ECOS2902 Sample

The IS Curve

Setting Up the Economy

- National income identity
  - $Y_t = C_t + I_t + G_t + EX_t - IM_t$
    - Can also be written as $Y_t + IM_t = C_t + I_t + G_t + EX_t$
      - Left side is the total resources available to the economy
        - Aggregate supply
      - Right side is total uses
        - Aggregate demand
- Five additional equations that explain how each of the uses of output is determined
  - $C_t = \bar{a}_c \bar{Y}_t$
  - $G_t = \bar{a}_g \bar{Y}_t$
  - $EX_t = \bar{a}_{ex} \bar{Y}_t$
  - $IM_t = \bar{a}_{im} \bar{Y}_t$
  - $\frac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b}(R_t - \bar{r})$
- Consumption and friends
  - $\bar{Y}_t$ is an exogenous component of the model
    - Determined by the long-run model
  - $C_t = \bar{a}_c \bar{Y}_t$
    - Says that consumption is a fraction of total output
    - Empirically, $\bar{a}_c$ is about 2/3
    - Potential output is also a lot smoother than actual output
      - Results in the conclusion that consumption is smoother than GDP
        - During a recession, people may keep their consumption at a steady level by drawing on their savings
  - Other equations have a similar form and similar interpretation
- The investment equation
  - Made up two parts
    - $\bar{a}_i$ captures the long-run fraction of potential output that goes to investment
    - Second part captures how the interest rate enters the model
      - Amount of investment depends on the gap between the real interest rate R_t and the marginal product of capital $\bar{r}$
        - $\bar{r}$ taken to be an exogenous parameter, determined by the long-run model
          - On a long-run balanced growth path, so no time subscript is included
        - If the marginal product of capital is low relative to the interest rate, then firms are better off saving their retained earnings in the financial market
          - Leads to a decrease in investment because $R_t > \bar{r}$
        - Vice versa, firms may find it profitable to borrow at the real interest rate and invest the proceeds in capital, leading to a rise in investment
        - R_t thus represents marginal cost of capital, whilst $\bar{r}$ represents the marginal benefit of capital

        - $\bar{b}$ captures how sensitive investment is to changes in the interest rate
    - In the long run, $\bar{r} = R_t$
        - Differences allowed for in short-run model as installing new capital to equate the two takes time

Deriving the IS Curve

- See book
    - $\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$
        - Straight, downward sloping curve that relates short-run output to the interest rate
- Implications
    - The gap between the real interest rate and the MPK is what matters for output fluctuations
    - An increase in the real interest rate R_t leads to a decline in short-run output
        - Firms find it more expensive to borrow in order to purchase capital equipment
        - Households see mortgage rates go up, resulting in a decline in housing investment
    - In the long run, the economy will settle to its long run values, $Y_t = \bar{Y}_t$ and $\tilde{Y}_t = 0$
        - $\bar{r} = R_t$
        - Equation reduces to $0 = \bar{a}$
            - Because national income identity is equal to $\bar{Y}$ and therefore the share parameters ($\bar{a}_c, \bar{a}_i$ etc) must add up to 1
            - Thought of as the default case
- Because $\bar{a}$ is derived from the demand equations for consumption, investment etc, we call it the aggregate demand shock
- Why is it called the 'IS Curve'?
    - IS stands for investment = savings
    - $Y - C - G + (IM - EX) = I$
        - $(Y - T - C) =$ private saving
        - $(T - G) =$ governmnet saving
        - $(IM - EX) =$ foreign saving

Using the IS Curve

- Horizontal axis graphs $\tilde{Y}$, vertical graphs R_t
- An increase in the interest rate
    - Effect
        - Raises borrowing costs
        - Reduces demand for investment
        - Reduces output below potential
    - Shifts the economy up the IS curve, does not shift the curve itself
- If the sensitivity to the interest rate is higher
    - IS curve would be flatter
    - Any change in the interest rate would be associated with larger changes in output
- An positive aggregate demand shock
    - Means that output is higher at every interest rate
        - Means that the IS curve shifts out
- A shock to potential output

- Since $\bar{Y}_t$ doesn't enter the equation for the IS curve, shocks to potential output therefore leaves the IS curve unchanged
    - Reason is that shocks to potential output in our setup changes actual output by the same amount
- Important to notice however that a new technology or earthquake may effect more than $\bar{Y}_t$
    - New technology may raise the marginal product of capital, leading to an increase in investment demand
        - Would shift the IS curve out and stimulate the economy

