IN THIS CHAPTER, YOU WILL LEARN, PART 1

an introduction to the most prominent work on consumption, including:

- John Maynard Keynes: consumption and current income
- Franco Modigliani: the life-cycle hypothesis
- Milton Friedman: the permanent income hypothesis
- Robert Hall: the random-walk hypothesis
- David Laibson: the pull of instant gratification
IN THIS CHAPTER, YOU WILL LEARN, PART 2

leading theories to explain investment
why investment is negatively related to the interest rate
things that shift the investment function
why investment rises during booms and falls during recessions
Keynes’s conjectures

1. $0 < MPC < 1$

2. **Average propensity to consume** ($APC$) falls as income rises.
   ($APC = \frac{C}{Y}$)

3. Income is the main determinant of consumption.
The Keynesian consumption function, part 1

\[ C = \bar{C} + cY \]

\[ c = MPC \]

= slope of the consumption function

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As income rises, consumers save a bigger fraction of their income, so $APC$ falls.

\[ C = \bar{C} + cY \]

\[ APC = \frac{C}{Y} = \frac{\bar{C}}{Y} + c \]
Early empirical successes: Results from early studies

- Households with higher incomes:
  - consume more, so $MPC > 0$
  - save more, so $MPC < 1$
  - save a larger fraction of their income, so $APC_i \propto Y_h$
- Very strong correlation between income and consumption: income seemed to be the main determinant of consumption
Problems for the Keynesian consumption function

• Based on the Keynesian consumption function, economists predicted that $C$ would grow more slowly than $Y$ over time.

• This prediction did not come true:
  • As incomes grew, $APC$ did not fall, and $C$ grew at the same rate as income.
  • Simon Kuznets showed that $C/Y$ was very stable from decade to decade.
The consumption puzzle

Consumption, C

Income, Y

Long-run consumption function (constant APC)

Short-run consumption function (falling APC)

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The Life-Cycle Hypothesis, part 1

- due to Franco Modigliani (1950s)
- The Life-Cycle Hypothesis (LCH) says that income varies systematically over the phases of the consumer’s life cycle, and saving allows the consumer to achieve smooth consumption.
The Life-Cycle Hypothesis, part 2

• The basic model:
  \( W \) = initial wealth
  \( Y \) = annual income until retirement (assumed constant)
  \( R \) = number of years until retirement
  \( T \) = lifetime in years

• Assumptions:
  • zero real interest rate (for simplicity)
  • consumption smoothing is optimal
The Life-Cycle Hypothesis, part 3

• Lifetime resources = \( W + RY \)

• To achieve smooth consumption, consumer divides her resources equally over time:

\[
C = \frac{(W + RY)}{T}, \text{ or }
C = \alpha W + \beta Y
\]

where
\( \alpha = \frac{1}{T} \) is the marginal propensity to consume out of wealth

\( \beta = \frac{R}{T} \) is the marginal propensity to consume out of income
The LCH can solve the consumption puzzle:

- The life-cycle consumption function implies
  \[ APC = \frac{C}{Y} = \alpha \left( \frac{W}{Y} \right) + \beta \]

- Across households, income varies more than wealth, so high-income households should have a lower \( APC \) than low-income households.

- Over time, aggregate wealth and income grow together, causing \( APC \) to remain stable.
LCH implies that saving varies systematically over a person’s lifetime.

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The Permanent Income Hypothesis, part 1

• due to Milton Friedman (1957)

• \( Y = Y^P + Y^T \)

  where

  \( Y = \) current income

  \( Y^P = \) permanent income
  average income, which people expect to persist into the future

  \( Y^T = \) transitory income
  temporary deviations from average income
The Permanent Income Hypothesis, part 2

- Consumers use saving & borrowing to smooth consumption in response to transitory changes in income.
- The Permanent Income Hypothesis (PIH) consumption function:

  \[ C = \alpha Y^p \]

where \( \alpha \) is the fraction of permanent income that people consume per year.
The Permanent Income Hypothesis, part 3

• The PIH can solve the consumption puzzle:
  • The PIH implies
    
    \[ APC = \frac{C}{Y} = \alpha \frac{Y^P}{Y} \]
  • If high-income households have higher transitory income than low-income households, \( APC \) is lower in high-income households.
  • Over the long run, income variation is due mainly (if not solely) to variation in permanent income, which implies a stable \( APC \).
PIH vs. LCH

- Both: people try to smooth their consumption in the face of changing current income.
- LCH: current income changes systematically as people move through their life cycle.
- PIH: current income is subject to random, transitory fluctuations.
- Both can explain the consumption puzzle.
The Random-Walk Hypothesis, part 1

- due to Robert Hall (1978)
- based on PIH, in which forward-looking consumers base consumption on expected future income
- Hall adds the assumption of rational expectations, that people use all available information to forecast future variables like income.
The Random-Walk Hypothesis, part 2

