LECTURE 15
CAPITAL AND INTEREST
March 10, 2016

I. OVERVIEW
   A. What is “capital”?
   B. Why do we care about input markets?

II. REVIEW OF THE LABOR MARKET FRAMEWORK
   A. The determinants of labor demand and labor supply
   B. Labor market diagram

III. RENTAL MARKET FOR CAPITAL
   A. Profit maximization and the demand for rental capital
   B. Supply and equilibrium
   C. Application: Effect of the housing bubble on rental rates for construction equipment
   D. Complications when we think about a firm buying rather than renting capital

IV. PRESENT VALUE
   A. Time preference and definition of present value
   B. Present value of a single payment to be received in the future
   C. Present value of a stream of payments to be received in the future

V. PURCHASING CAPITAL
   A. Profit maximization and a firm’s decision about how many machines to buy
   B. Investment demand curve
   C. Shifts in the investment demand curve

VI. STOCK PRICES
   A. Financial capital versus physical capital
   B. Stock price equals the PV of expected future dividends
   C. What affects stock prices?
   D. Efficient markets hypothesis
LECTURE 15
Capital and Interest

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Announcements

• Suggested answers to Problem Set 3 will be posted tonight.

• You should read the paper by Piketty and Saez for next time.
I. Overview
Continuing Our Discussion of Input Markets

• Discussed the market for labor last time.

• Discuss the market for capital today.

  • “Capital” refers to any manmade aids to the production process.

  • Tools, machines, trucks, computers.
II. REVIEW OF THE LABOR MARKET FRAMEWORK
Two Sides of the Labor Market

- Labor demand comes from profit maximization:
  - Firms want to hire labor up to the point where: $\text{MRP}_L = W$.
  - $\text{MRP}_L = \text{MP}_L \cdot MR$

- Labor supply comes from utility maximization:
  - Households substitute away from leisure (and toward work) when the wage rises.
Market for Workers in Manufacturing

\[ \text{Market for Workers in Manufacturing} \]

\[ W \]

\[ S_1 \]

\[ D_1 \]

\[ W_1 \]

\[ L_1 \]
III. THE RENTAL MARKET FOR CAPITAL
How much capital does a firm want to rent?

• Its decision will be based on profit maximization.

• The firm looks at the MRP of another machine:
  • \( \text{MRP}_K = \text{MP}_K \times \text{MR} \)

• \( \text{MRP}_K \) declines as more machines are rented.

• The firm wants to rent machines up to the point where \( \text{MRP}_K = \text{Rental Price} \).
A Firm’s Demand Curve for Rental Capital

Rental Price

$P_1$

$P_2$

$k_1$

$k_2$

$\text{MRP}_{K,d}$
Rental Market for a Type of Capital

![Graph showing rental market for a type of capital with Rental Price (P₁) and K₁ on the axes.](image-url)
Effect of the Housing Bubble

Construction Services

Rental Equipment

Rental Price
## Turner Building Cost Index

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IV. PRESENT VALUE
Present Value

• What a payment to be received in the future is worth to you today.
Present value of $100 one year from now:

- Assuming the interest rate is 3%.

\[ x \times (1+.03) = 100 \]
\[ x = \frac{100}{(1 + .03)} \]
\[ x = 97.09 \]
Present value of $100 one year from now:

- Assuming the interest rate is 8%.

\[ x(1+.08) = 100 \]

\[ x = \frac{100}{1 + .08} \]

\[ x = $92.59 \]
Present value of $100 two years from now:

• Assuming the interest rate is 3%.

\[ x(1+.03)(1+.03) = 100 \]

\[ x = \frac{100}{(1 + .03)^2} \]

\[ x = $94.26 \]
Present value of a single payment in the future:

\[ PV(F) = \frac{F}{(1 + i)^t} \]

- \( F \) = future payment
- \( i \) = interest rate (expressed as a decimal)
- \( t \) = number of years in the future the payment is to be received
Present value of $1000 each of the next three years:

- Assuming the interest rate is 3%.

