

Chapter 4: Consumption, Saving, and Investment

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- Describe the factors that affect consumption and saving decisions.
- Discuss the factors that affect investment behavior of firms.
- Explain the factors affecting goods market equilibrium.

The importance of consumption and saving

- Desired consumption: consumption amount desired by ... given...
- The aggregate level of desired consumption, C_d , is obtained by...
- Desired national saving (S_d):...

$$S_d = \dots \quad (1)$$

Here for simplicity we assume that $NFP = 0$.

The consumption and saving decision of an individual

- A person can consume less than current income (saving is ...).
- A person can consume more than current income (saving is ...).
- Trade-off between current consumption and future consumption:

Effect of changes in current income

- Increase in current income: both consumption and saving ...
- *Marginal propensity to consume (MPC)* = ...
- Individual households' consumption decisions also apply at...
- Aggregate level: When current income (Y) rises, C_d ..., but not... as Y , so S_d ...

Effect of changes in expected future income

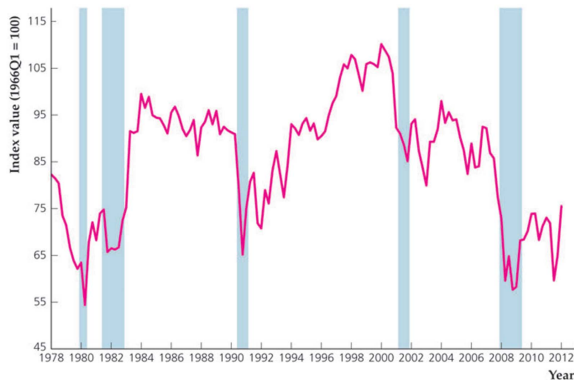
- Today's consumption decisions may depend not only on current income but also on ...
- Higher expected future income is likely to lead the consumer to...
- The same result applies at the macro level: If people expect that aggregate output (income), Y , will be higher in the future, C_d should ... and S_d should ...
- Giant oil discovery?

Application: consumer sentiment and forecasts of consumer spending

- Do consumer sentiment indexes help economists forecast consumer spending?



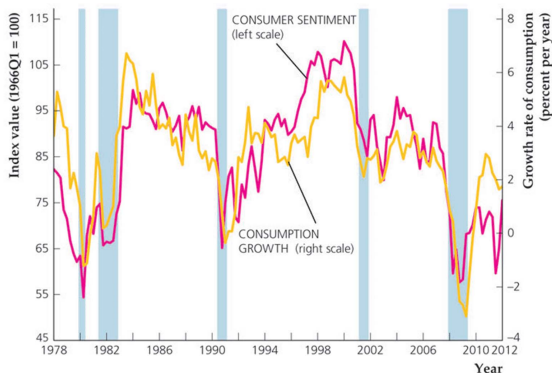
Figure 4.1 Consumer Sentiment, 1978Q1–2012Q1



Source: Index of Consumer Sentiment (© Thomson Reuters/University of Michigan) from FRED database, research.stlouisfed.org/fred2/series/UMCSENT and updates from news releases by Reuters.com.



Figure 4.2 Consumer Sentiment and Consumption Spending Growth, 1978Q1—2012Q1



Source: *Index of Consumer Sentiment* (© Thomson Reuters/University of Michigan) from research.stlouisfed.org/fred2/series/UMCSENT and updates from news releases by Reuters.com; consumption spending from research.stlouisfed.org/fred2/series/PCECC96.

Effect of changes in wealth

- Increase in wealth raises ...
- The Carnegie conjecture:
<http://piketty.pse.ens.fr/files/Holtz-Eakinetal1993.pdf>.
- The ups and downs in the stock market...

Effect of changes in real interest rate

- Increased real interest rate has two opposing effects:
 - *Substitution effect*: ...
 - *Income effect*: ...
 - For a borrower who is a payer of interest: ...
 - Empirical studies have mixed results...
- Taxes and the real return to saving. Expected after-tax real interest rate:

$$r_{a-t} = (1 - t) i - \pi^e, \quad (2)$$

is the appropriate interest rate for consumers to use in making consumption-saving decisions.



Table 4.1 Calculating After-Tax Interest Rates

i = nominal interest rate = 5% per year
 π^e = expected inflation rate = 2% per year

Example 1

t = tax rate on interest income = 30%

After-tax nominal interest rate = $(1 - t)i = (1 - 0.30)5\% = 3.5\%$

Expected after-tax real interest rate = $(1 - t)i - \pi^e = (1 - 0.30)5\% - 2\% = 1.5\%$

Example 2

t = tax rate on interest income = 20%

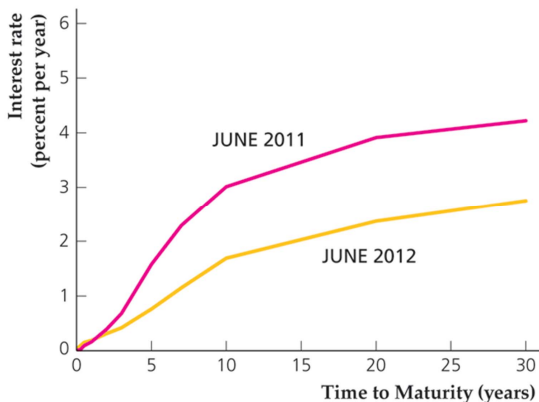
After-tax nominal interest rate = $(1 - t)i = (1 - 0.20)5\% = 4\%$

