

ECON 3510 - INTERMEDIATE MACROECONOMIC THEORY

Fall 2015

Mankiw, *Macroeconomics*, 8th ed., Chapter 17

Chapter 17: Theories of Investment

Key points:

- Determinants of Business Fixed Investment
- Determinants of Residential Fixed Investment
- Determinants of Inventory Investment

Business Fixed Investment:

- Explain business fixed investment using the neoclassical model of investment
 - Shows how the price and quantity of investment relate to the productivity of investment
 - Cost of investment is the real rental rate of capital, $\frac{R}{P}$
 - Benefit of investment is the marginal product of capital, $MPK = \frac{\partial F(K,L)}{\partial K}$
- 2 types of firms:
 1. Firms that rent capital and make final goods
 2. Firms that buy capital and rent it out
 - Yes, firms do both, this separation just makes things more clear

Final Goods Producers and the Rental Market for Capital:

- DRAW downward sloping demand curve that is determined by MPK. Vertical axis is the real rental rate, horizontal the quantity of capital. The intersection of this demand curve and the fixed supply curve determines the eq'm price and quantity of capital.
- Eq'm: Supply = Demand $\Rightarrow \frac{R}{P} = MPK$
- recall how we got MPK
 - $Y = AK^\alpha L^{1-\alpha}$
 - $\frac{\partial Y}{\partial K} = MPK = \alpha AK^\alpha L^{1-\alpha}$
 - $\Rightarrow MPK = \alpha A \left(\frac{L}{K}\right)^{1-\alpha}$
- Thus, in eq'm, $\frac{R}{P} = \alpha A \left(\frac{L}{K}\right)^{1-\alpha} = \alpha \frac{Y}{K}$
 - Which means:
 - $\uparrow K \Rightarrow \downarrow \left(\frac{R}{P}\right)$
 - $\uparrow L \Rightarrow \uparrow \left(\frac{R}{P}\right)$
 - $\uparrow A \Rightarrow \uparrow \left(\frac{R}{P}\right)$

- The Rental Firms:

- Buy capital and rent it out
- Renting it out earns $\frac{R}{P}$
- The price of capital is P_k
 - * \Rightarrow The real price is $\frac{P_k}{P}$
- Other costs to buying capital:
 1. If borrow money, pay interest rate i (and if don't borrow, i is the opportunity cost of using money to buy capital)
 2. Machinery and equipment breaks down - depreciates at rate δ

- The cost of capital is thus:

* cost of capital =
$$\underbrace{iP_k}_{\text{cost borrow/opp cost not lend}} - \underbrace{\Delta P_k}_{\text{Gain/loss from sale after use}} + \underbrace{\delta P_k}_{\text{depreciation}}$$

* $= P_k(i - \frac{\Delta P_k}{P_k} + \delta)$

* Assume: $\frac{\Delta P_k}{P_k} = \frac{\Delta P}{P}$ = rate of inflation

* \Rightarrow cost of capital = $P_k(\underbrace{i - \pi}_{=r} + \delta)$

* \Rightarrow the real cost of capital = $\frac{P_k}{P}(r + \delta)$

- Rental firms try to maximize profits:

* Profit Rate = Revenue per unit - Cost per unit =
$$\frac{R}{P} - \frac{P_k}{P}(r + \delta)$$
 (this is profit per unit of capital)

In eq'm = MPK

* \Rightarrow Profits =
$$\underbrace{MPK - \frac{P_k}{P}(r + \delta)}_{\text{Net invest depends on this}}$$

- * \rightarrow if profits > 0 , $\uparrow K$
- * \rightarrow if profits < 0 , $\downarrow K$
- * Let $I_n(\cdot)$ be the net investment function
- * $\Rightarrow \Delta K = I_n[MPK - \frac{P_k}{P}(r + \delta)]$

- Gross Investment, I = net investment + depreciation

- * $I = I_n[MPK - \frac{P_k}{P}(r + \delta)] + \delta K$
- * $\Rightarrow \frac{\partial I}{\partial r} < 0$
- * That is, as r increases the cost of investment increases, resulting in less investment
- * DRAW investment as a downward sloping function of r
- * Note: If $MPK \uparrow$, this implies a shift out in the investment function I_r
- * A higher MPK means higher demand for investment at any given interest rate
- * DRAW shift out in investment function

* In eq'm,
$$\underbrace{MPK}_{\text{marginal benefit of invest}} = \underbrace{\frac{P_k}{P}(r + \delta)}_{\text{marginal cost of invest}}$$

- * if $MB > MC$, then invest more until MB falls to equal MC
- * if $MB < MC$, then divest until $MB = MC$

Taxes and Investment:

- Corporate Income Tax
 - Affects investment because based on accounting profits, not real economic profits (which are zero for competitive firms)
 - ↑ tax results in lower after-tax benefits to investment, thus decreases investment (shifts investment curve in)
- Investment tax credit
 - What they do: If invest, get a reduction in tax bill (this is called a tax credit)
 - Acts to lower P_K , the price of capital
 - Lowers cost of investment - shifts investment curve out

