Topic 3: Consumption, Savings and Investment

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Chapter Outline

- 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.

Consumption

- Income-expenditure identity

$$Y = C + I + G$$

$NX = 0$ for a closed economy

where

Y = aggregate output = aggregate income = GDP

$C + I + G$ = aggregate expenditure

G is determined primarily by political process, taken as given (exogenous variable)

Consumption

- Consumption (C)
  - total spending by households on final goods (durable and nondurable goods) and services
  - consumption amount desired by households (HHs) given income and other factors that determine HHs' economic opportunities.
  - We can analyze desired consumption and its response to various factors, such as income and the interest rates, by examining the consumption decisions of individuals.
- Why C is important?
  - The major component of aggregate expenditure
  - Economic welfare depends in large part on C
  - Consumption decision is closely linked to savings decision, savings decision important for growth and external balances

The importance of consumption and saving

- Desired consumption (C_d)
  - aggregate consumption by households
  - C_d, is obtained by adding up the desired consumption of all households.
  - Any factor that affects individual hhs' desired consumption will affect C_d.
- National savings

$$S = (Y - T - C) + (T - G)$$

- Desired national saving (S_d): level of national saving when consumption is at its desired level:

$$S_d = Y - C_d - G$$

National savings

- Components of national savings
  - Household savings
  - Corporate savings
  - Government savings
- Mainly focusing on household savings in this unit

The consumption and saving decision of an individual

- A person can consume less than current income (saving is positive).
- A person can consume more than current income (saving is negative).
- Individual household savings (s): difference between current disposable income (y) and household consumption (c)

$$s = y - c$$

s can be negative (dis-savings)

The consumption and saving decision of an individual

- Trade-off between current consumption and future consumption:
  - The price of 1 unit of current consumption is $1 + r$ units of future consumption, where r is the real interest rate.
  - r also represents the opportunity cost of current consumption
- Assumption
  - Individuals dislike fluctuations in their consumption and like smooth consumption.
- Consumption-smoothing: look at lifetime resources and spread their current and future consumption evenly
  - lifetime resources: wealth, current income, expected future income
  - wealth = assets - liabilities
  - assets: bank deposits, bonds, shares
  - liabilities: loans

Effect of changes in current income

- Increase in current income: both consumption and saving increase (vice versa for decrease in current income).
- *MPC*: marginal propensity to consume

  fraction of additional current disposable income consumed in current period $\Delta c/\Delta y$
- *MPS*: marginal propensity to save

  fraction of additional current disposable income saved in current period $\Delta s/\Delta y$
- Both propensities
  - $0 < MPC < 1$, $0 < MPS < 1$
  - why?
  - normal goods

Effect of changes in current income

- Changes in current income
  - Individual level:
    Given $0 < MPC < 1$, $0 < MPS < 1$
    current income rises (falls), both current consumption and savings rise (fall)
  - Individual HHs' consumption decisions also apply at the macro-level.
  - Aggregate level: When current income (Y) rises (falls), C_d rises (falls), but not by as much as Y, so S_d rises (falls).

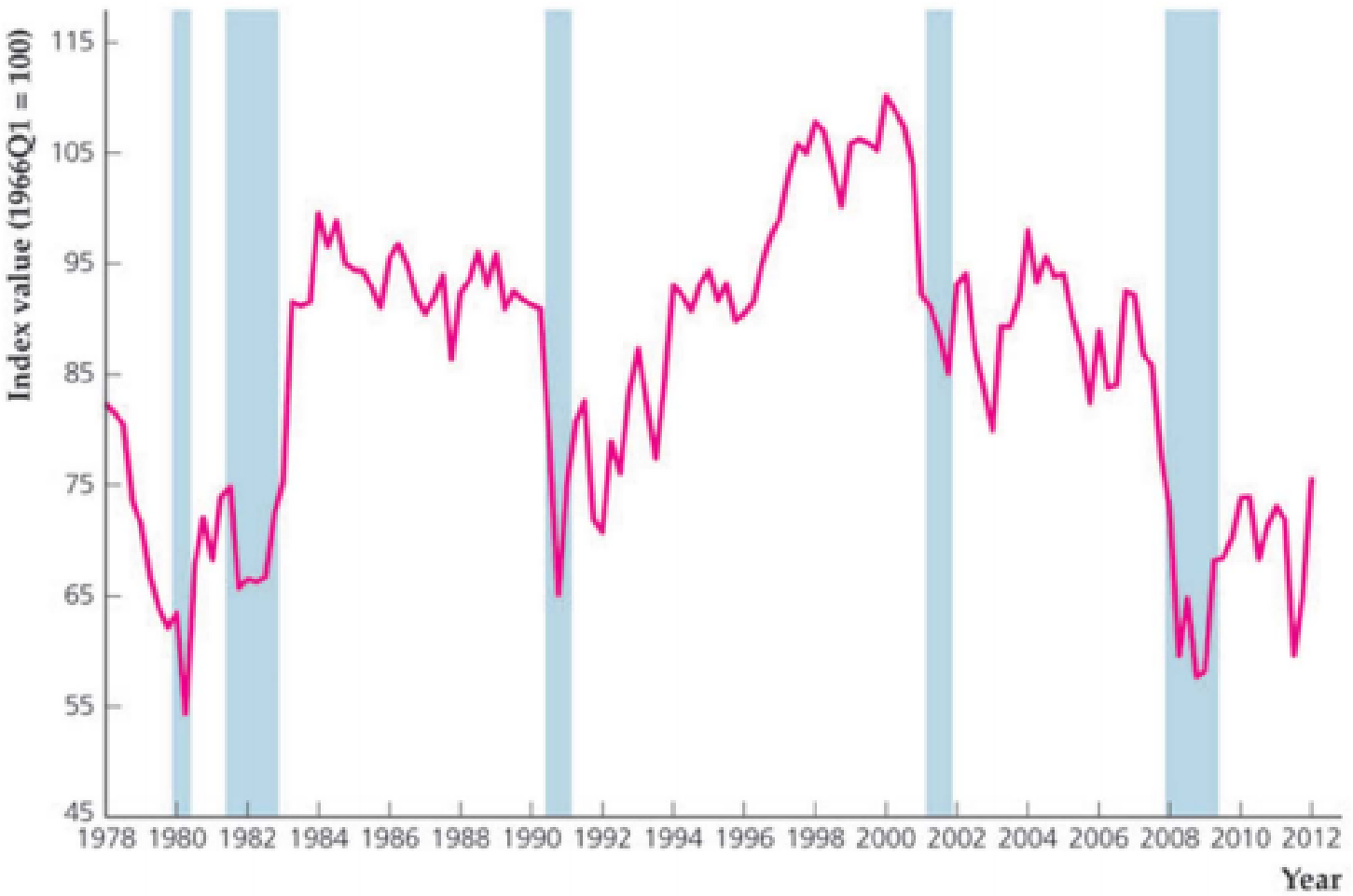
Effect of changes in expected future income

- Today's consumption decisions may depend not only on current income but also on the income that one expects to earn in the future.
- Higher expected future income is likely to lead the consumer to increase current consumption and reduce current saving.
- 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 increase and S_d should decrease.

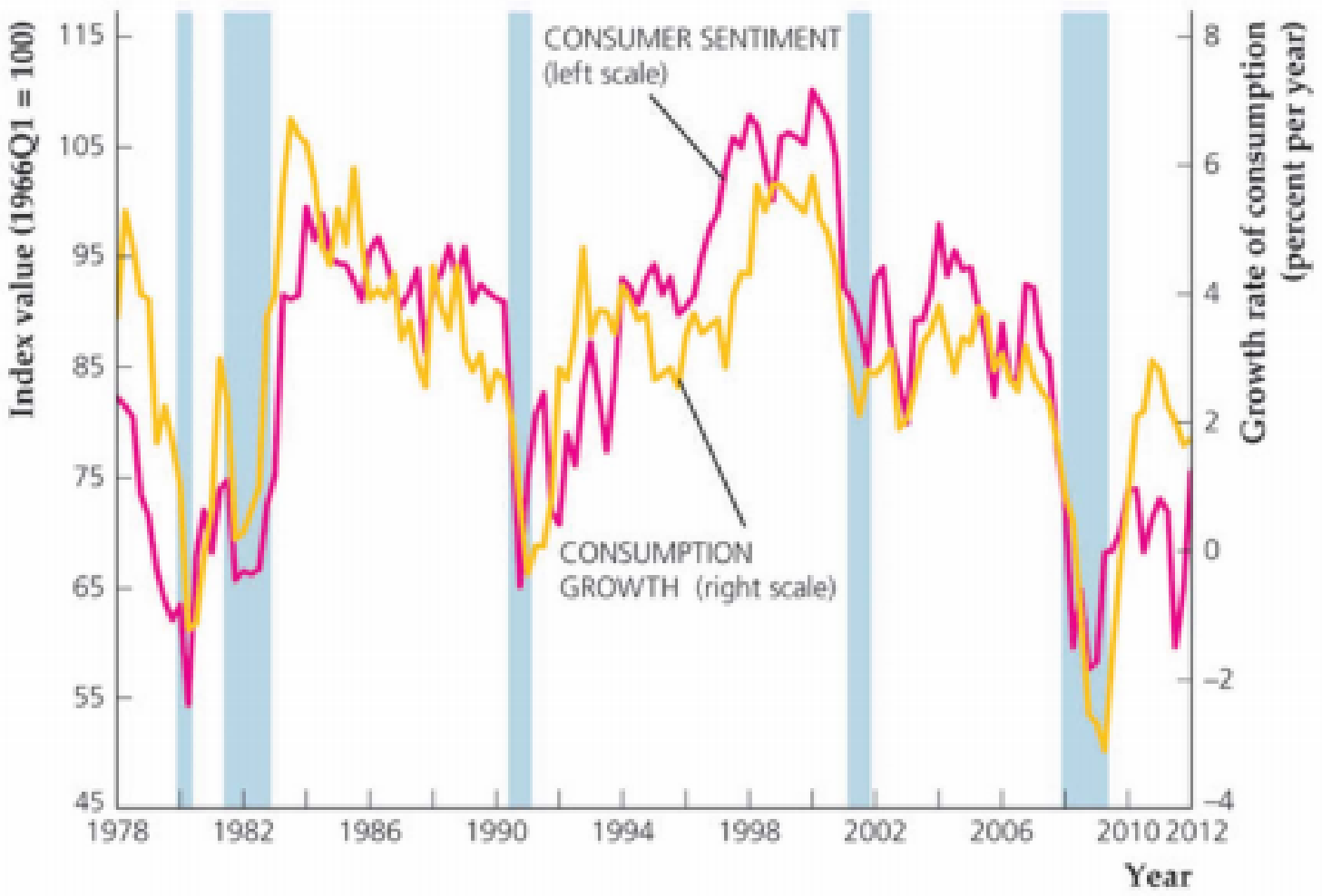
Application: consumer sentiment and forecasts of consumer spending

- Do consumer sentiment indexes help economists forecast consumer spending?
- Data do not seem to give much warning before recessions.
- Data on consumer spending are correlated with data on consumer confidence.
- But formal statistical analysis shows that data on consumer confidence do not improve forecasts of consumer spending based on real-time data.