\[
\frac{1000}{(1 + .03)^1} \quad + \quad \frac{1000}{(1 + .03)^2} \quad + \quad \frac{1000}{(1 + .03)^3}
\]

\[
970.09 \quad + \quad 942.60 \quad + \quad 915.14
\]

\[
= \$2827.83
\]
Present value of a stream of payments:

$$\text{PV(\text{Stream of F’s})} = \frac{F}{(1 + i)^1} + \frac{F}{(1 + i)^2} + \frac{F}{(1 + i)^3} + \ldots + \frac{F}{(1 + i)^t}$$

- $F$ = future payment in each year
- $i$ = interest rate (expressed as a decimal)
- $t$ = number of years in the future the last payment is made
V. PURCHASING CAPITAL AND THE INVESTMENT DEMAND CURVE
What a machine is worth to a firm:

\[
PV(\text{Stream of } MRP_K \text{'s}) = \frac{MRP_K}{(1+i)^1} + \frac{MRP_K}{(1+i)^2} + \frac{MRP_K}{(1+i)^3} + \ldots + \frac{MRP_K}{(1+i)^t}
\]

- \( MRP_K \) = marginal revenue product of capital in each year
- \( i \) = interest rate (expressed as a decimal)
- \( t \) = lifespan of the machine
Profit Maximization Implies:

- Firms want to purchase capital up to the point where:

\[ PV(\text{Stream of } MRP_K's) = \text{Purchase Price} \]
Important Relationship

• We focus on the relationship between purchases of new capital and the interest rate.

• Why?

• We refer to purchases of new capital (additions to the capital stock) as investment.
Why is there a negative relationship between purchase of new capital and the interest rate?

- Recall the condition for how much capital a firm wants to buy:

  \[ PV(\text{Stream of MRP}_K\text{'s}) = \text{Purchase Price} \]

- A decrease in \( i \) cause \( PV(\text{Stream of MRP}_K\text{'s}) \) to rise.

- This makes firms want to buy more capital.
Investment Demand Curve

Interest Rate (i) vs Investment (I)
Shifts in the Investment Demand Curve
(Investment Tax Credit)
Shifts in the Investment Demand Curve
(Pessimism about Future $\text{MRP}_K$)
VI. STOCK PRICES
Physical Capital versus Financial Capital

• **Physical capital** refers to man-made aids to the production process: machines, buildings, trucks, computers.

• **Financial capital** refers to the funds used to purchase, rent or build physical capital.
Two Ways to Raise Financial Capital

• **Issue bonds:** borrow funds in return for a promise to repay later with interest.

• **Issue stocks:** sell people a share of the company. In return, they are entitled to a share of future profits (that is what a dividend is).
What should someone be willing to pay for a stock?

Stock price = 

PV(Stream of Expected Future Dividends)
What moves stock prices?

- A change in the interest rate.
  - Lower interest rates, all else equal, are likely to be associated with higher stock prices.

- A change in expected future dividends.
  - If something makes people expect higher future dividends, that should be associated with a higher stock price.
  - The higher expected dividends could apply to a particular firm or to firms in general.
Bristol Myers Squibb Stock Price and Drug Approval

Source: Barron’s and CNN Money
Chipotle Stock Price and News about Illness

News of salmonella and e. coli: October 2015

Source: CNN Money
S&P 500 and News about the Financial Crisis

Lehman Bankruptcy

Vote against TARP

Source: FRED, Federal Reserve Bank of St. Louis.
Recent Overall Stock Price Movements

Source: FRED, Federal Reserve Bank of St. Louis.
Dow Tumbles Nearly 400 Points on China Worries
Dow industrials, S&P 500 are off to their worst-ever starts to the year

Updated Jan. 8, 2016 12:57 a.m. ET
The Dow Jones Industrial Average fell nearly 400 points Thursday as steep falls in Chinese equities spilled over to global markets
Efficient Markets Hypothesis

• It is difficult to make money off news in the stock market because information is processed very quickly.