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Input Demand: The Capital Market and the Investment Decision

Appendix: Calculating Present Value

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The Capital Market



Capital

- **Capital** are those goods produced by the economic system that are used as inputs to produce other goods and services in the future.

Tangible Capital

- **Physical**, or **tangible capital** refers to the material things used as inputs in the production of future goods and services.
- Major categories of physical capital are:
 - Nonresidential structures
 - Durable equipment
 - Residential structures
 - Inventories

Social Capital: Infrastructure

- **Social capital**, or **infrastructure**, is capital that provides services to the public.
- Most social capital takes the form of:
 - Public works (roads and bridges)
 - Public services (police and fire protection)

Intangible Capital

- **Intangible capital** refers to nonmaterial things that contribute to the output of future goods and services.
- For example, an advertising campaign to establish a brand name produces intangible capital called goodwill.

Intangible Capital

- **Human capital** is a form of intangible capital that includes the skills and other knowledge that workers have or acquire through education and training.
- Human capital yields valuable services to a firm over time.

Measuring Capital

- The measure of a firm's **capital stock** is the current market value of its plant, equipment, inventories, and intangible assets.
- When we speak of capital, we refer not to money or financial assets such as bonds or stocks, but to the firm's physical plant, equipment, inventory, and intangible assets.

Investment and Depreciation

- **Investment** refers to new capital additions to a firm's capital stock.
 - Although capital is measured at a given point in time (a stock), investment is measured over a period of time (a flow).
 - The flow of investment increases the capital stock.
- **Depreciation** is a decline in an asset's economic value over time.

Private Investment in the U.S. Economy, 2002

	BILLIONS OF CURRENT DOLLARS	AS A PERCENTAGE OF TOTAL GROSS INVESTMENT	AS A PERCENTAGE OF GDP
Nonresidential structures	269.3	16.9	2.6
Equipment and software	848.1	53.2	8.1
Change in inventories	3.9	0.2	0.0
Residential structures and equipment	471.9	29.6	4.5
Total gross private investment	1593.2	100.0	15.2
- depreciation	-1393.5	-87.5	-13.3
Net investment = gross investment minus depreciation	199.7	12.5	1.9%

The Capital Market

- The **capital market** is a market in which households supply their savings to firms that demand funds to buy capital goods.



The Capital Market



\$1,000 in savings becomes \$1,000 of investment

The Capital Market

- A **bond** is a contract between a borrower and a lender, in which the borrower agrees to pay the loan at some time in the future, along with interest payments along the way.
- The **financial capital market** is the part of the capital market in which savers and investors interact through intermediaries.

Capital Income: Interest and Profits

- **Capital income** is income earned on savings that have been put to use through financial capital markets.
- **Interest** is the payment made for the use of money. Interest is a reward for postponing consumption.
- **Profit** is the excess of revenues over cost in a given period. Profit is a reward for innovation and risk taking.

Financial Markets in Action

- Four mechanisms for channeling household savings into investment projects include:
 - Business loans
 - Venture capital
 - Retained earnings
 - The stock market

Financial Markets Link Household Saving and Investment by Firms



Capital Accumulation and Allocation

- In modern industrial societies, investment decisions (capital production decisions) are made primarily by firms.
- Households decide how much to save, and in the long-run saving limits or constrains the amount of investment that firms can undertake. The capital market exists to direct savings into profitable investment projects.

The Demand for New Capital and the Investment Decision

- Decision makers must have *expectations* about what is going to happen in the future.
- The investment process requires that the potential investor evaluate the expected flow of future productive services that an investment project will yield.

Forming Expectations

- The ability to lend at the market rate of interest means that there is an *opportunity cost* associated with every investment project.
- The evaluation process thus involves not only estimating *future benefits*, but also comparing the possible *alternative uses* of the funds required to undertake the project. At a minimum, those funds earn interest in financial markets.

Comparing Costs and Expected Return

- The **expected rate of return** is the annual rate of return that a firm expects to obtain through a capital investment.

Comparing Costs and Expected Return

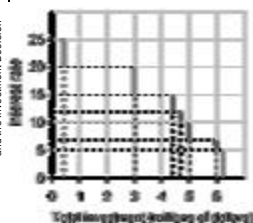
- The expected rate of return on an investment project depends on:
 - the price of the investment,
 - the expected length of time the project provides additional cost savings or revenue, and
 - the expected amount of revenue attributable each year to the project.