Expected after-tax real interest rate = $(1 - t)i - \pi^e = (1 - 0.20)5\% - 2\% = 2\%$

- In reality, there are many different interest rates, each of which depends on the identity of the borrower and the terms of the loan:
 - The prime rate is...
 - *The Federal funds rate is the rate ...*
 - Treasury bills, notes and bonds are ..., and municipal bonds are obligations of ... governments.
- The interest rates charged on these different types of loans need not be the same. One reason is differences in ... (example with default rate 5% and prevailing interest rate 5%).
- Since interest rates often move together, we frequently refer ...
- Yield curve: ...



In Touch Yield Curve



- Government purchases affect desired consumption through ...
- Directly affects desired national saving,

$$S_d = \dots \quad (3)$$

- Government purchases (temporary increase)
 - Higher G financed by higher current taxes reduces ...
 - Even true if financed by ..., if people realize...
 - Since C_d declines ... than G rises, national saving ...
 - So government purchases reduce both ... and ...

- Lump-sum tax cut today, financed by higher future taxes.
- Decline in future income may offset increase in current income; desired consumption could rise or fall.
- *The Ricardian equivalence proposition:* ...
 - ...
- Why does it fail? Short-lived agent, borrowing constraint...

Application: How consumers respond to tax rebates

- The government provided tax rebates in recessions of 2001 and 2007 – 2009, hoping to stimulate the economy.
- Research by Shapiro and Slemrod suggests that consumers did not increase spending much in 2001, when the government provided a similar tax rebate.
- New research by Agarwal, Liu, and Souleles finds that even though consumers originally saved much of the tax rebate, later they increased spending and increased their credit-card debt.
- The new research comes from credit-card payments, purchases, and debt over time.
- People getting the tax rebates initially made additional payments on their credit cards, paying down their balances; but after nine months they had increased their purchases and had more credit-card debt than before the tax rebate (timing).

- (Conti.) Younger people, who were more likely to face binding borrowing constraints, increased their purchases on credit cards the most of any group in response to the tax rebate (borrowing constraint).
- People with high credit limits also tended to pay off more of their balances and spent less, as they were less likely to face binding borrowing constraints and behaved more in the manner suggested by Ricardian equivalence.
- New evidence on the tax rebates in 2008 and 2009 was provided in a research paper by Parker et al.
 - Consumers spent 50% – 90% of the tax rebates.
 - Inconsistent with Ricardian equivalence.



Summary 5

Determinants of Desired National Saving		
An increase in	Causes desired national saving to	Reason
Current output, Y	Rise	Part of the extra income is saved to provide for future consumption.
Expected future output	Fall	Anticipation of future income raises current desired consumption, lowering current desired saving.
Wealth	Fall	Some of the extra wealth is consumed, which reduces saving for given income.
Expected real interest rate, r	Probably rise	An increased return makes saving more attractive, probably outweighing the fact that less must be saved to reach a specific savings target.
Government purchases, G	Fall	Higher government purchases directly lower desired national saving.
Taxes, T	Remain unchanged or rise	Saving doesn't change if consumers take into account an offsetting future tax cut; saving rises if consumers don't take into account a future tax cut and thus reduce current consumption.

How Much Can the Consumer Afford? The Budget Constraint (Two Period Model or Two Goods)

- Current income y ; future income y^f ; initial wealth a .
- Choice variables: a^f = wealth at beginning of future period; c = current consumption; c^f = future consumption

-

$$a^f = \dots$$

so

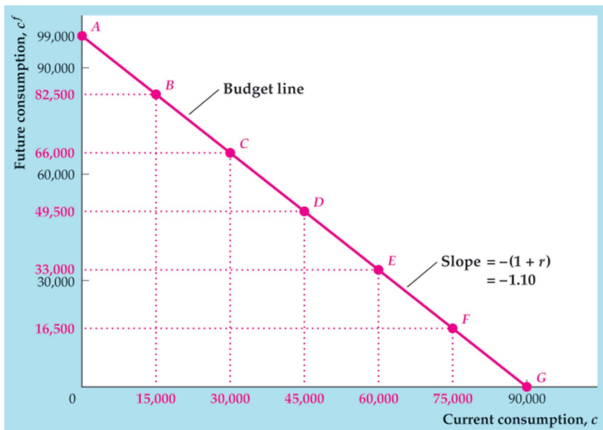
$$c^f = \dots$$

This is the budget constraint.

- The budget line. Graph budget line in (c, c^f) space. (Fig. 4.A.1)
Slope of line = $-(1 + r)$.



Figure 4.A.1 The budget line



Present Values

- Present value is the value of payments to be made in the future in terms of today's dollars or goods.
- Example: At an interest rate of 10%, \$12,000 today invested for one year is worth \$13,200 ($\$12,000 \times 1.10$); so the present value of \$13,200 in one year is \$12,000.
- General formula: Present value = future value/ $(1 + i)$, where amounts are in dollar terms and i is the nominal interest rate.
- Alternatively, if amounts are in real terms, use the real interest rate r instead of the nominal interest rate i .