Financing Constraints:

- If firms face limits to raising external funding, then investment depends upon current profits
- This means that during a recession, profits falling means less investment
- SHOW graph of private fixed investment over time
- w/o financing constraints, firms would keep investing through a recession, seeing that things would improve in the future

Q-theory of Investment:

- Stock prices reflect incentives to invest
 - Higher prices suggest should invest more
 - Lower prices suggest should invest less
- Tobin's q : $q = \frac{\text{Market value of capital}}{\text{Replacement value of capital}}$
- q is basically $\frac{\text{Market Value}}{\text{Book Value}}$, where MV is found by looking at market capitalization of the firm
- If $q < 1$, then the cost of buying capital is larger than the amount that capital increases firm value
 - \Rightarrow don't invest
- If $q > 1$, then the cost of buying capital is less than the amount that capital increases firm value
 - \Rightarrow invest
- This is very much like comparing the MPK to the cost of capital, BUT Tobin's q includes not just the current costs and benefits, but the future costs and benefits because they are all incorporated into the firm's stock price/market value

The Efficient Markets Hypothesis:

- Idea: Stock prices are based on all available information
- Prices move to equate supply and demand, so that at any point in time, prices are "fair" valued (value based on fundamentals like expected future dividends).

- When prices move, it means that expectations about those fundamentals have changed because new information is revealed
 - New information is entirely random (else it would have been priced in)
 - \Rightarrow changes in stock prices are random - they follow a “random walk”
- Implication:
 - Can’t beat the market on average
 - Invest in index funds (track market, lower costs)

Residential Investment:

- The market for housing includes new homes and old homes
- At any point in time, the supply of housing is fixed - i.e., it’s a stock
- DRAW the market for housing - fixed supply, downward sloping demand curve. $\frac{P_H}{P}$ is real price of housing, K_h is stock of housing
- $\frac{P_H}{P}$ moves to equate supply and demand
- The supply of new housing is a flow and depends upon the price of housing
- DRAW the supply of new housing with the upward sloping supply curve for new housing. $\frac{P_H}{P}$ is real price of housing, I_h is amount of new housing
- If the demand for housing shifts (e.g., because of a change in the tax on capital gains or change in the real interest rate), prices of housing adjust and we move along the supply curve.
- DRAW the market for housing next to the supply of new housing. Show that shift in demand in market for housing increases price and higher prices mean higher supply of new houses.

The Tax Treatment of Housing:

- Taxes set up to favor homeownership:
 1. Get to deduct mortgage interest payments from taxable income
 2. Landlords pay tax on rents they get, but a homeowner does not pay tax on the implicit rent he pays himself to live in the house
 3. Capital gains on sale of home are not taxed if you buy a home w/in 2 years (up to \$500,000)
- These “tax expenditures” are large (over \$100 billion per year) and dwarf actual outlays on housing assistance
- Distributionally, these tax advantages disproportionately go to high income households b/c
 - These households pay higher tax rates (and the value of a deduction is equal to the filer’s marginal tax rate)
 - These households own more valuable property

Inventory Investment:

- Why hold inventory?

1. Production smoothing
 2. Inventories as a factor of production (e.g., spare parts)
 3. Stock-out avoidance
 4. Work in process
- The Accelerator Model of inventories:
 - Let N be the stock of inventories
 - $N = \beta Y$
 - β is the fraction of output held in inventories
 - \Rightarrow Investment, $I = \Delta N = \beta \Delta Y$
 - * e.g., if $\beta = 0.16$
 - * $I = 0.16 \Delta Y$
 - * As $Y \uparrow$, build up inventories and $I \uparrow$
 - * As $Y \downarrow$, sell off (and don't add to) inventories and $I \downarrow$
 - * \Rightarrow less inventory investment during recessions
 - * SHOW graph with inventory invest over business cycle
 - Inventories and r
 - r is the opportunity cost of holding inventories $\Rightarrow \uparrow r, \downarrow N \Rightarrow I \downarrow$
 - So get that inventory investment move in opposite direction of the real interest rate

Summary:

- All types of investment fall as r increases
 - If r goes up:
 1. The cost of capital rises, lowering business fixed investment
 2. The demand for housing shifts in, resulting in a fall in $\frac{P_H}{P}$ and thus a fall in residential investment
 3. The opportunity cost of holding inventories increases, lowering inventory investment
- Investment is volatile (i.e. it moves a lot) over the business cycle
 - Higher employment $\Rightarrow \uparrow MPK \Rightarrow$ more business fixed investment
 - Higher profits relax financing constraints and increase business fixed investment
 - Higher income raises the demand for homes, increasing $\frac{P_H}{P}$ and thus residential investment
 - Higher output increases the amount of inventories a firm wishes to hold, increasing inventory investment