- Movement along or shift?
    - A change in R shows up as a movement along the IS curve
    - Any other change in the parameters of the short-run model causes the IS curve to shift

Microfoundations of the IS Curve

- Consumption
    - Based on two models
        - Permanent-income hypothesis
        - Life-cycle model of consumption
    - Both models observe that people seem to prefer a smooth path for consumption to a path that involves large movements
        - Application of the theory of diminishing marginal utility
    - Permanent income hypothesis
        - People will base their consumption on an average of their income over time rather than on their current income
    - Life-cycle model of consumption
        - Consumption is based on average lifetime income rather than on income at any given age
        - When people are young and in school, their consumption is typically higher than their income
            - As people age and their income rises, their consumption rises more slowly and they save more
            - In retirement income falls, but people still continue to consume at the same level
                - Live off their savings they have accumulated
    - People clearly tend to smooth their consumption relative to income
        - $C_t = \bar{a}_c \bar{Y}_t$
            - Captures this insight by setting consumption proportional to potential output rather than to actual output
                - Actual output varies and so wouldn't capture
        - Heish finds that the LC/PI hypothesis works well for large and easy to predict changes in income but less well for small and harder-to-predict shocks
- Multiplier effects
    - Suppose aggregate consumption responds to temporary changes in income
        - Modify the consumption equation:
            - $\frac{C_t}{\bar{Y}_t} = \bar{a}_c + \bar{x}\tilde{Y}_t$
        - Now includes an additional term that is proportional to short-run output
            - When the economy experiences a boom, consumption rises temporarily, proportionate to $\bar{x}$

        - Assumed to be between 0 and 1
    - IS curve then becomes
        - $\tilde{Y} = \frac{1}{1-\bar{x}} \times \left[\bar{a} - \bar{b}(R_t - \bar{r})\right]$
            - Multiplier is larger than 1
- Economic intuition
    - Consider an increase in investment reduces investment by 1%
        - Reduction in investment may cost workers their jobs
        - Unemployment leads to less consumption
        - Other firms may be forced to cut jobs because of decreased consumption
    - Results in a geometric series that decreases output
        - IS curve thus involves feedback that leads to 'vicious' or 'virtuous cycles'
        - Hence the multiplier
    - Multiplier doesn't change the overall form of the IS curve
        - Only results in the coefficients of $\bar{a}$ and $\bar{b}$ being larger
- What matters for consumption today
    - The permanent-income hypothesis
        - What matters is the present discounted value of your lifetime income, after taxes
    - Ricardian equivalence
        - What matters is the present value of what the government takes from the consumers rather than the specific timing of the taxes

- Investment
    - Two main determinants of investment at the firm level
        - Gap between the real interest rates and the marginal product of capital
            - Important issue as to how to calculate the return on capital
        - Firm's cash flow
            - The amount of internal resources the company has on hand after paying its expenses
            - A firm with a high cash flow finds it easy to finance additional investment
            - Generally more expensive for firms to borrow to finance investment because of 'agency problems'
                - Occur when one party in a transaction holds information that the other party does not possess
                    - Adverse selection and moral hazards cause a banks to be careful how they lend and at what rate
                - Adverse selection
                    - If a firm knows it is particular vulnerable
                        - It will want to borrow because if the firm does well it can pay back the loans
                        - If it fails, the firm cannot pay back the loan, but will instead declare bankruptcy
                - Moral hazard

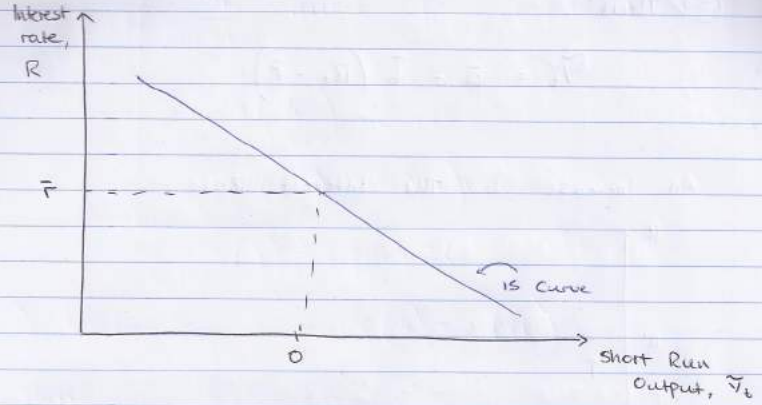
        - A firm that borrows a large sum of money may undertake riskier investments
            - If it does well can repay the loan
            - If it fails, it can declare bankruptcy
    - If we rewrite the original equation we can capture such effects
        - $I_t = \bar{a}_i \bar{Y}_t - \bar{b}(R_t - \bar{r})\bar{Y}_t$
            - Cash flow effect seen in the presence of potential output
                - Introduction of $\bar{Y}_t$ provides additional justification for a multiplier