Consumer Sentiment, 1978Q1-2012Q1



Consumer Sentiment and Consumption Spending Growth, 1978Q1-2012Q1



Effect of changes in wealth

- Increase in wealth raises current consumption, so lowers current saving. For example, an increase in wealth from a unanticipated bequest has the same effect on the consumer's available resources as the same amount increase in current income.
- The ups and downs in the stock market are an important source of changes in wealth and thus have significant impacts on consumption.

Effect of changes in real interest rate

- Increased real IR has two opposing effects:
  - *Substitution effect*: Positive effect on saving, since rate of return is higher; this increased reward for current saving tends to increase saving.
  - *Income effect*: The consumer can achieve any future savings target with a smaller amount of current saving. For a saver: Negative effect on saving, since it takes less saving to obtain a given amount in the future (target saving).
  - For a borrower who is a payer of interest: both the substitution effect and the income effect operate to increase saving. Consequently, the saving of a borrower unambiguously increases (a loss of wealth).

Effect of changes in real interest rate

- Changes in real interest rate r:

  At the aggregate level

  - National savings: empirical studies have mixed results; the increase in aggregate saving from an increase in the real interest rate is not significant (substitution effect dominates when aggregating).
  - Upward sloping national savings curve

- Taxes and the real return to saving. Expected after-tax real IR:

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

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

Calculating After-Tax Interest Rates

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

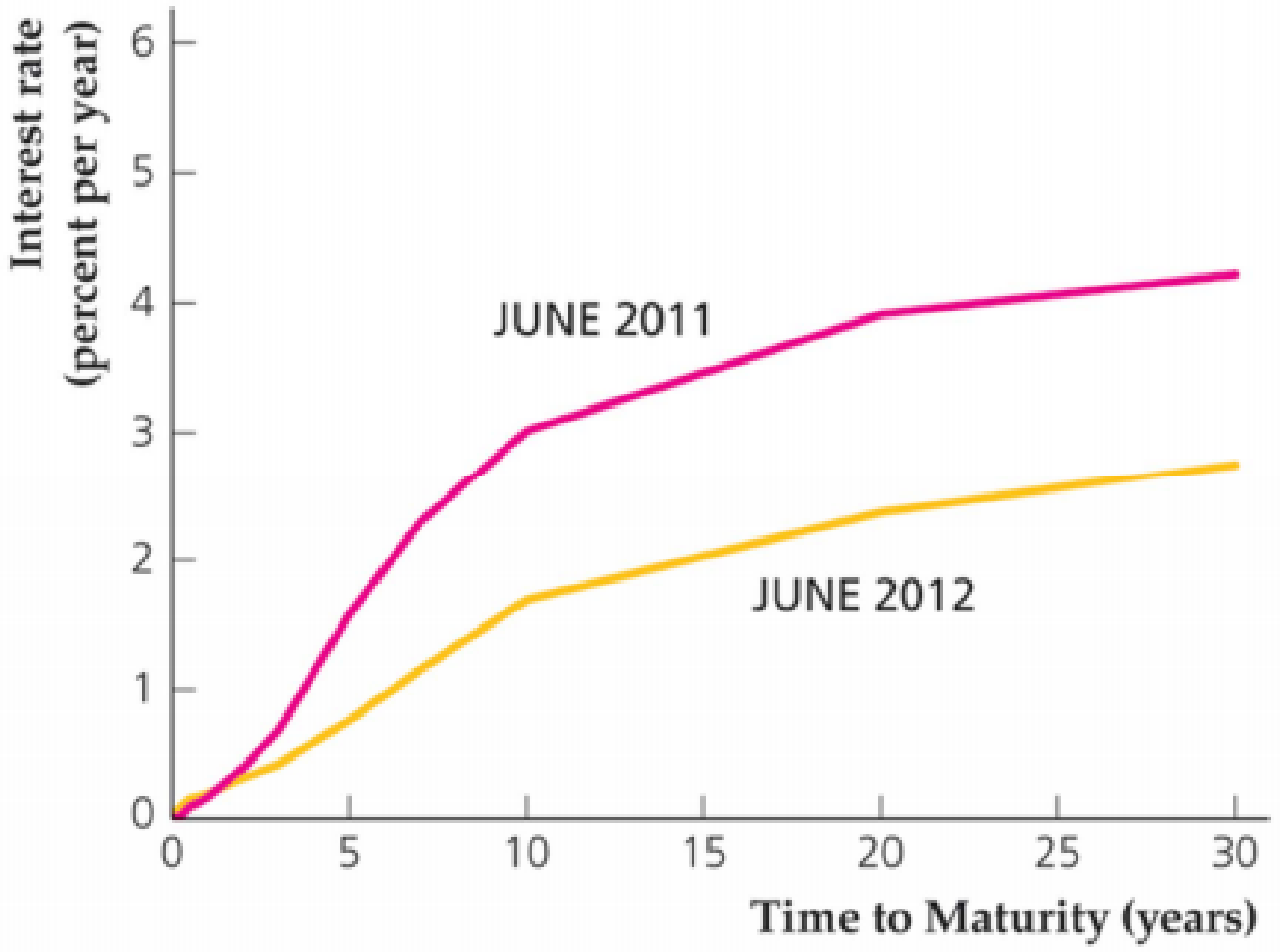
Example 1
t = tax rate on interest income = 30%
After-tax nominal interest rate = $(1 - t)i = (1 - 0.30)5\% = 3.5\%$
Expected after-tax real interest rate = $(1 - t)i - \pi^e = (1 - 0.30)5\% - 2\% = 1.5\%$

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 touch with data and research: interest

- In reality, there are many different IRs, each of which depends on the identity of the borrower and the terms of the loan:
  - The prime rate is the basic rate that banks charge on loans to their best customers.
  - The Federal funds rate is the rate at which banks make overnight loans to one another.
  - Treasury bills, notes and bonds are debts of the U.S. govt., and municipal bonds are obligations of state and local govt.
- The IRs charged on these different types of loans need not be the same. One reason is differences in the risk of nonrepayment or default.
- Since IRs often move together, we frequently refer to "the" interest rate.
- Yield curve: relationship between life of a bond and the IR it pays.

In Touch Yield Curve



Fiscal policy: Government purchases

- Government purchases affects desired consumption through changes in current and expected future income.
- Directly affects desired national saving,

$$S_d = Y - C_d - G$$

- Government purchases (temporary increase)
  - Higher G financed by higher current taxes reduces *after-tax* income, lowering desired consumption.
  - Even true if financed by higher future taxes, if people realize how future incomes are affected.
  - Since C_d declines less than G rises, national saving ($S_d = Y - C_d - G$) declines.
  - So government purchases reduce both desired consumption and desired national saving.

Fiscal policy: Taxes

- 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*: If future income loss exactly offsets current income gain, no change in consumption.
  - Tax change affects only the timing of taxes, not their ultimate amount (present value).
  - In practice, people may not see that future taxes will rise if taxes are cut today; then a tax cut leads to increased desired consumption and reduced desired national saving.

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.

Application: How consumers respond to tax rebates

- 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.
- 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

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

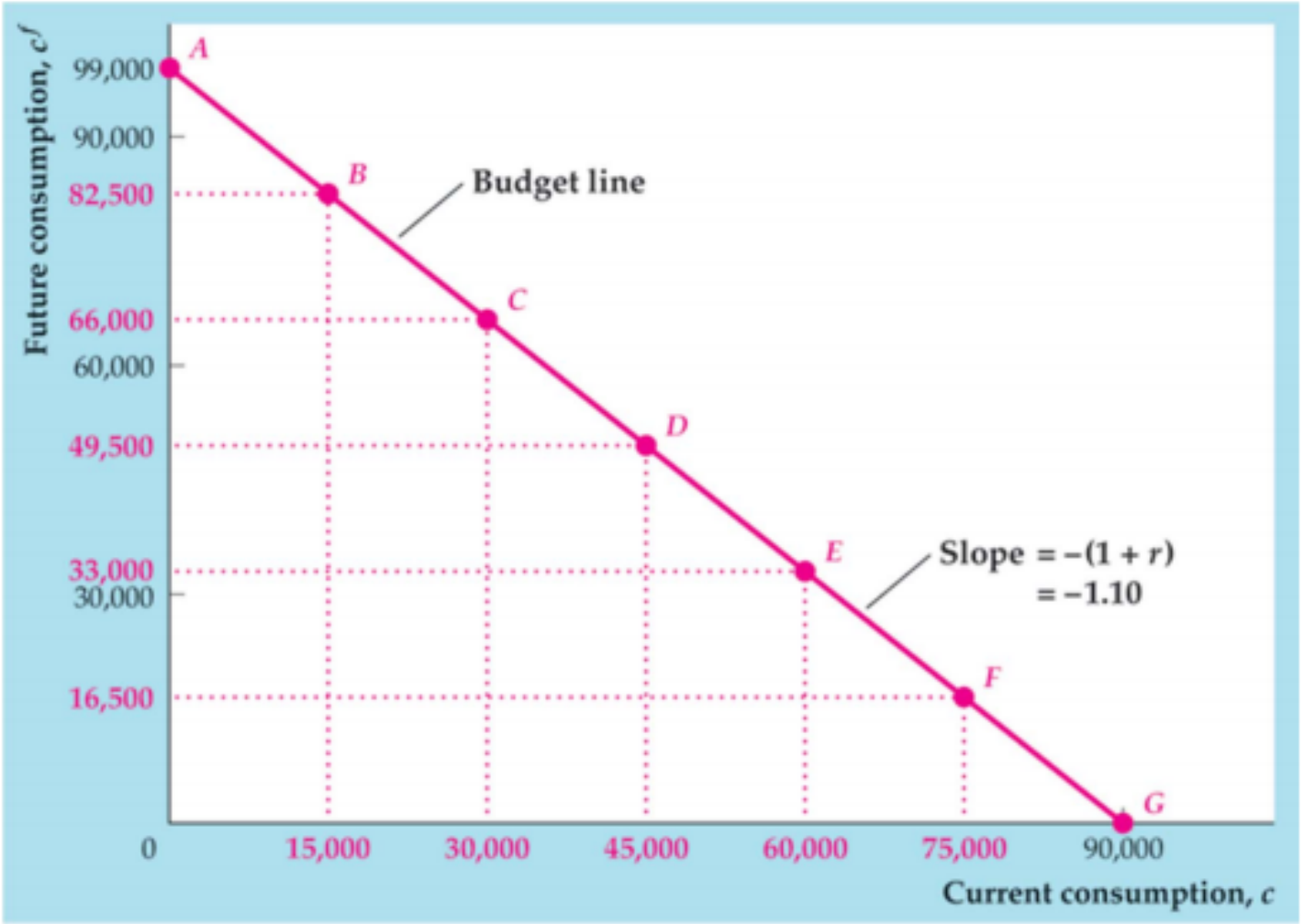
- Current income y; future income y^f; initial wealth a.
- Choice variables: a^f = wealth at beginning of future period; c = current consumption; c^f = future consumption
- $a^f = (y + a - c)(1 + r)$

  so

  $c^f = (y + a - c)(1 + r) + y^f$

  This is the budget constraint.
- The budget line. Graph budget line (c, c^f) space. Slope of line $= -(1 + r)$.

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 IR 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 IR.
- Alternatively, if amounts are in real terms, use the real interest rate r instead of the nominal IR i.