Present Value and the Budget Constraint

- Present value of lifetime resources:

$$PVLR = y + y^f / (1 + r) + a \quad (4)$$

- Present value of lifetime consumption:

$$PVLC = c + c^f / (1 + r) \quad (5)$$

- The budget constraint means

$$PVLC = PVLR \iff c + c^f / (1 + r) = y + y^f / (1 + r) + a$$

Horizontal intercept of budget line is $c = PVLR, c^f = 0$.

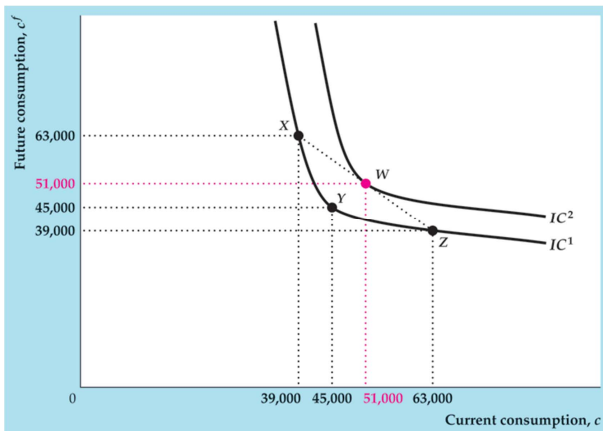
What Does the Consumer Want? Consumer Preferences

- Utility = ...
- Graph a person's preference for current versus future consumption using indifference curves.
- An indifference curve shows ...
- A person is equally happy at ...

Indifference Curve



Figure 4.A.2 Indifference curves



Features of the Indifference Curve

- Slope downward ...
- Indifference curves that are farther up and to the right represent...
- Indifference curves are ... toward ...

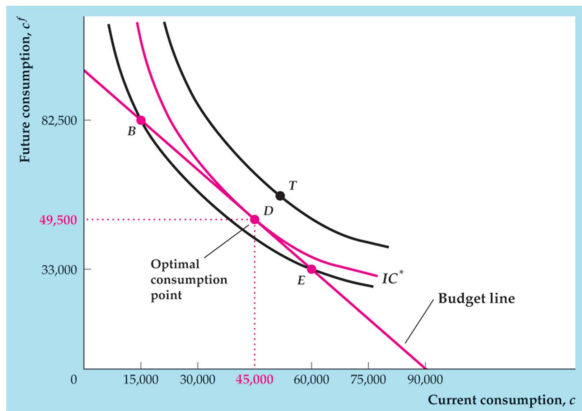
The Optimal Level of Consumption

- Optimal consumption point is where the budget line is tangent to an indifference curve (Fig. 4.A.3).
- That's the highest indifference curve that it's possible to reach.
- All other points on the budget line are on lower indifference curves.

Optimal Consumption



Figure 4.A.3 The optimal consumption combination



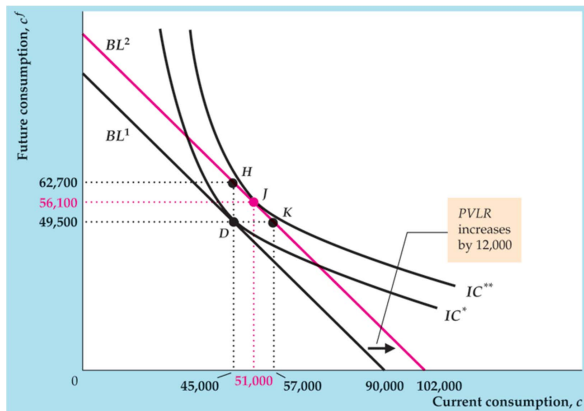
The Effects of Changes in Income and Wealth on Consumption and Saving

- The effect on consumption of a change in income ...
- An increase in current income (Fig. 4.A.4):
 - Increases PVLR, so shifts ...
 - If there is a ... motive, both ...
 - Both consumption and saving...

- (Conti.) An increase in future income (getting a job offer before leaving HKU) ...
- An increase in wealth ...
 - Same parallel shift ...
 - Again, saving ..., since c ... and y is



Figure 4.A.4 An increase in income or wealth



The permanent income theory (Milton Friedman)

- Different types of changes in income:
 - Temporary increase in income: ...
 - Permanent increase in income: ...
- Permanent income increase causes bigger increase in ... than a ...
 - So current consumption will rise ... with a permanent income increase.
 - So saving from a permanent increase in income is ... than from a ...

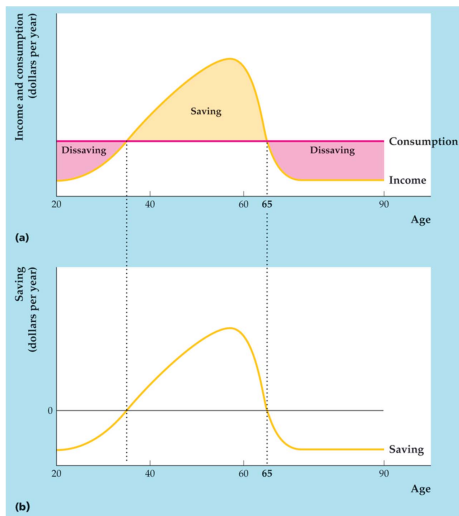
- (Conti.) This distinction between permanent and temporary income changes was made by Milton Friedman in the 1950s and is known as the permanent income theory:
 - ...
- Learning about change in your income (permanent or transitory):
 - Getting a good job offer may not be a permanent change in income.
 - Getting a good internship might not be a temporary change in income.