- If PIH is correct and consumers have rational expectations, then consumption should follow a random walk: changes in consumption should be unpredictable.
  - A change in income or wealth that was anticipated has already been factored into expected permanent income, so it will not change consumption.
  - Only unanticipated changes in income or wealth that alter expected permanent income will change consumption.
Implication of the R-W Hypothesis

If consumers obey the PIH and have rational expectations, then policy changes will affect consumption only if they are unanticipated.
The Psychology of Instant Gratification, part 1

• Previous theories assume that consumers are rational and act to maximize lifetime utility.
• Recent studies by David Laibson and others consider the psychology of consumers.
The Psychology of Instant Gratification, part 2

- Consumers consider themselves to be imperfect decision makers.
  - In one survey, 76% said they were not saving enough for retirement.
- Laibson: The “pull of instant gratification” explains why people don’t save as much as a perfectly rational lifetime utility maximizer would save.
Two questions and time inconsistency

1. Would you prefer (A) a candy today, or (B) two candies tomorrow?

2. Would you prefer (A) a candy in 100 days, or (B) two candies in 101 days?

In studies, most people answered (A) to 1 and (B) to 2.

A person confronted with question 2 may choose (B).

But in 100 days, when confronted with question 1, the pull of instant gratification may induce her to change her answer to (A).
**Summing up consumption**

• Keynes: consumption depends primarily on current income.

• Recent work: consumption also depends on
  • expected future income
  • Wealth
  • Interest rates

• Economists disagree over the relative importance of these factors, borrowing constraints, and psychological factors.
Moving on: Three types of investment

• **Business fixed investment:** businesses’ spending on equipment and structures for use in production.

• **Residential investment:** purchases of new housing units (either by occupants or landlords).

• **Inventory investment:** the value of the change in inventories of finished goods, materials and supplies, and work in progress.
Understanding business fixed investment

• The standard model of business fixed investment: the **neoclassical model of investment**

• Shows how investment depends on:
  • \( MPK \)
  • interest rate
  • tax rules affecting firms
Two types of firms

- For simplicity, assume two types of firms:
  1. **Production firms** rent the capital they use to produce goods and services.
  2. **Rental firms** own capital, rent it to production firms.

  *In this context, “investment” is the rental firms’ spending on new capital goods.*
The capital rental market

Production firms must decide how much capital to rent.

Recall from Chap. 3: Competitive firms rent capital to the point where \( \text{MPK} = \frac{R}{P} \).
Factors that affect the rental price

For the Cobb-Douglas production function, 

\[ Y = AK^\alpha L^{1-\alpha} \]

the $MPK$ (and hence equilibrium $R/P$) is 

\[ \frac{R}{P} = MPK = \alpha A \frac{L}{K}^{1-\alpha} \]

The equilibrium $R/P$ would increase if:

- $\downarrow K$ (e.g., earthquake or war)
- $\uparrow L$ (e.g., pop. growth or immigration)
- $\uparrow A$ (technological improvement or deregulation)
Rental firms’ investment decisions

• Rental firms invest in new capital when the benefit of doing so exceeds the cost.
• The benefit (per unit capital): $R/P$, the income that rental firms earn from renting the unit of capital to production firms.
Components of the cost of capital:

*interest cost*: $i \times P_K$,
where $P_K = \text{nominal price of capital}$

*depreciation cost*: $\delta \times P_K$,
where $\delta = \text{rate of depreciation}$

*capital loss*: $-\Delta P_K$
(a capital gain, $\Delta P_K > 0$, reduces cost of $K$)

Add these three parts to get the total cost of capital:
The cost of capital, part 2

Nominal cost of capital = \( iP_K + \delta P_K - \Delta P_K = P_K \left( i + \delta - \frac{\Delta P_K}{P_K} \right) \)

**Example: car rental company** (capital: cars)

Suppose \( P_K = 10,000 \), \( i = 0.10 \), \( \delta = 0.20 \), and \( \Delta P_K/P_K = 0.06 \)

Then, interest cost = $1000

depreciation cost = 2000

capital loss = $-600

total cost = $2400
The cost of capital, part 3

For simplicity, assume $\Delta P_k / P_k = \pi$.

Then, the nominal cost of capital equals

$$P_k(i + \delta - \pi) = P_k(r + \delta)$$

and the real cost of capital equals

$$\frac{P_k}{P}(r + \delta)$$

The real cost of capital depends positively on:

- the relative price of capital
- the real interest rate
- the depreciation rate
The rental firm’s profit rate

A firm’s net investment depends on its profit rate:

\[
\text{Profit rate} = \frac{R}{P} - \frac{P_k}{P}(r + \delta) = MPK - \frac{P_k}{P}(r + \delta)
\]

- If profit rate > 0, then increasing \( K \) is profitable
- If profit rate < 0, then the firm increases profits by reducing its capital stock (i.e., not replacing capital as it depreciates)
Net investment & gross investment

Hence,

\[
\text{net investment} = \Delta K = I_n \left[ MPK - \left( \frac{P_k}{P} \right)(r + \delta) \right]
\]

where \( I_n[ ] \) is a function that shows how net investment responds to the incentive to invest.