Present Value and the Budget Constraint

- Present value of lifetime resources:

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

- Present value of lifetime consumption:

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

- The budget constraint means

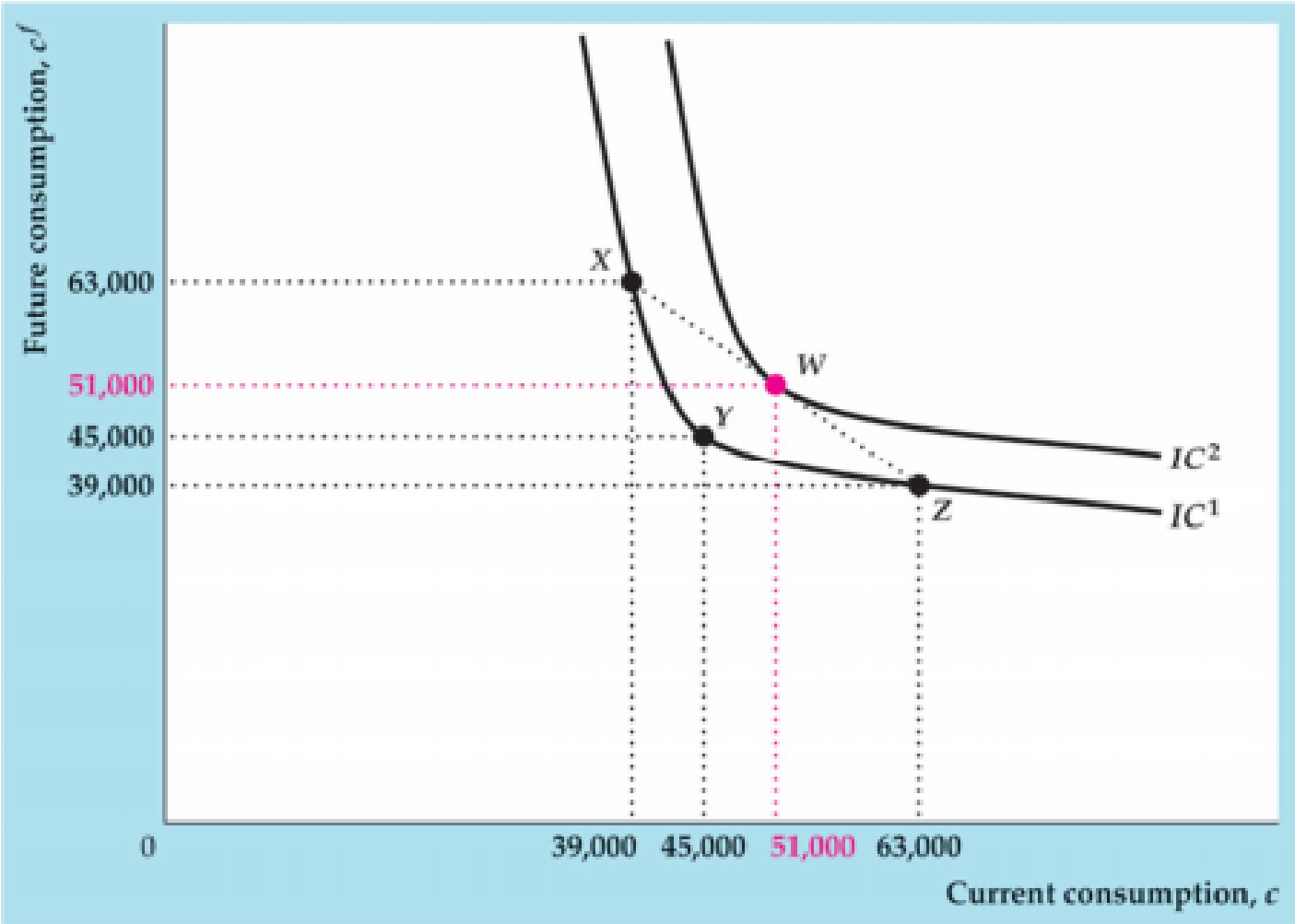
$$PVLC = PVLR \Leftrightarrow c + c^f/(1+r) = y + y^f/(1+r) + a$$

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

What Does the Consumer Want? Consumer Preferences

- Utility = a person's satisfaction or well-being.
- Graph a person's preference for current versus future consumption using indifference curves.
- An indifference curve shows combinations of c and c^f that give the same utility.
- A person is equally happy at any point on an indifference curve

Indifference curves



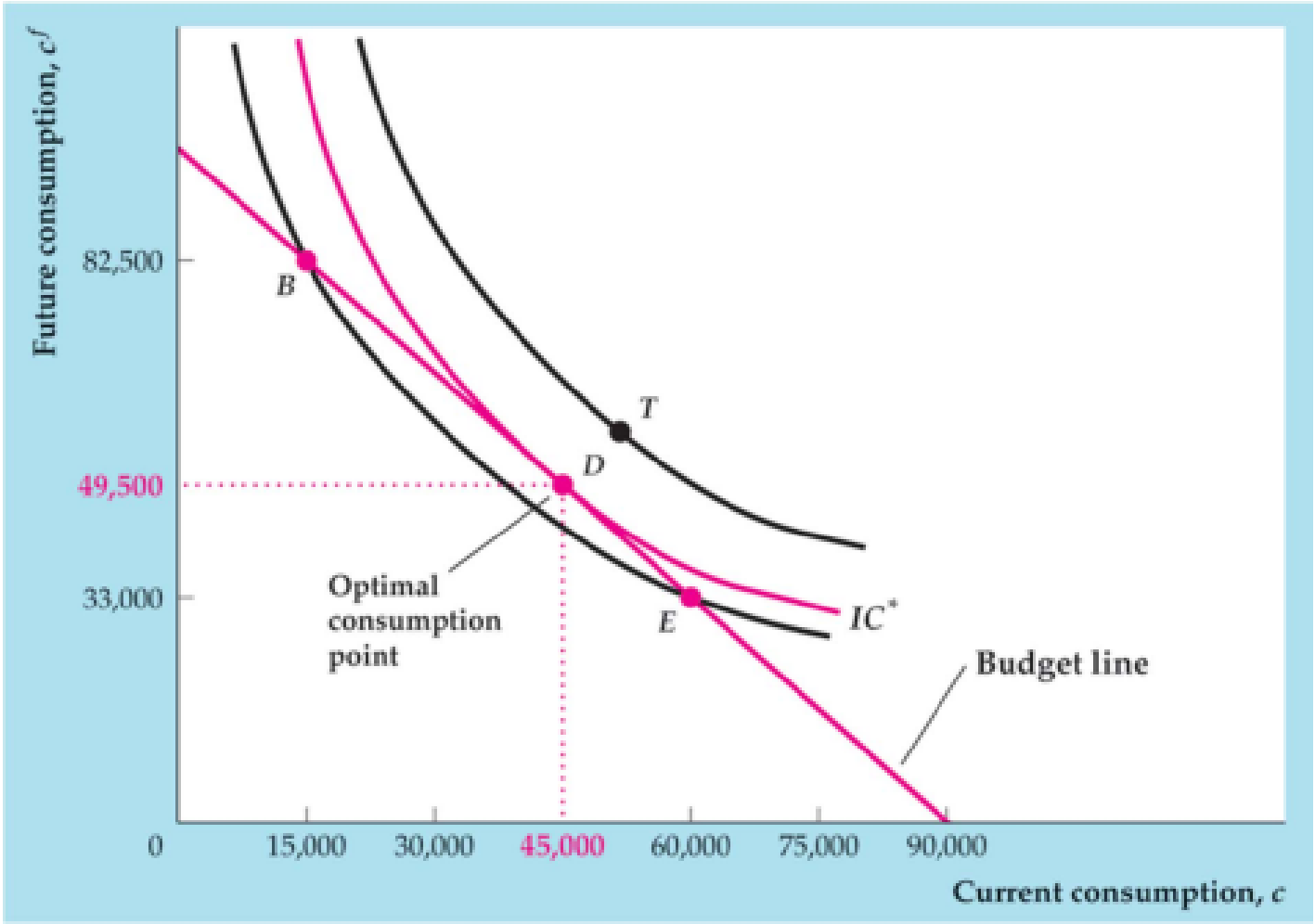
Features of the Indifference Curve

- Slope downward from left to right: Less consumption in one period requires more consumption in the other period to keep utility unchanged.
- Indifference curves that are farther up and to the right represent higher levels of utility, because more consumption is preferred to less.
- Indifference curves are bowed toward the origin, because people have a consumption-smoothing motive, they prefer consuming equal amounts in each period rather than consuming a lot one period and little the other period.

The Optimal Level of Consumption

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

The optimal consumption combination



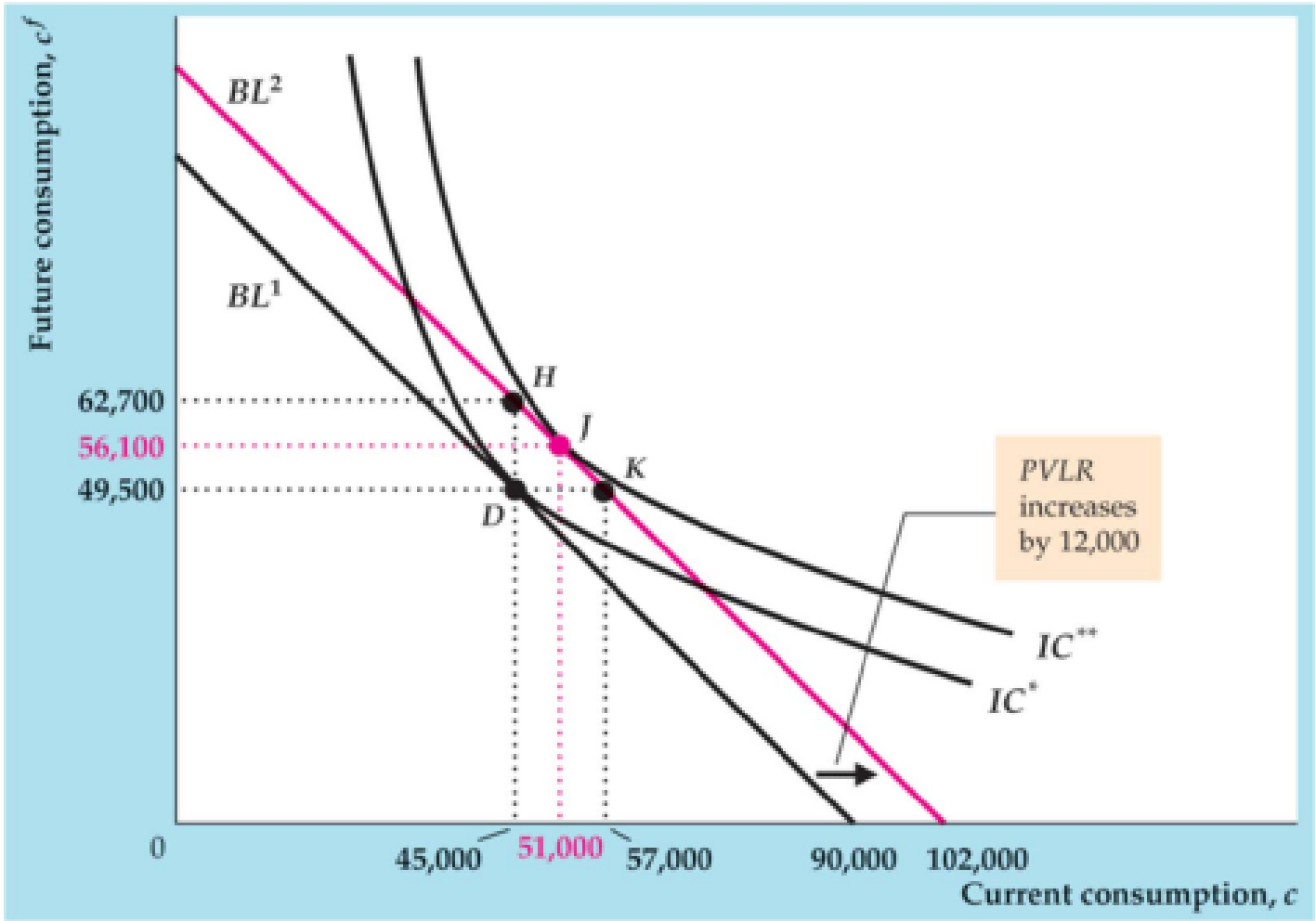
The Effects of Changes in Income and Wealth on Consumption and Saving

- The effect on consumption of a change in income (current or future) or wealth depends only on how the change affects the *PVLR*.
- An increase in current income:
  - Increases *PVLR*, so shifts budget line out parallel to old budget line.
  - If there is a consumption-smoothing motive, both current and future consumption will increase.
  - Then both consumption and saving rise because of the rise in current income.