Life-cycle model (Modigliani)

- A closely related model is the Life-cycle model. It was developed by Franco Modigliani and his followers in the 1950s.
 - Looks at patterns of income, consumption, and saving over an individual's lifetime.
 - Typical consumer's income and saving pattern shown in Fig. 4.A.5.
- Observation 1: Real income steadily ...
- Observation 2: Lifetime pattern of consumption is much ... than income pattern.



Figure 4.A.5
Life-cycle
consumption,
income, and
saving



Consumption and Saving over Life-cycle

- Saving has the following lifetime pattern:
 - Saving is ... early in working life.
 - *Maximum saving occurs when income is highest at ages*
 - Dissaving occurs in ...
- Bequests and saving
 - What effect does a bequest motive (a desire to leave an inheritance) have on saving?
 - ...

- We can use the above two-period model to examine the Ricardian equivalence proposition.
- The two-period model shows that consumption is changed only if the *PVLR* changes:

$$c + c^f / (1 + r) = .. \quad (6)$$

- Suppose the government reduces taxes by 100 in the current period,
...
- Then the *PVLR* ..., and thus there is no change in consumption.
- how can RE fail?

Excess sensitivity and borrowing constraints

- Generally, theories about consumption, including the permanent income theory, have been supported by looking at real-world data.
- But some researchers have found that the data show that the impact of an income or wealth change is different than that implied by a change in the *PVLR*:
- There seems to be excess sensitivity of consumption to *changes in current income*:
 - ...
 - ...
- Borrowing constraints mean ...
 - If a person wouldn't borrow anyway, the borrowing constraint is said to be nonbinding.
 - But if a person wants to borrow and can't, the borrowing constraint is binding.

- (Conti.) A consumer with a binding borrowing constraint spends all...
 - So an increase in income or wealth will be entirely spent on...
 - This causes consumption ...
- How prevalent are borrowing constraints? Perhaps 20% to 50% of the U.S. population faces binding borrowing constraints.
- Natural borrowing limit (zero borrowing limit); endogenous borrowing constraints (income and collateral).

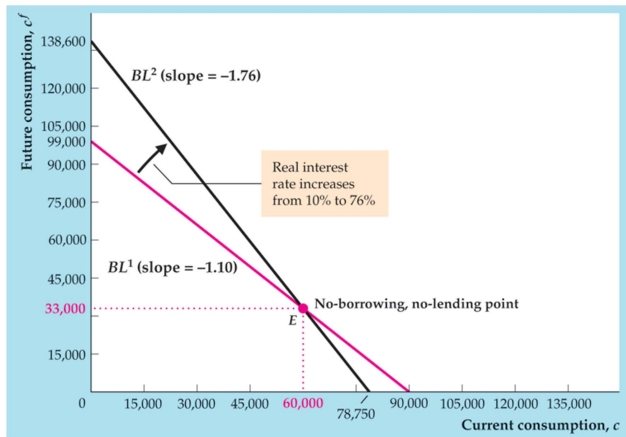
The Real Interest Rate and the Consumption-Saving Decision

- The real interest rate and the budget line (Fig. 4.A.6):
 - When the real interest rate rises, one point on the old budget line is also on the new budget line: the no-borrowing, no-lending point.
 - Slope of new budget line is steeper.

Increase in Interest Rate



Figure 4.A.6 The effect of an increase in the real interest rate on the budget line



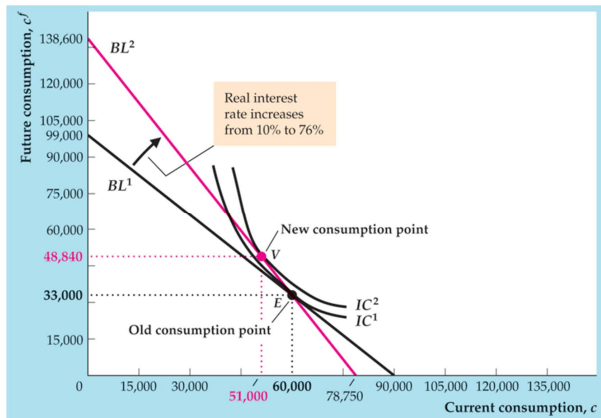
The substitution effect

- A higher real interest rate makes future consumption cheaper relative to current consumption....
- Suppose a person is at the no-borrowing, no-lending point when the real interest rate rises (Fig. 4.A.7):
 - An increase in the real interest rate unambiguously leads...
 - The increase in saving represents the ...

Substitution Effect



Figure 4.A.7 The substitution effect of an increase in the real interest rate



The income effect

- But if a person is planning to consume at a different point than the no-borrowing, no-lending point, there is also an income effect.
- If the person originally planned to be a lender, ...
- If the person originally planned to be a borrower, ...