- Government purchases
    - Can affect short-run economic activity in two ways
        - As a shock that can function as a source of fluctuations
            - Discretionary fiscal policy
                - Eg. higher expenditure before the election
            - Captured by a temporary change in $\bar{a}_g$
            - Change in the tax rate can potentially change $\bar{a}_i$
        - Policy instrument that can be used to reduce fluctuations
            - Automatic stabilisers in the budget
            - Additional spending occurs automatically to help stablise the economy
    - Impact of fiscal policy on the economy depends on two additional considerations
        - Timing
            - Discretionary fiscal policies are often put in place only with considerable delay
                - By the time the policy is in place, the shock it was designed to mitigate may have passed
        - Government's budget constraint
            - 'No-free-lunch' principle
            - Higher spending today must be for, if not today but at some point in the future
                - If the government raises taxes to pay for the spending, and the permanent-income hypothesis of consumption is applied, then the present discounted value of your income is lower, and hence individuals are worse off
    - Characterisation of the effects of fiscal policy
        - An increase in government purchases financed by an increase in taxes of the same amount will have a modest positive impact on the IS curve
            - Raise output by a small amount in the short run
        - An increase in spending today financed by an unspecified change in taxes and/or spending at some future date will shift the IS curve out by a moderate amount
        - These effects can be even larger during a recession
            - Economies resources are underutilised

- Net exports
    - Trade balance

- Deficit
    - Economy imports more than it exports
    - IS curve shifts left and reduces short-run output
- Surplus
    - Economy exports more than it imports
    - IS curve shifts right

The IS Curve



Deriving The IS Curve

① Divide national income identity by the level of potential output

$$\frac{Y_t}{\bar{Y}_t} = \frac{C_t}{\bar{Y}_t} + \frac{I_t}{\bar{Y}_t} + \frac{G_t}{\bar{Y}_t} + \frac{EX_t - IM_t}{\bar{Y}_t}$$

② Sub in equations:

$$\frac{Y_t}{\bar{Y}_t} = \bar{a}_c + \bar{a}_i - \bar{b}\left(R_t - \bar{r}\right) + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} \quad (*)$$

③ Recall that short-run output is the percentage by which actual output differs from potential output:

$$\tilde{Y}_t = \frac{Y_t - \bar{Y}_t}{\bar{Y}_t}$$

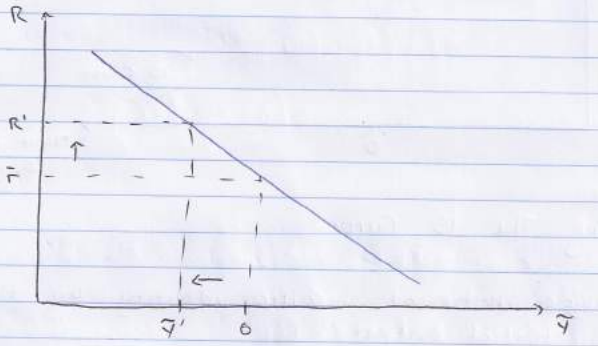
④ Subtract 1 from both sides of (*)

$$\frac{Y_t}{\bar{Y}} - 1 = \underbrace{\bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} - 1}_{=\bar{a}} + \bar{b}\left(R_t - \bar{r}\right)$$

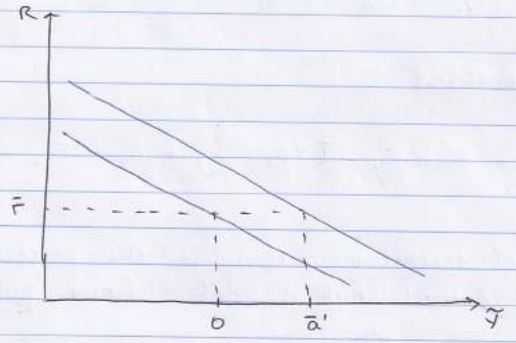
(5) Then:

$$\tilde{Y}_t = \bar{a} - \bar{b}\left(R_t - \bar{r}\right)$$

An Increase In The Interest Rate



An Aggregate Demand Shock



Ceteris paribus, an increase in $\bar{a}$ to $\bar{a}'$, will increase $\tilde{Y}_t$ by $\bar{a}'$.