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

- An increase in future income:
  - Same outward shift in budget line as an increase in current income.
  - Again, with consumption smoothing, both current and future consumption increase.
  - Now saving declines, since current income is unchanged and current consumption increases.
- An increase in wealth:
  - Same parallel shift in budget line, so both current and future consumption rise.
  - Again, saving declines, since c rises and y is unchanged.

An increase in income or wealth



The permanent income theory

- Different types of changes in income:
  - Temporary increase in income: y rises and y^f is unchanged.
  - Permanent increase in income: Both y and y^f rise.
- Permanent income increase causes bigger increase in $PVLR$ than a temporary income increase:
  - So current consumption will rise more with a permanent income increase.
  - So saving from a permanent increase in income is less than from a temporary increase in income.

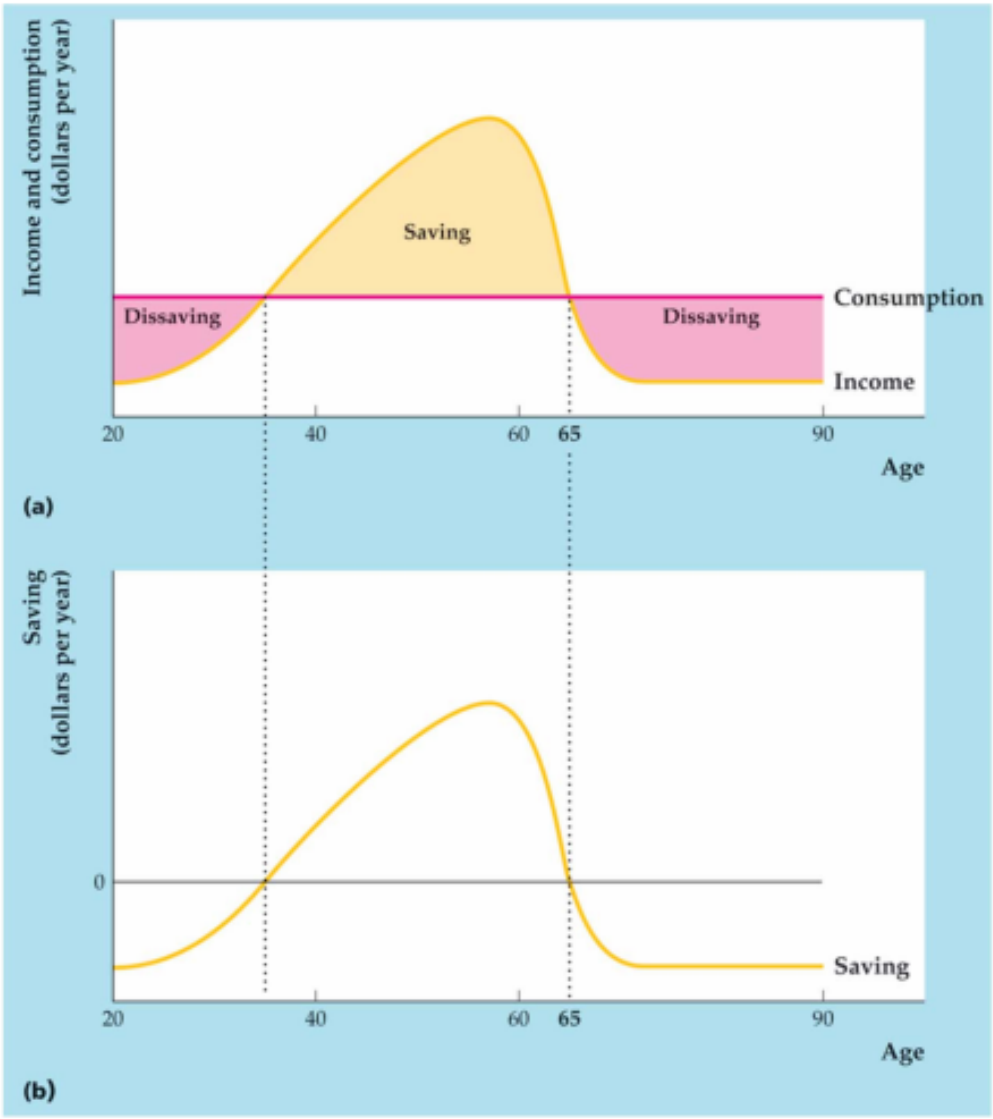
The permanent income theory

- This distinction between permanent and temporary income changes was made by Milton Friedman in the 1950s and is known as the permanent income theory:
  - Permanent changes in income lead to much larger changes in consumption.
  - Thus permanent income changes are mostly consumed, while temporary income changes are mostly saved.

Life-cycle model

- 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.
- Observation 1: Real income steadily rises over time until near retirement; at retirement, income drops sharply.
- Observation 2: Lifetime pattern of consumption is much smoother than the income pattern.

Life-cycle consumption, income, and saving



Consumption and Saving over Life-cycle

- Saving has the following lifetime pattern:
  - Saving is low or negative early in working life.
  - Maximum saving occurs when income is highest (ages 50 to 60).
  - Dissaving occurs in retirement.
- Bequests and saving
  - What effect does a bequest motive (a desire to leave an inheritance) have on saving?
  - Simply consume less and save more than without a bequest motive.

Ricardian equivalence

- 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:

$$c + c^f/(1+r) = y + y^f/(1+r) + a$$

- Suppose the government reduces taxes by 100 in the current period, the interest rate is 10%, and taxes will be increased by 110 in the future period.
- Then the *PVLR* is unchanged, and thus there is no change in consumption.

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*:
  - This could be due to short-sighted behavior.
  - Or it could be due to borrowing constraints.
- Borrowing constraints mean people can't borrow as much as they want Lenders may worry that a consumer won't pay back the loan, so they won't lend
  - 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.

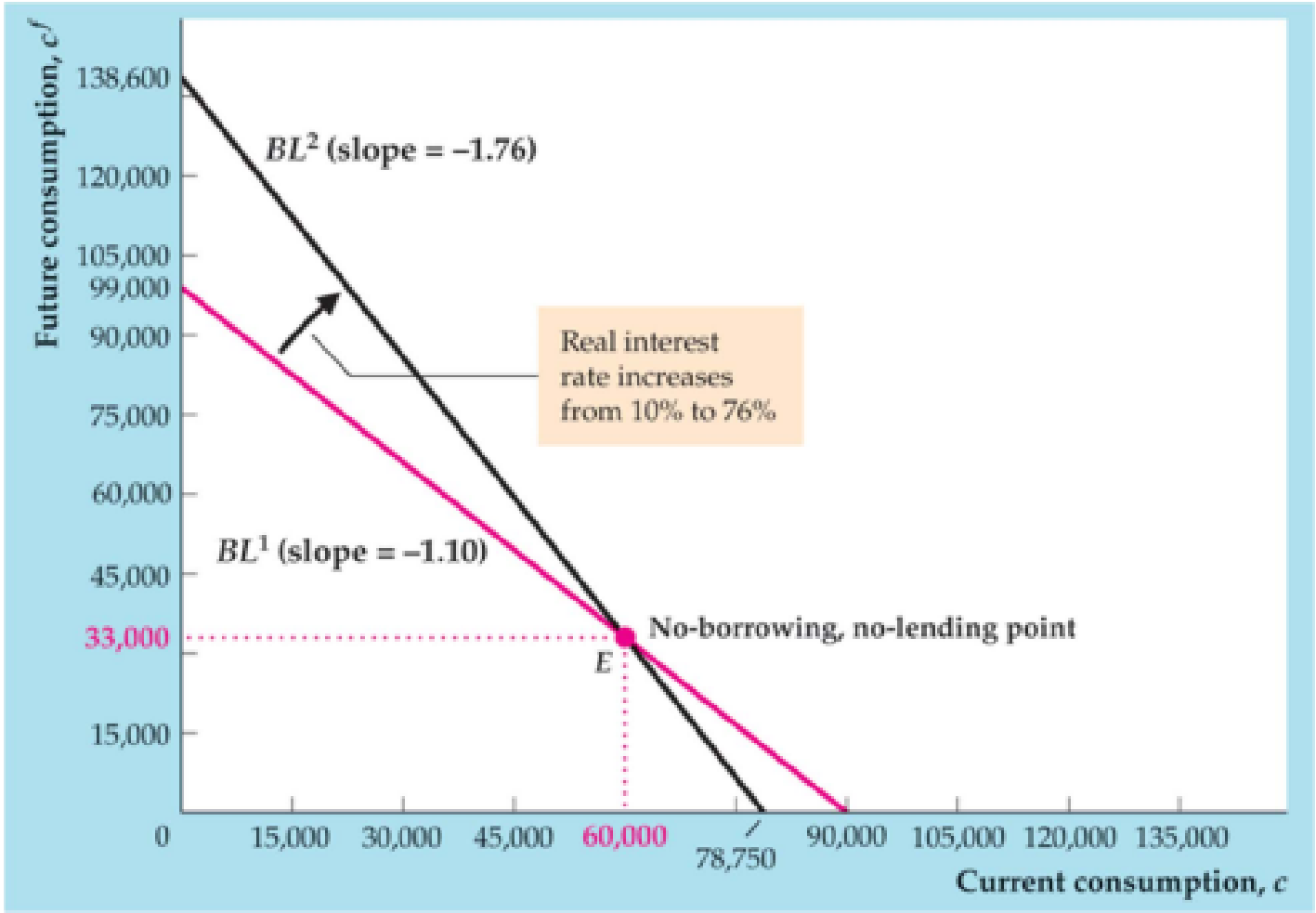
Excess sensitivity and borrowing constraints

- A consumer with a binding borrowing constraint spends all income and wealth on consumption:
  - So an increase in income or wealth will be entirely spent on consumption as well.
  - This causes consumption to be excessively sensitive to current income changes.
- How prevalent are borrowing constraints? Perhaps 20% to 50% of the U.S. population faces binding borrowing constraints.