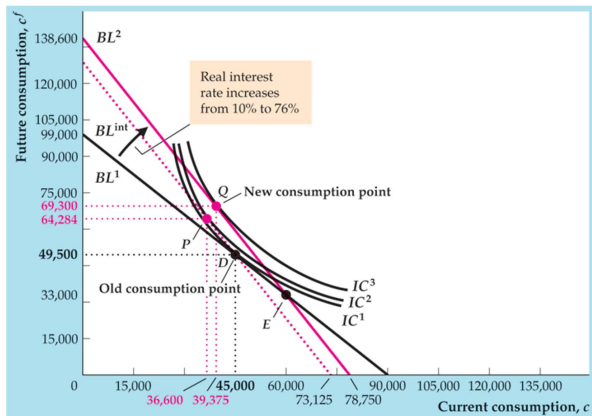
The income and substitution effects together

- The substitution effect decreases current consumption, but the income effect increases current consumption; so saving may increase or decrease.
- Both effects increase future consumption.
- *For a borrower, both effects ...*
- The effect on aggregate saving of a rise in the real interest rate is ambiguous theoretically:
 - Empirical research suggests that saving increases.
 - But the effect is small.
- Summarize change in current and future consumption.

Two Effects



Figure 4.A.8 An increase in the real interest rate with both an income effect and a substitution effect



Why is investment important?

- The decision about how much to invest depends ...
- Investment fluctuates sharply over
- Investment plays a crucial role in ...

The desired capital stock

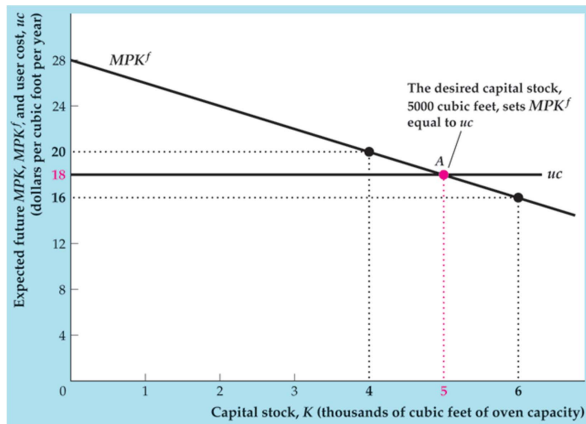
- *Desired capital stock* is the amount of capital ...
- Since investment becomes capital stock with a lag, the benefit of investment is ...
- The user cost of capital. Example of Kyle's Bakery: cost of capital, depreciation rate, and expected real interest rate
 - User cost of capital = real cost of using a unit of capital for a specified period of time = real interest cost + depreciation:

$$uc = \dots p_K. \quad (7)$$

- Determining the desired capital stock (Fig. 4.3).



Figure 4.3 Determination of the desired capital stock



- (Conti.) Desired capital stock is the level of capital stock at which $MPK^f = uc$.
- MPK^f falls as K rises due to diminishing marginal productivity.
- uc doesn't vary with K , so is a horizontal line.
- If $MPK^f > uc$, profits rise as K is added (marginal benefits $>$ marginal costs).
- If $MPK^f < uc$, profits rise as K is reduced (marginal benefits $<$ marginal costs).
- Profits are maximized where $MPK^f = uc$.

Changes in the desired capital stock

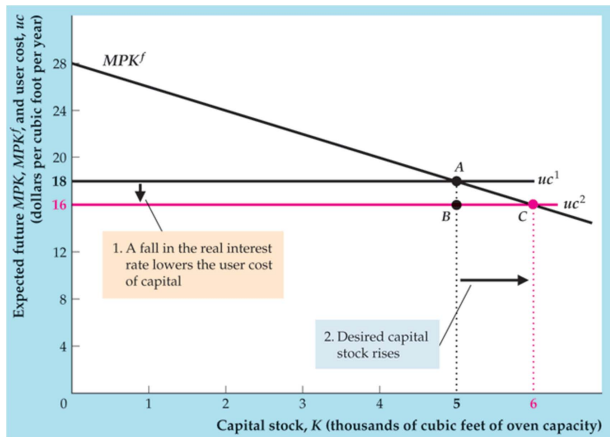
- Factors that shift the MPK^f curve or change the user cost of capital cause the desired capital stock to change.
- These factors are changes in the real interest rate, depreciation rate, price of capital, or technological changes that...
- Taxes and the desired capital stock
 - With taxes, the return to capital is only...
- A firm chooses its desired capital stock so that the return equals the user cost, so $(1 - \tau)MPK^f = uc$, which means:

$$MPK^f = uc / \dots = (r + d)p_K / \dots \quad (8)$$

Decline in Real Interest Rate



Figure 4.4 A decline in the real interest rate raises the desired capital stock



- (Conti.) Tax-adjusted user cost of capital is $uc/(1 - \tau)$.
- An increase in τ raises the tax-adjusted user cost and reduces the desired capital stock.
 - So depreciation allowances reduce the tax paid by firms, because they reduce profits.
- Investment tax credits reduce taxes when firms make new investments.
- In reality, there are complications to the tax-adjusted user cost
 - Summary measure: the effective tax rate—
 - Table 4.2 shows effective tax rates for many different countries.