Comparing Costs and Expected Return

Potential Investment Projects and Expected Rates of Return for a Hypothetical Firm, Based on Forecasts of Future Profits Attributable to the Investment

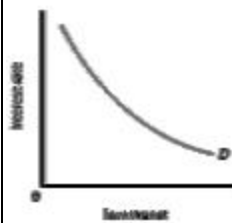
PROJECT	(1) TOTAL INVESTMENT (DOLLARS)	(2) EXPECTED RATE OF RETURN (PERCENT)
A. New computer network	400,000	25
B. New branch plant	2,600,000	20
C. Sales office in another state	1,500,000	15
D. New automated billing system	100,000	12
E. Ten new delivery trucks	400,000	10
F. Advertising campaign	1,000,000	7
G. Employee cafeteria	100,000	5

Investment as a Function of the Market Interest Rate



- The demand for new capital depends on the interest rate.
- When the interest rate is low firms are more likely to invest in new plant and equipment.
- The interest rate determines the opportunity cost (alternative investment) of each project.

Investment Demand



- The market demand curve for new capital is the sum of all the individual demand curves for new capital in the economy.
- In a sense, the investment demand schedule is a ranking of all the investment opportunities in the economy in order of expected yield.

The Expected Rate of Return and the Marginal Revenue Product of Capital

- A perfectly competitive profit-maximizing firm will keep investing in new capital up to the point at which the expected rate of return is equal to the interest rate.
- This is analogous to:

$$MRP_K = P_K$$

Review Terms and Concepts

<u>Bond</u>	<u>Human capital</u>
<u>Capital</u>	<u>Intangible capital</u>
<u>Capital income</u>	<u>Interest</u>
<u>Capital market</u>	<u>Investment</u>
<u>Capital stock</u>	<u>Physical, or tangible, capital</u>
<u>Depreciation</u>	<u>Profit</u>
<u>Expected rate of return</u>	<u>Social capital, or infrastructure</u>
<u>Financial capital market</u>	

Appendix: Calculating Present Value

Expected Profits from a \$1,200 Investment Project

Year 1	\$100
Year 2	100
Year 3	400
Year 4	500
Year 5	500
All later years	0
Total	1,600

- Based on the expected profits as listed and the cost of \$1,200, should the investment project be undertaken?

Appendix: Calculating Present Value

- Present-value analysis is a method of evaluating future revenue streams.
- The “price” (X) of \$1 to be delivered a year from now with interest (r) equals:

$$X + rX = X(1 + r)$$

$$\$1 = X(1 + r), \text{ so } X = \frac{\$1}{1 + r}$$

Appendix: Calculating Present Value

- The present value of \$100 to be delivered in two years at an annual interest rate of 10 percent equals:

$$X = \frac{\$100}{(1.1)^2} = \$82.64$$

- \$82.64 plus interest of \$8.26 after one year and interest of \$9.09 in the second year would leave you with \$100 at the end of two years.

Appendix: Calculating Present Value

- In general, the present value (PV), or present discounted value, of R dollars t years from now is:

$$PV = \frac{R}{(1 + r)^t}$$

Appendix: Calculating Present Value

Calculation of Total Present Value of a Hypothetical Investment Project (Assuming $r = 10$ Percent)

END OF...	\$(r)	DIVIDED BY (1 + r) ^t	PRESENT VALUE (\$)
Year 1	100	(1.1)	90.91
Year 2	100	(1.1) ²	82.65
Year 3	400	(1.1) ³	300.53
Year 4	500	(1.1) ⁴	341.51
Year 5	500	(1.1) ⁵	310.46
Total Present Value			1,126.06

- An investment project with an initial outlay of \$1,200 and a PV = \$1,126.06 based on $r = 10\%$ would not be undertaken.

Appendix: Calculating Present Value

- Lower interest rates result in higher present values. The firm has to *pay more now* to purchase the same number of future dollars.

$$\begin{matrix} \$100 \\ 10\% \\ 2 \text{ years} \end{matrix} X = \frac{\$100}{(1.1)^2} = \$82.64$$

$$\begin{matrix} \$100 \\ 5\% \\ 2 \text{ years} \end{matrix} X = \frac{\$100}{(1+r)^2} = \frac{\$100}{(1.05)^2} = \$90.70$$

Appendix: Calculating Present Value

Calculation of Total Present Value of a Hypothetical Investment Project (Assuming $r = 5$ Percent)

END OF...	\$(r)	DIVIDED BY (1 + r) ^t	PRESENT VALUE (\$)
Year 1	100	(1.05)	95.24
Year 2	100	(1.05) ²	90.70
Year 3	400	(1.05) ³	345.54
Year 4	500	(1.05) ⁴	411.35
Year 5	500	(1.05) ⁵	391.76
Total Present Value			1,334.59

- An investment project with an initial outlay of \$1,200 and a PV = \$1,334.59 based on $r = 5\%$ should be undertaken.

Appendix: Calculating Present Value

- The basic rule is:
 - If the present value of an expected stream of earnings from an investment is greater (less) than the cost of the investment necessary to undertake it, ~~then the~~ investment should (should not) be undertaken.