The Real Interest Rate and the Consumption-Saving Decision

- The real IR and the budget line
  - When the real IR 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.

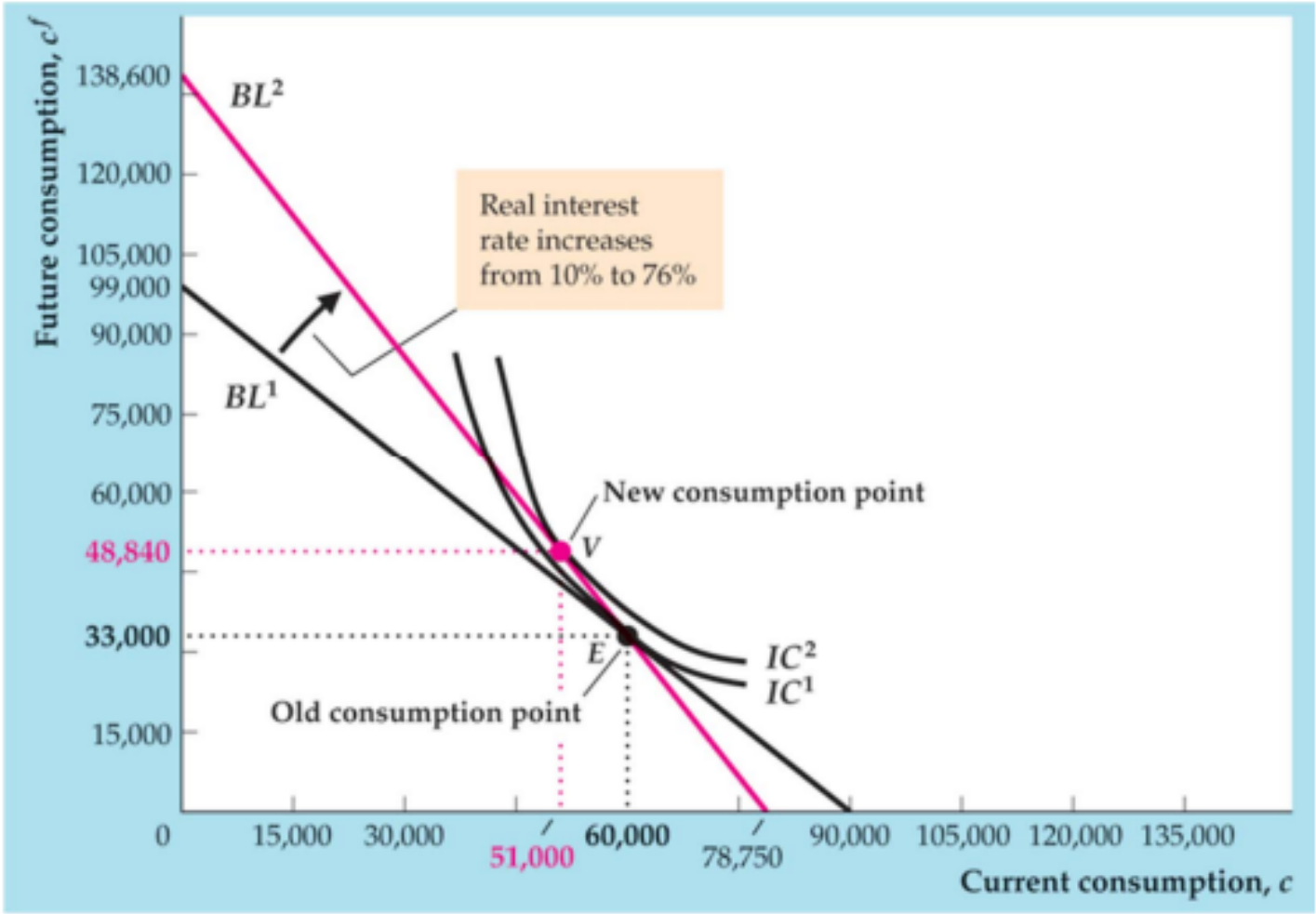
The effect of an increase in the real interest rate on the budget line



The substitution effect

- A higher real interest rate makes future consumption cheaper relative to current consumption.
- Increasing future consumption and reducing current consumption increases saving.
- Suppose a person is at the no-borrowing, no-lending point when the real interest rate rises:
  - An increase in the real IR unambiguously leads the person to increase future consumption and decrease current consumption.
  - The increase in saving, equal to the decrease in current consumption, represents the substitution effect.

The substitution effect of an increase in the real interest rate



The income effect

- If a person is planning to consume at the no-borrowing, no-lending point, then a rise in the real IR leads just to a substitution 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, the rise in the real IR gives the person more income in the future period; the income effect works in the opposite direction of the substitution effect, since more future income increases current consumption.
- If the person originally planned to be a borrower, the rise in the real IR gives the person less income in the future period; the income effect works in the same direction as the substitution effect, since less future income reduces current consumption further.

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 decrease current consumption, so saving definitely increases but the effect on future consumption is ambiguous.
- 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.

Other factors

- Habit
- Precautionary savings motive

  Uncertainties lead to higher savings
- Social factors

  Du and Wei (2013): gender ratio imbalance

Why is investment important?

- Investment: spending for new capital goods (fixed investment such as factories, office buildings, new houses) plus inventory investment
- The decision about how much to invest depends largely on expectations about the economy's future. Investment also shares the idea of a trade-off between the present and the future.
- Investment fluctuates sharply over the business cycle, so we need to understand investment to understand the business cycle. Investment is only about 1/6 of GDP, and in the typical recession half or more of the total decline in spending reduced investment spending.
- Investment plays a crucial role in economic growth (capital accumulation and economic growth).

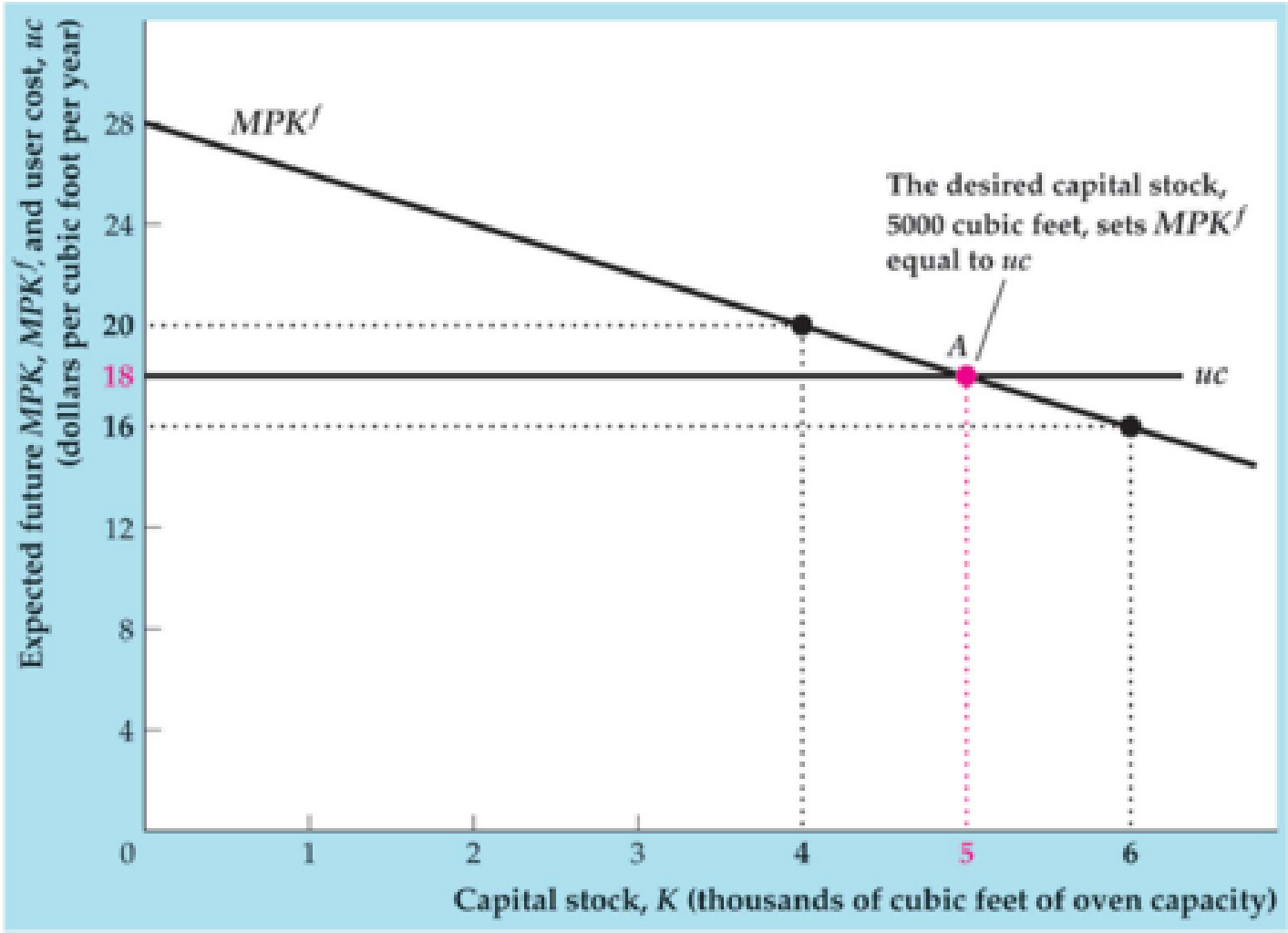
The desired capital stock

- *Desired capital stock* is the amount of capital that allows firms to earn the largest expected profit.
- Desired capital stock depends on costs and benefits of additional capital.
- Since investment becomes capital stock with a lag, the benefit of investment is the future marginal product of capital (MPK^f).
- The user cost of capital.
  - User cost of capital = real cost of using a unit of capital for a specified period of time = real interest cost + depreciation:

    $$uc = rp_K + dp_K = (r + d)p_K$$

    r: real interest rate, d: depreciation rate, p_k: real price of a unit of capital
  - Determining the desired capital stock

