:
If w ↑ ... MB of vacancy ↓ ... fewer vacancies ... θ ↓ ... $q(\theta)$ ↑ and match rate will increase up until expected profit of vacancy equals 0 again.

– Thus we have the following graphs:





– For questions on this often easiest to write out the Beveridge curve for the matching function provided.

  * E.g. Cobb-Douglas matching function gives $u = \frac{s}{s+\mu\theta^{1-n}}$
  * Hence, changes to s, μ, or other parameters of the matching function will shift the BC
  * Whilst changes to θ will mean a movement along the BC

4 Dynamic Macro Model (MT Week 10)

- Quite an easy topic with a little practice, this involves examining a stylised 2 period model of an economy in general equilibrium.

- Assume there are three markets: Goods (Y), Labour (N) and Bond (B). For each of these to clear we must equate supply and demand, although note by Walras' Law we only need to consider 2 of the 3 markets.

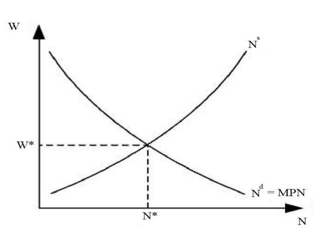
  – Good market:
    * $Y^D = C + I + G$
    * $Y^S = F(K, N)$

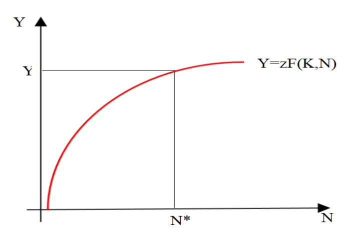
  – Labour market:
    * $N^D = MPN$
    * N^S is upward sloping as we assume substitution effect dominates bc no income effect

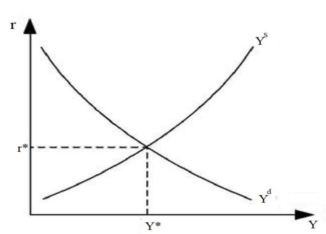
- Bond market:
  - $B^D = S^P$ = private saving by households
  - B^S= govt debt - private saving
  - Note: $-$private saving = private debt
- Budget constraints are as follows:
  $C + S^P = W(h - l) + \pi - T$
  $C' = w'(h - l) + \pi' - T' + S^P(1 + r)$
  These can be combined (eliminate S^P) into a lifetime budget constraint:
  $C + \frac{C'}{1+r} = We = w(h - l) + \pi - T + \frac{w'(h'-l')+\pi'-T'}{1+r}$

- Our equilibrium conditions are standard: $MRS_{C,C'}$ = 1+r, $MRS_{l,C}$ = w, $MRS_{l',C'}$=w', $MRS_{l,l\,'}$= $\frac{(1+r)w}{w'}$
  - The intuition is each of these express the value of one good in terms of another. Thus, foregoing one unit of good x for $MRS_{x,y}$ units of y leaves the consumer with the exact same utility.
  - For example, we can consider $MRS_{l,l\,'}$= $\frac{(1+r)w}{w'}$. If a household reduces l by 1 unit, will need to increase C by w to be indifferent, or equivalently increasing C' by w(1+r), or equivalently increasing l' by $\frac{(1+r)w}{w'}$. Hence, that is clearly the $MRS_{l,l\,'}$.

- Now we can assemble the various components of the model. Recall we just need to examine the labour and goods market in equilibrium, as by Walras' Law the financial market must also be. The following graphs are useful aids.







- The shapes of the graphs are important.

  - Y^D=$C+I+G$ is downwards sloping as C falls with r because there is a greater incentive to save, I falls with r as financing investment becomes costlier, and G is exogeneous unaffected by r.
  - Y^S is increasing in r due to the labour market. A greater r increases the incentive to work now so labour supply shifts right, and hence the labour force N* increases. Our assumptions on the production function, F(K,N), mean a greater N leads to increased output produced.
  - In the labour market both curves should be clear. We assume there is no income effect so higher wages simply lead workers to substitute away from leisure to work as the return on work has risen, hence N^S is upward sloping.

- When answering questions on this topic, it is important to understand the process of **crowding out**. This is relevant when discussing implications of changes to government spending.
  - An example question may be **"Analyse the effects of increased government spending using the Dynamic Macro Model"**.
    - Firstly, increased G will shift Y^D=$C+I+G$ to the right. This is the direct effect.
    - Secondly, consider the wealth effect. Consumer disposable income will fall as their lifetime income has fallen because the increased G must be financed by a tax rise at some point. As consumption and leisure are normal goods, both of these must decrease from the negative wealth effect.
    - Y^D will shift right overall as the direct effect dominates the fall in consumption.
    - N^S will shift right as the negative wealth effect will induce households to work more, so the size of the labour force will increase. This will mean more output is produced at a given interest rate so the Y^S curve will shift right.
    - The goods market clearing will mean higher r and higher Y than before. This higher r will further induce a shift in labour supply as households will substitute away from leisure to work.
    - Refer to the lecture notes for the accompanying diagrams if it is not clear.
  - **Crowding out** here may be explained as follows. The increase in G increases output demand, for the goods market to clear the real interest rate r must increase for output supply to increase sufficiently to satisfy this demand. The increase in r, however, makes investment costlier and incentivises saving over consumption. Hence, C and I decrease.

    Thus, Δ G > Δ Y = Δ G + Δ I + Δ C