Total spending on business fixed investment equals net investment plus replacement of depreciated \( K \):

\[
\text{gross investment} = \Delta K + \delta K
\]

\[
= I_n \left[ MPK - \left( \frac{P_k}{P} \right)(r + \delta) \right] + \delta K
\]
An increase in $r$:
- raises the cost of capital
- reduces the profit rate
- and reduces investment

$$I = I_n \left[ MPK - \left( \frac{P^*_K}{P} \right) \left( r + \delta \right) \right] + \delta K$$
An increase in $MPK$ or decrease in $P_K/P$

- increases the profit rate
- increases investment at any given interest rate
- shifts $I$ curve to the right

\[ I = I_n \left[ MPK - \left( \frac{P_K}{P} \right) (r + \delta) \right] + \delta K \]
Taxes and investment

Two of the most important tax policies affecting investment:

1. Corporate income tax
2. Investment tax credit
Corporate income tax: A tax on profits

Impact on investment depends on definition of “profit.”

- In our definition (rental price minus cost of capital), depreciation cost is measured using current price of capital, and the corporate income tax would not affect investment.

- But, the legal definition uses the historical price of capital.

- If $P_k$ rises over time, then the legal definition understates the true cost and overstates profit,

- so firms could be taxed even if their true economic profit is zero.

Thus, corporate income tax discourages investment.
The Investment Tax Credit (ITC)

- The ITC reduces a firm’s taxes by a certain amount for each dollar it spends on capital.
- Hence, the ITC effectively reduces $P_k$, which increases the profit rate and the incentive to invest.
Tobin’s $q$

\[ q = \frac{\text{Market value of installed capital}}{\text{Replacement cost of installed capital}} \]

- **numerator**: the stock market value of the economy’s capital stock.
- **denominator**: the actual cost to replace the capital goods that were purchased when the stock was issued.
- If $q > 1$, firms buy more capital to raise the market value of their firms.
- If $q < 1$, firms do not replace capital as it wears out.
Relation between $q$ theory and neoclassical theory

$$q = \frac{\text{Market value of installed capital}}{\text{Replacement cost of installed capital}}$$

- The stock market value of capital depends on the current & expected future profits of capital.
- If $MPK > \text{cost of capital}$, then profit rate is high, which drives up the stock market value of the firms, which implies a high value of $q$.
- If $MPK < \text{cost of capital}$, then firms are incurring losses, so their stock market values fall, so $q$ is low.
The stock market and GDP, part 1

Reasons for a relationship between the stock market and GDP:
1. A wave of pessimism about future profitability of capital would:
   - cause stock prices to fall
   - cause Tobin’s q to fall
   - shift the investment function down
   - cause a negative aggregate demand shock
The stock market and GDP, part 2

Reasons for a relationship between the stock market and GDP:

2. A fall in stock prices would:
   - reduce household wealth
   - shift the consumption function down
   - cause a negative aggregate demand shock
Reasons for a relationship between the stock market and GDP:

3. A fall in stock prices might reflect bad news about technological progress and long-run economic growth. This implies that aggregate supply and full-employment output will be expanding more slowly than people had expected.
Financing constraints

- Neoclassical theory assumes firms can borrow to buy capital whenever doing so is profitable.
- But some firms face **financing constraints**: limits on the amounts they can borrow (or otherwise raise in financial markets).
- A recession reduces current profits. If future profits expected to be high, investment might be worthwhile. But if firm faces financing constraints and current profits are low, firm might be unable to obtain funds.
1. Keynesian consumption theory
   - Keynes’s conjectures
     - $MPC$ is between 0 and 1
     - $APC$ falls as income rises
     - current income is the main determinant of current consumption
   - Empirical studies
     - in household data & short time series: confirmation of Keynes’s conjectures
     - in long-time series data: $APC$ does not fall as income rises
2. Modigliani’s life-cycle hypothesis
   - Income varies systematically over a lifetime.
   - Consumers use saving & borrowing to smooth consumption.
   - Consumption depends on income & wealth.
3. Friedman’s permanent-income hypothesis
   - Consumption depends mainly on permanent income.
   - Consumers use saving & borrowing to smooth consumption in the face of transitory fluctuations in income.
4. Hall’s random-walk hypothesis
   - Combines PIH with rational expectations.
   - Main result: changes in consumption are unpredictable, occur only in response to unanticipated changes in expected permanent income.
5. Laibson and the pull of instant gratification

- Uses psychology to understand consumer behavior.
- The desire for instant gratification causes people to save less than they rationally know they should.
6. Investment depend negatively on the real interest rate.

7. Things that shift the investment function:
   - Technological improvements raise MPK and raise business fixed investment.
   - Increase in population raises demand for, price of housing and raises residential investment.
   - Economic policies (corporate income tax, investment tax credit) alter incentives to invest.
8. Investment is the most volatile component of GDP over the business cycle.
   - Fluctuations in employment affect the MPK and the incentive for business fixed investment.