Determination of the desired capital stock



The desired capital stock

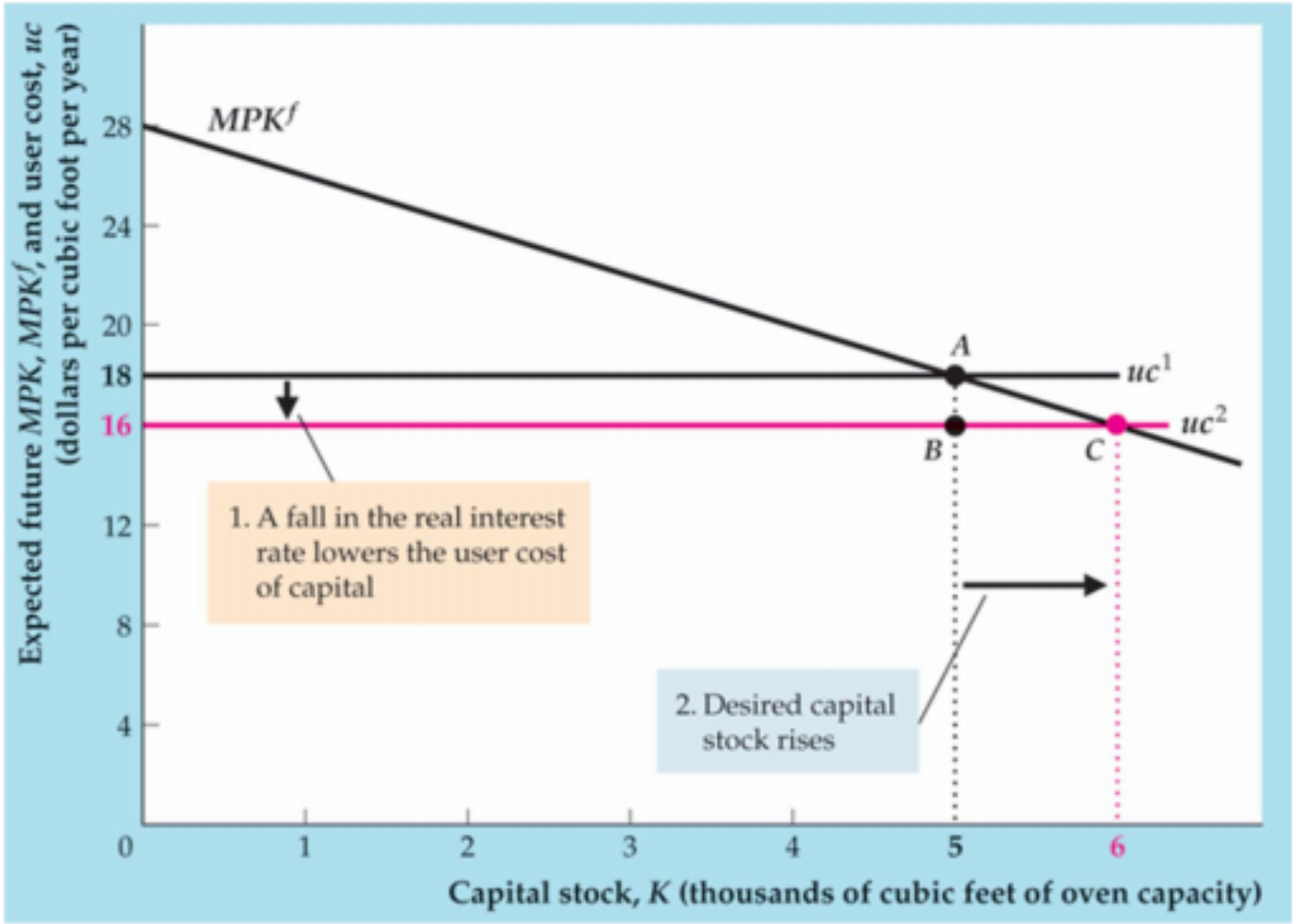
- Desired capital stock is the level of capital stock at which $MPK^f = uc$.
- MPK^f falls as K rises due to diminishing marginal productivity.
- uc doesn't vary with K, so is a horizontal line.
- If $MPK^f > uc$, profits rise as K is added (marginal benefits $>$ marginal costs).
- If $MPK^f < uc$, profits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

Changes in the desired capital stock

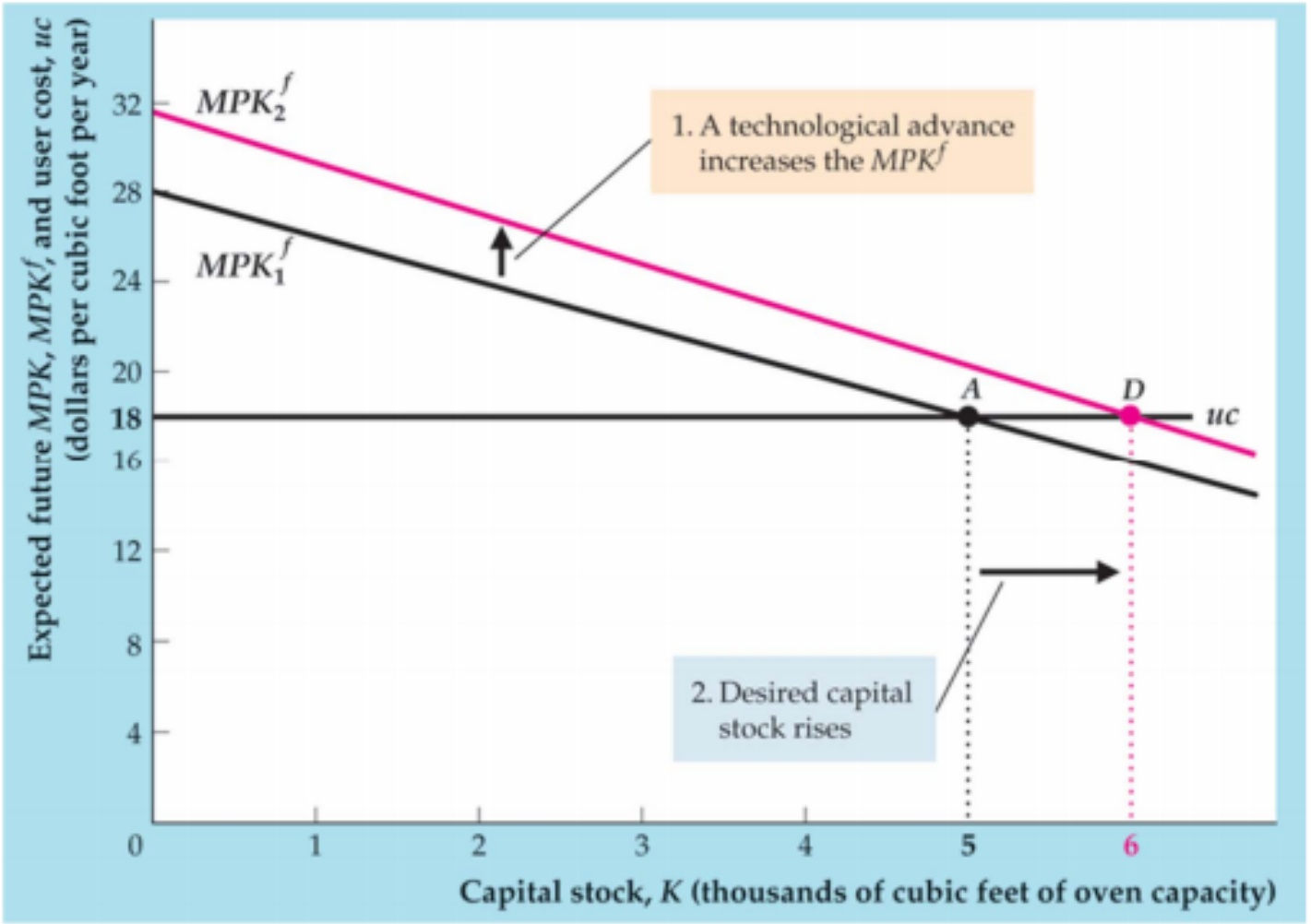
- Factors that shift the MPK^f curve or change the user cost of capital cause the desired capital stock to change.
- Supply side:
  - Changes in the real IR, depreciation rate, price of capital.
- Demand side:
  - Technological changes that affect the MPK^f.
  - Taxes: with taxes, the return to capital is only $(1-\tau)MPK^f$.
- A firm chooses its desired capital stock so that the return equals the user cost, so $(1-\tau)MPK^f = uc$, which means:

$$MPK^f = uc/(1-\tau) = (r+d)p_K/(1-\tau)$$

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



An increase in the expected future *MPK* raises the desired capital stock



Changes in the desired capital stock

- 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.
- In reality, there are complications to the tax-adjusted user cost
  - We assumed that firm revenues were taxed. In reality, profits, not revenues, are taxed.
  - 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 – the tax rate on firm revenue that would have the same effect on the desired capital stock as do the actual provisions of the tax code.

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? No easy answer. One problem is that the factors other than taxes that affect the desired capital stock – such as the expected future marginal product of capital and real IRs – are always changing, making it difficult to isolate the pure effects of tax changes.
- 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).

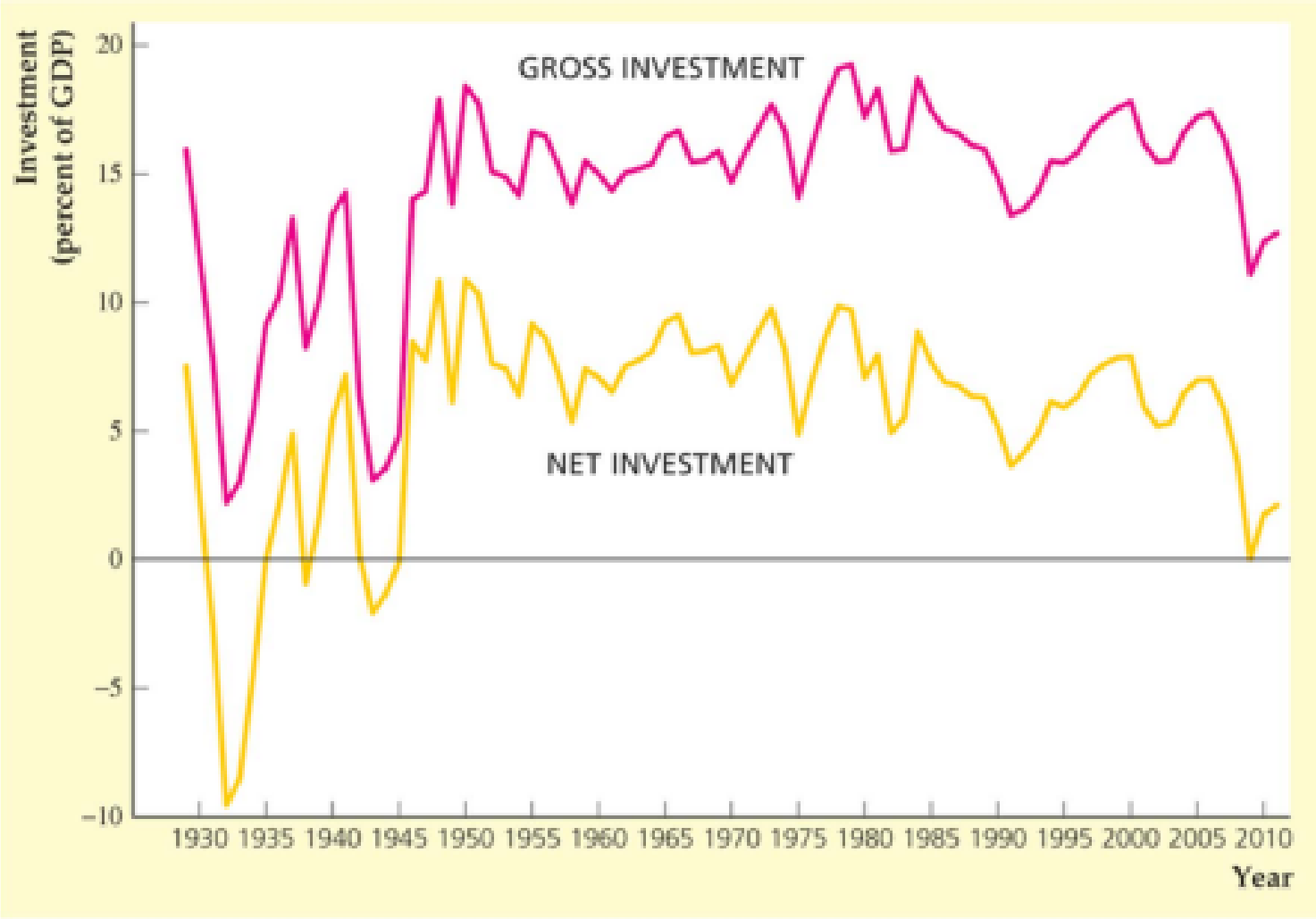
Capital accumulation

- 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 depreciation:

$$\Delta K_{t+1} = K_{t+1} - K_t = I_t - dK_t$$

where net investment equals the change in the capital stock

Gross and net investment, 1929-2011



Capital accumulation

- Rewriting the above equation gives

$$I_t = K_{t+1} - K_t + dK_t$$

  If firms can change their capital stocks in one period, then the desire capital stock $(K^*) = K_{t+1}$.
- Thus investment has two parts:
  - Desired net increase in the capital stock over the year $(K^* - K_t)$.
  - Investment needed to replace depreciated capital (dK_t).
- 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.