Effective Tax Rate: No Clear Relationship



Table 4.2 Effective Tax Rate on Capital, 2007

	ETR	I/GDP		ETR	I/GDP
Australia	29.3	27.7	Korea (Rep. of)	37.1	28.8
Austria	26.4	22.2	Luxembourg	19.1	19.6
Belgium	-3.4	21.7	Mexico	15.4	20.8
Canada	31.9	22.6	Netherlands	16.6	20.0
Czech Republic	17.0	24.3	New Zealand	20.1	22.9
Denmark	18.6	22.2	Norway	24.5	21.3
Finland	20.1	20.3	Poland	14.0	21.7
France	35.9	21.5	Portugal	19.0	21.8
Germany	35.1	18.7	Slovak Republic	12.6	26.1
Greece	11.9	22.5	Spain	28.7	31.0
Hungary	13.5	21.0	Sweden	21.1	19.0
Iceland	12.8	27.5	Switzerland	17.2	22.0
Ireland	13.2	26.3	Turkey	9.2	21.5
Italy	33.4	21.1	United Kingdom	30.3	17.8
Japan	35.0	23.2	United States	36.0	18.4

Note: ETR is effective tax rate on capital in 2007, in percent. I/GDP is the ratio of gross capital formation to GDP, in percent, for 2007.

Sources: ETR from Duanjie Chen and Jack Mintz, *Still a Wallflower: The 2008 Report on Canada's International Tax Competitiveness* (Toronto: C. D. Howe Institute, 2008): Table 1, p. 3. I/GDP from Organization for Economic Cooperation and Development, OECD Factbook 2009, www.oecd.org.

Application: measuring the effects of taxes on investment

- Do changes in the tax rate have a significant effect on investment?
- A 1994 study by Cummins, Hubbard, and Hassett found that after major tax reforms, investment responded strongly; elasticity about -0.66 (of investment to user cost of capital).

From the desired capital stock to investment

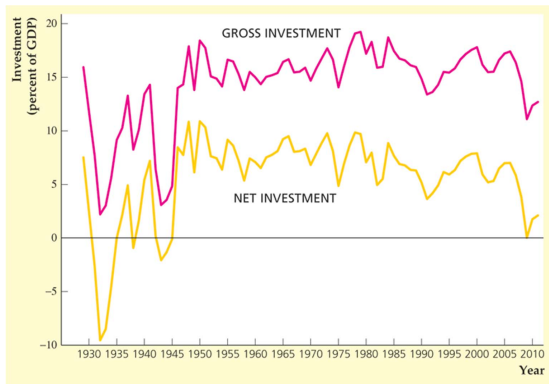
- The capital stock changes from two opposing channels
 - New capital increases the capital stock; this is gross investment.
 - The capital stock depreciates, which reduces the capital stock.
- Net investment = gross investment (I) minus ...

$$K_{t+1} - K_t = I_t \dots, \quad (9)$$

where net investment equals the change in the capital stock. Fig. 4.6 shows gross and net investment for the U.S.



Figure 4.6 Gross and net investment, 1929-2011



Sources: GDP, gross private domestic investment, and net private domestic investment from BEA Web site, Tables 1.1.5, 5.1, and 5.2.5.

Three features of Investment: Think About Reality

- Large fixed cost → Inaction and abrupt investment.
- Convex adjustment cost → Smooth investment.
- Complete or partially irreversible → Negative investment is rare.

Inaction and Investment

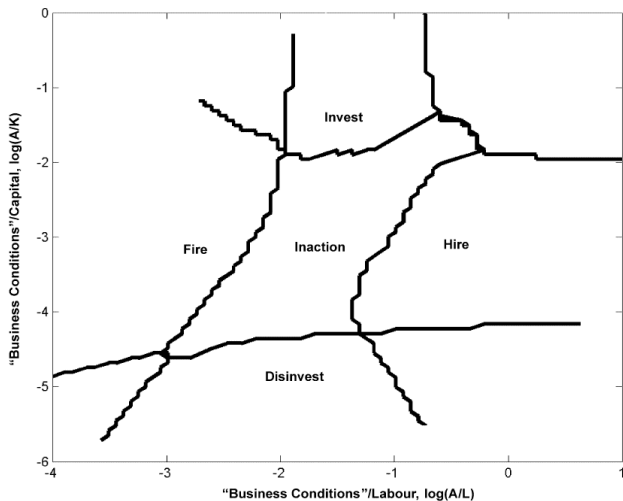


FIGURE 4.—Hiring/firing and investment/disinvestment thresholds. Simulated thresholds using the adjustment cost estimates from the column All in Table III. Although the optimal policies are of the (s, S) type, it cannot be proven that this is always the case.