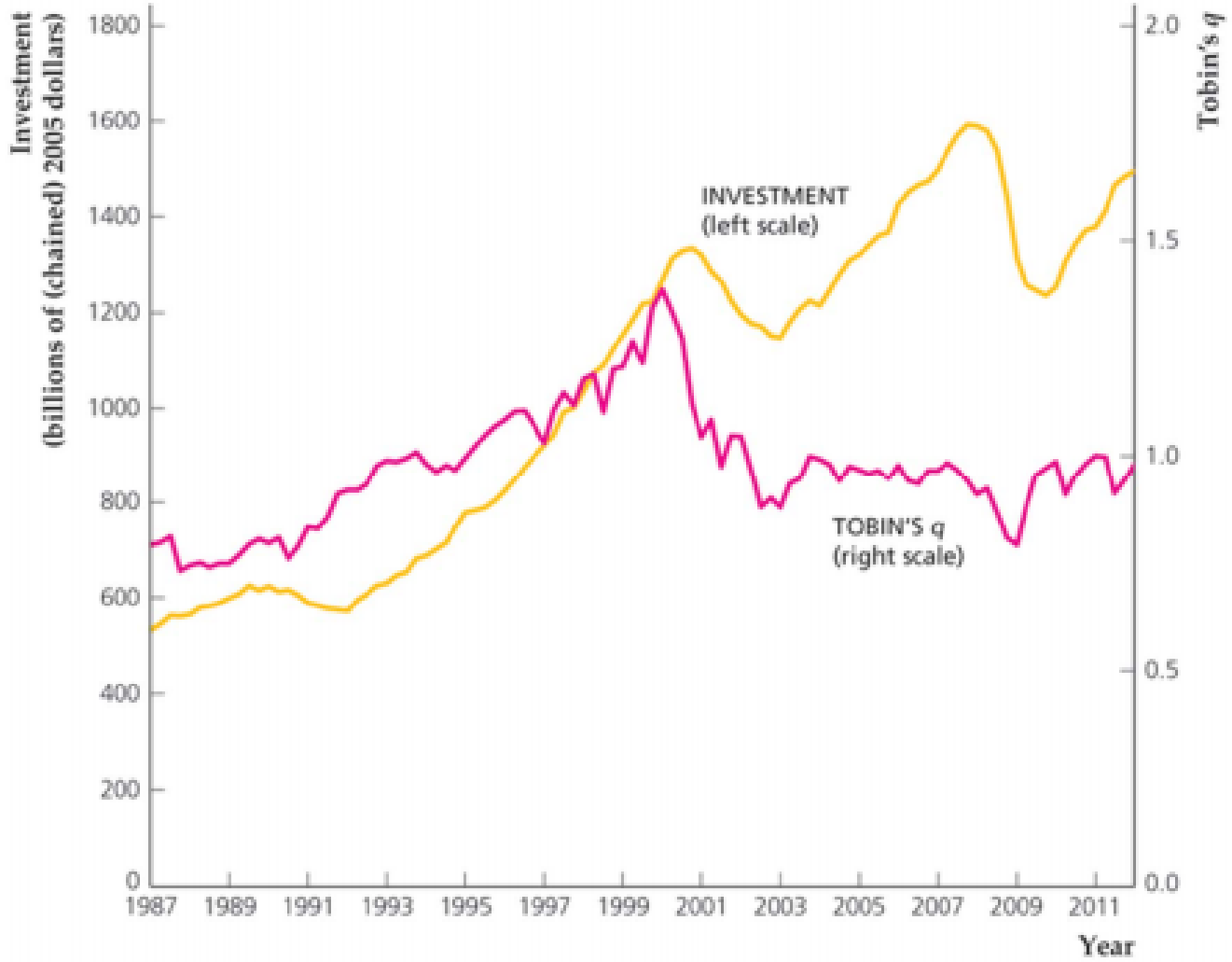
In touch with data and research: investment and the stock market

- Firms change investment in the same direction as the stock market: Tobin's q theory of investment.
- If market value $>$ replacement cost, then firm should invest more.
- Tobin's q = capital's market value divided by its replacement cost:
  - If $q < 1$, don't invest.
  - If $q > 1$, invest more.
- Stock price times number of shares equals firm's market value, which equals value of firm's capital:
  - Formula: $q = V/(p_K K)$, where V is stock market value of firm, K is firm's capital, p_K is price of new capital.
  - So $p_K K$ is the replacement cost of firm's capital stock.
  - Stock market boom raises V, causing q to rise, increasing investment.

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

- 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
- This theory is similar to text discussion:
  - Higher MPK^f -> increases future earnings of firm -> V rises, higher q -> invest
  - A falling real interest rate (lower uc) -> also raises V as people buy stocks instead of bonds -> higher q -> invest
  - A decrease in the cost of capital (lower p_K) -> raises q -> invest

Investment and Tobin's q, 1987-2012



Investment in inventories and housing

- 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.

Desired investment function

- Function

$$I^d = H(r, MPK^f, \text{others})$$

- One example:

$$I^d = i_0 - i_r r$$

where i_0: include factors other than r such as MPK^f, $i_r > 0$ (recall, real interest rate is part of uc)

Goods market equilibrium condition

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

$$Y = C^d + I^d + G$$

- 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

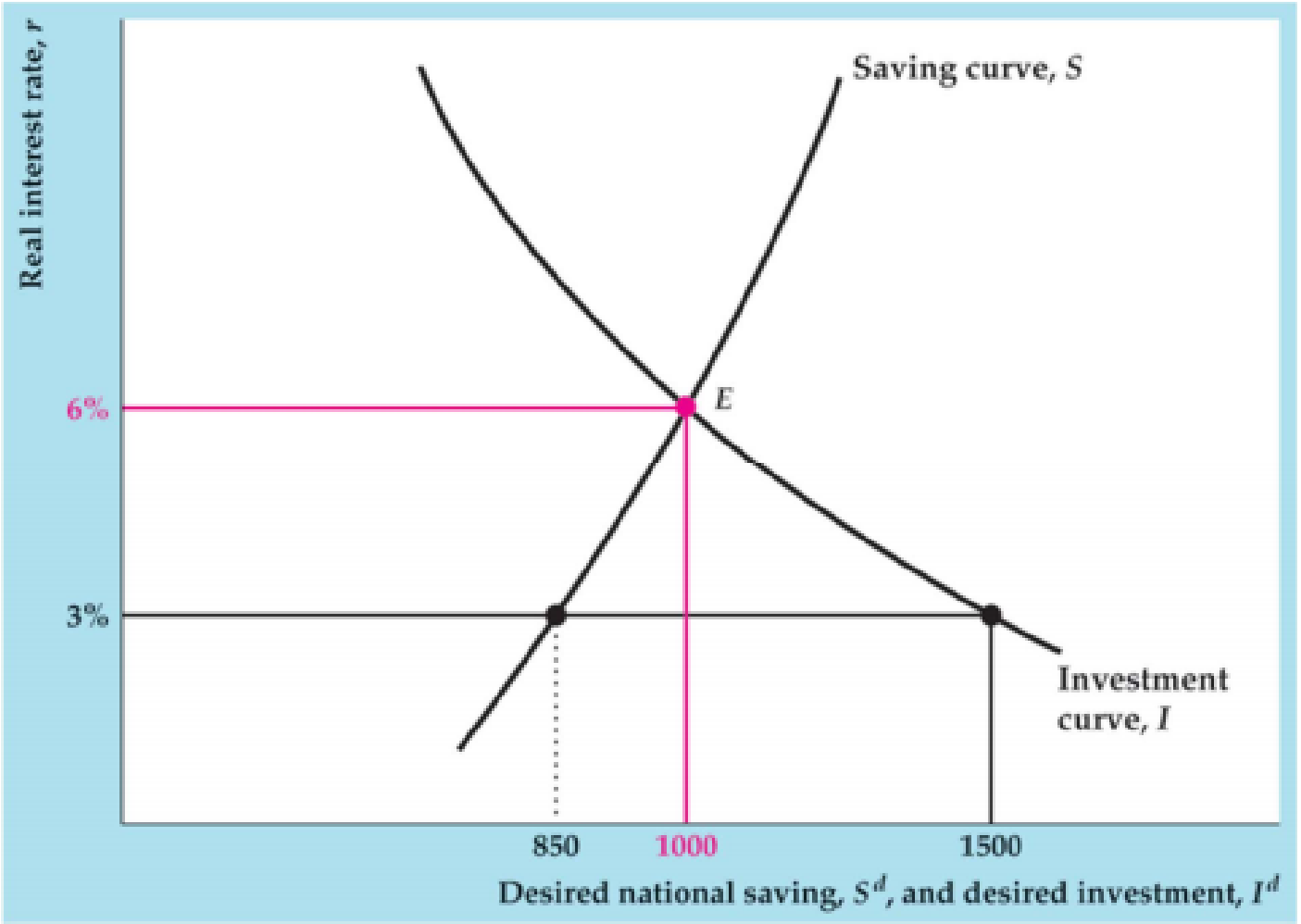
$$S^d = Y - C^d - G$$

  we have

$$S^d = I^d$$

- The saving-investment diagram: Plot S^d vs. I^d. How to reach equilibrium? Adjustment of r.