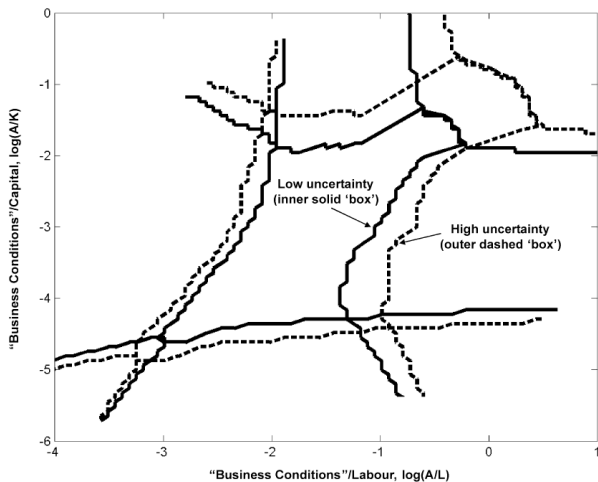


FIGURE 5.—Thresholds at low and high uncertainty. Simulated thresholds using the adjustment cost estimates from the column All in Table III. High uncertainty is twice the value of low uncertainty ($\sigma_H = 2 \times \sigma_L$).

- (Conti.) Rewriting the above equation gives

$$I_t = K_{t+1} - K_t + dK_t \quad (10)$$

If firms can change their capital stocks in one period, then the desired capital stock (K^*) = K_{t+1} .

- Thus investment has two parts: ...
- Lags and investment
 - Some capital can be constructed easily, but other capital may take years to put in place.
 - So investment needed to reach the desired capital stock may be spread out over several years.

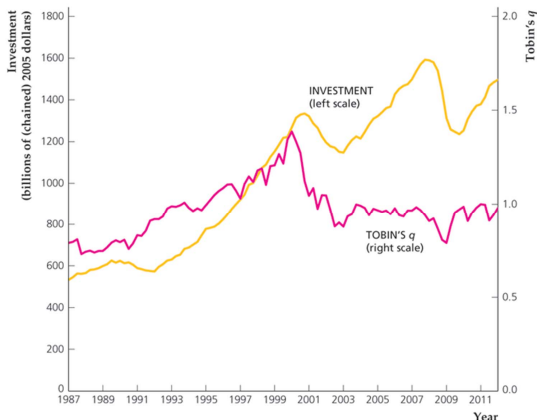
In touch with data and research: investment and the stock market

- Firms change investment in the same direction as the stock market: Tobin's q theory of investment.
- If market value $>$ replacement cost, ...
- Tobin's $q = \dots$
 - If $q < 1$, ...
 - If $q > 1$, ...
- Stock price times number of shares equals firm's market value, which equals value of firm's capital:
 - Formula: $q = V / (p_K K)$ (average q), ...
 - So $p_K K$ is the replacement cost of firm's capital stock.
 - Stock market boom raises V , causing q to ... investment.

- (Conti.) Data show general tendency of investment to rise when stock market rises; but relationship isn't strong because many other things change at the same time (Figure 4.7)
- This theory is similar to text discussion:
 - Higher MPK^f increases future earnings of firm, so V rises.
 - A falling real interest rate also raises V as people ...
 - A decrease in the cost of capital, p_K , raises ...
- Investment sensitivity to cash flow (importance of financial constraints): Unexpected change in oil prices; winning lawsuits.



Figure 4.7 Investment and Tobin's q , 1987-2012



Source: Investment from authors' calculations based on real nonfinancial fixed investment quantity index at bea.gov/iTable and real nonfinancial fixed investment in 2005 dollars from St. Louis Fed Web site at research.stlouisfed.org/fred2/series/PNFIC1; Tobin's q from Federal Reserve Flow of Funds Accounts, Table B.102, for nonfarm nonfinancial corporate business, market value plus liabilities divided by assets.

- For two other components of investment: inventory investment and residential investment.
- The concepts of future marginal product of capital and user cost apply equally, as with equipment and structures.
- The car dealer case.



Summary 6

Determinants of Desired Investment

An increase in	Causes desired investment to	Reason
Real interest rate, r	Fall	The user cost increases, which reduces desired capital stock.
Effective tax rate, τ	Fall	The tax-adjusted user cost increases, which reduces desired capital stock.
Expected future MPK	Rise	The desired capital stock increases.

Goods market equilibrium condition

- The real interest rate adjusts to bring the goods market into equilibrium:

$$Y = \dots \quad (11)$$

- Differs from income-expenditure identity, as goods market equilibrium condition need not hold; undesired goods may be produced, so goods market won't be in equilibrium.
- Alternative representation: since

$$S^d = \dots$$

we have

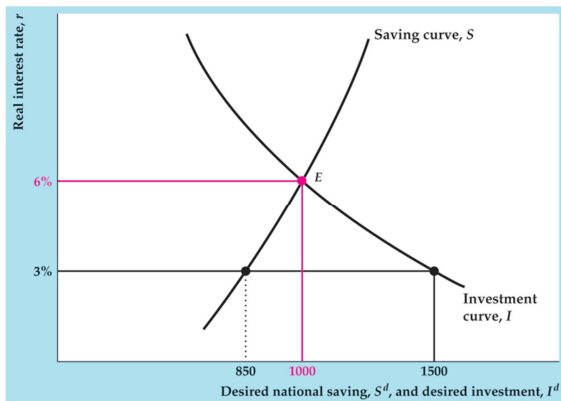
$$S^d = I^d.$$

- The saving-investment diagram: Plot S^d vs. I^d (Fig. 4.8). How to reach equilibrium? Adjustment of r . See text example (Table 4.3).

Good Market Equilibrium



Figure 4.8 Goods market equilibrium



Components of Aggregate Demand



Table 4.3 Components of Aggregate Demand for Goods (An Example)

Real Interest Rate, r	Output, Y	Desired Consumption, C^d	Desired Investment, I^d	Government Purchases, G	Desired National Saving, $S^d = Y - C^d - G$	Aggregate Demand for Goods, $C^d + I^d + G$
3%	4500	2150	1500	1500	850	5150
6%	4500	2000	1000	1500	1000	4500

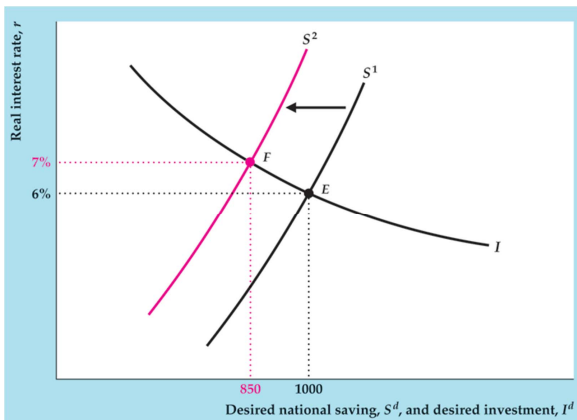
Shifts of the saving curve

- Saving curve shifts right due to a rise in current output, a fall in expected future output, a fall in wealth, a fall in government purchases, a rise in taxes (unless Ricardian equivalence holds, in which case tax changes have no effect).
- Example: Temporary increase in government purchases shifts S left.
- Result of lower savings: higher r , causing crowding out of I (Fig. 4.8).

Decline in Desired Saving



Figure 4.9 A decline in desired saving



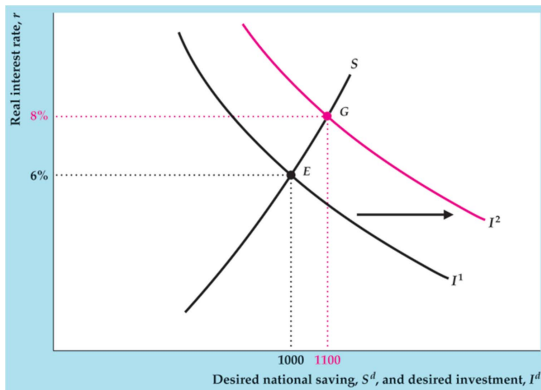
Shifts of the investment curve

- Investment curve shifts right due to a fall in the effective tax rate or a rise in expected future marginal productivity of capital.
- Result of increased investment: higher r , higher S and I (Fig. 4.9).

Increase in Desired Investment



Figure 4.10 An increase in desired investment

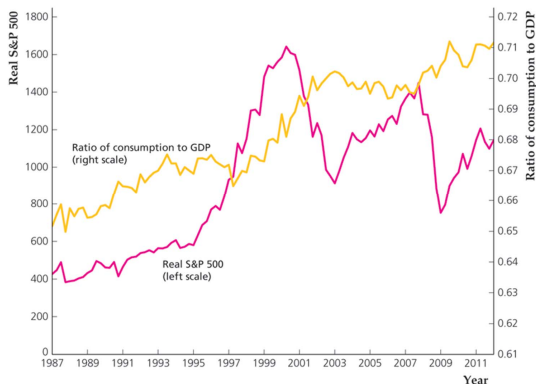


Application: Macroeconomic consequences of the boom and bust in stock prices

- Sharp changes in stock prices affect ...
- Data in Fig. 4.11.



Figure 4.11 Real U.S. stock prices and the ratio of consumption to GDP, 1987-2012



Source: S&P 500 from Yahoo finance Web site, finance.yahoo.com; real S&P 500 calculated as S&P 500 divided by GDP deflator; GDP deflator, consumption spending, and GDP from St. Louis Fed Web site at research.stlouisfed.org/fred2 series GDPDEF, PCEC, and GDP, respectively.

The boom and bust in stock prices

- Consumption and the 1987 crash
 - When the stock market crashed in 1987, wealth declined by about \$1 trillion.
 - *Consumption fell somewhat less than might be expected, and it wasn't enough to cause a recession.*
 - There was a temporary decline in confidence about the future, but it was quickly reversed.
 - The small response may have been because there had been a large run-up in stock prices between December 1986 and August 1987, so the crash mostly erased ...
- Consumption and the rise in stock market wealth in the 1990s
 - Stock prices more than tripled in real terms.
 - But consumption was not strongly affected by the runup in stock prices.

- (Conti.) Consumption and the decline in stock prices in the early 2000s
 - In the early 2000s, wealth in stocks declined by about \$5 trillion.
 - But consumption spending increased as a share of GDP in that period.
- Investment and the declines in the stock market in the 2000s

- (Conti.) The financial crisis of 2008
 - Stock prices plunged in fall 2008 and early 2009, and home prices fell sharply as well, leading to a large decline in household net wealth.
 - Despite the decline in wealth, the ratio of consumption to GDP did not decline much.