Goods market equilibrium



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

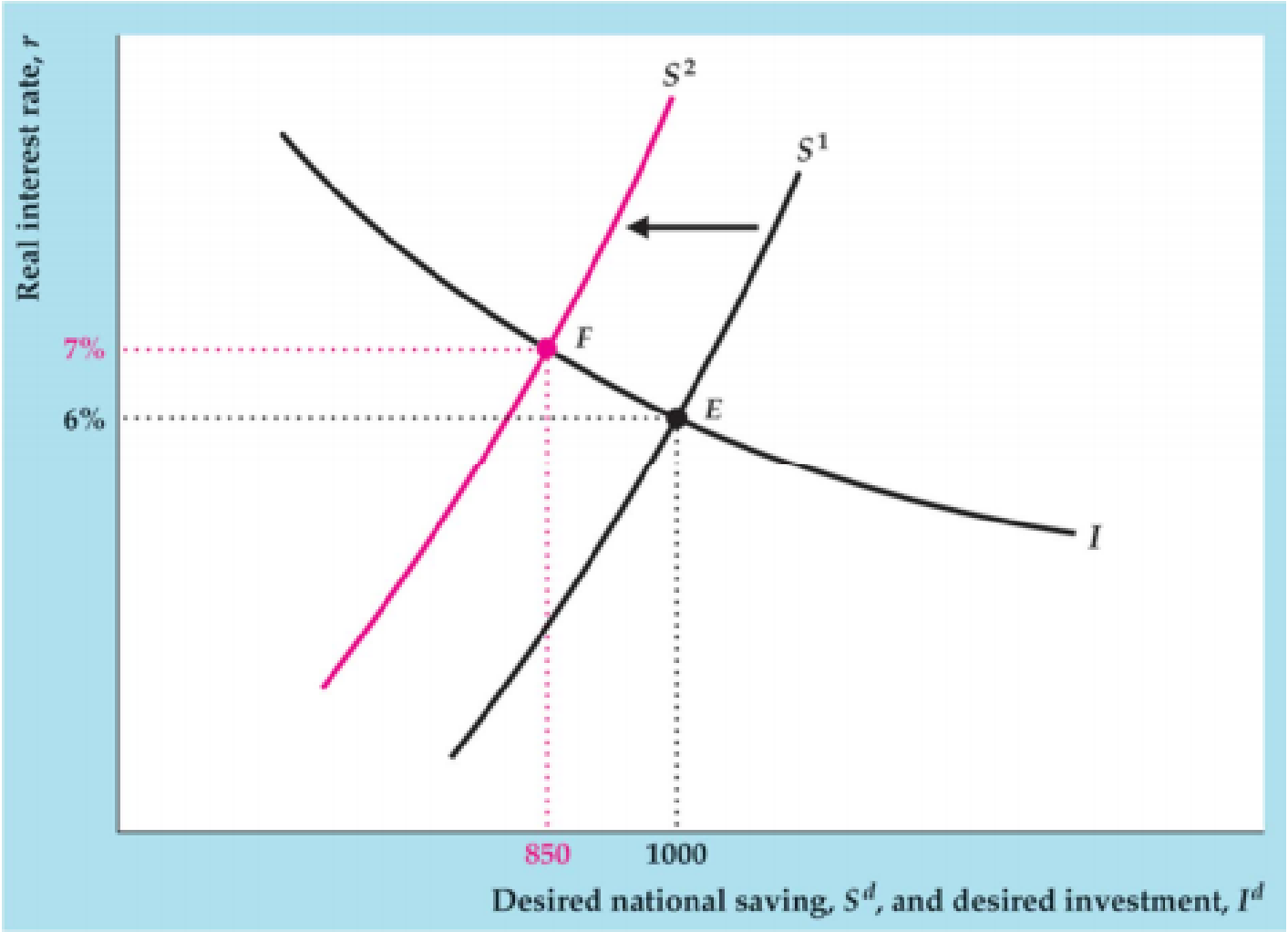
Shifts of the saving curve

- 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.

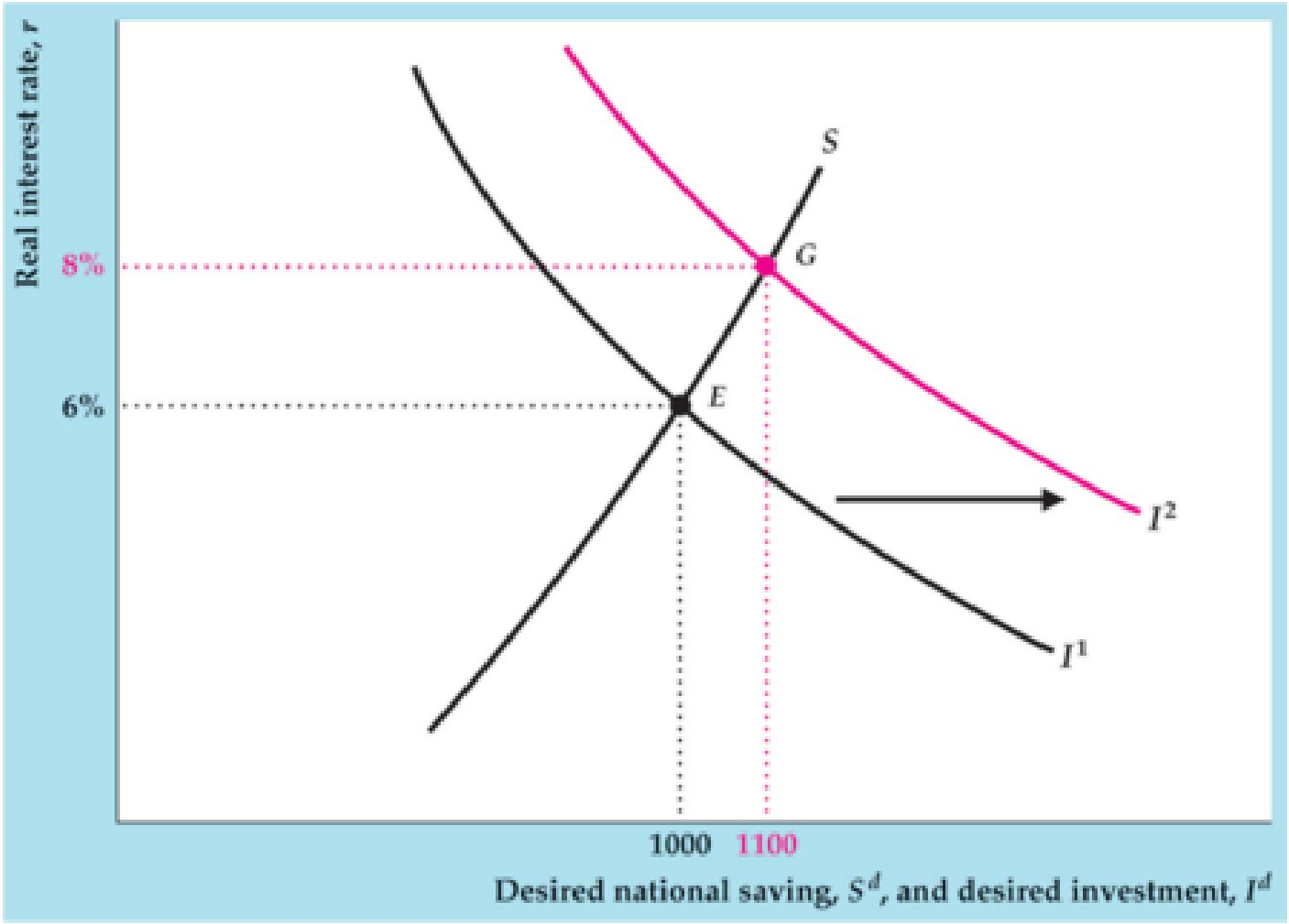
Shifts of the investment curve

- 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.

A decline in desired saving



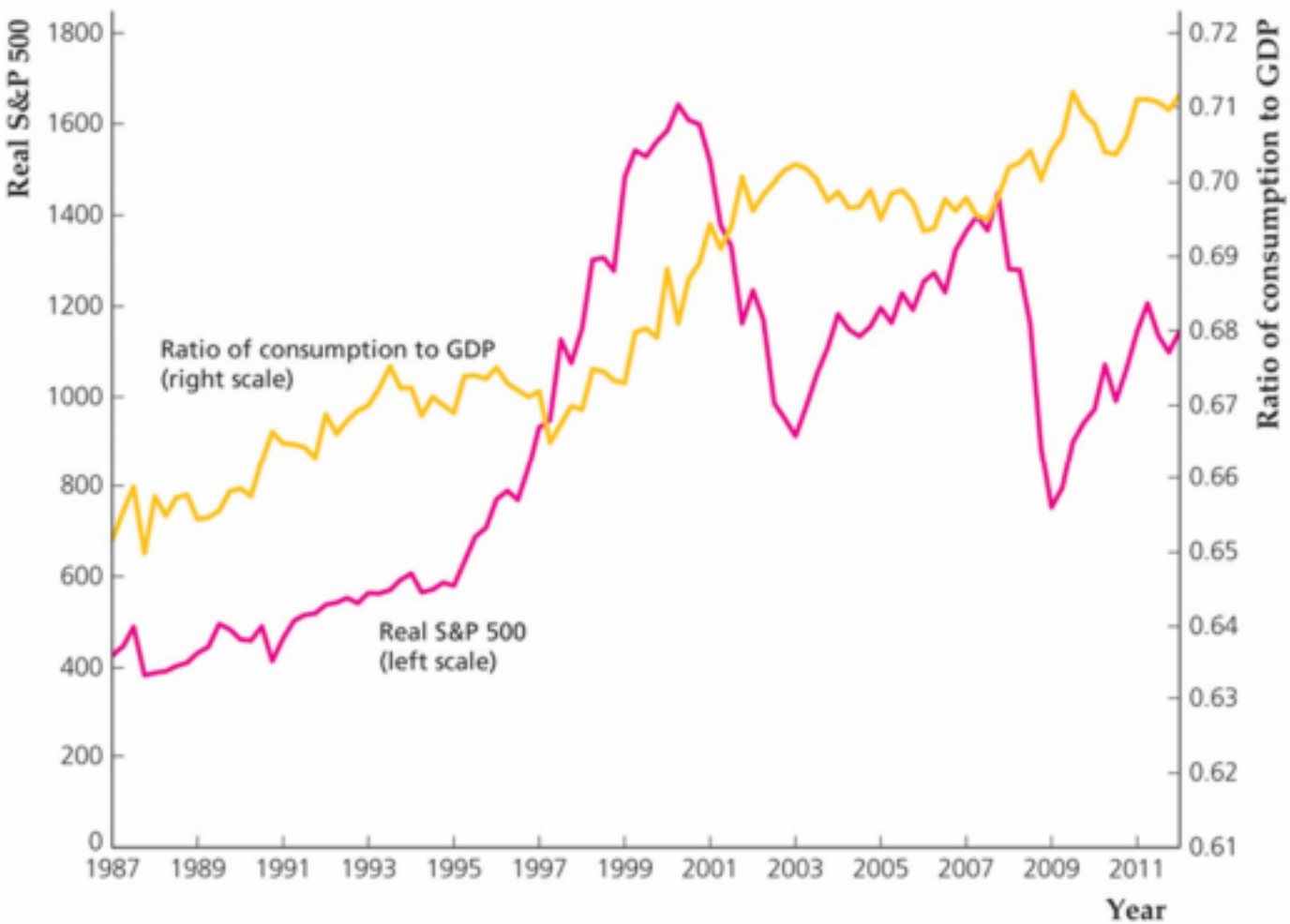
An increase in desired investment



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

- Sharp changes in stock prices affect consumption spending (a wealth effect) and capital investment (via Tobin's q).

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



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 this run-up.
- 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.

The boom and bust in stock prices

- 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
  - Investment and Tobin's q were correlated in 2000 and 2008, when the stock market fell sharply.
  - Investment tended to lag the decline in the stock market, reflecting lags in the process of making investment decisions.

The boom and bust in stock prices

- 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.
- Investment and Tobin's q
  - Investment and Tobin's q were not closely correlated following the 1987 crash in stock prices.
  - But the relationship has been tighter in the 1990s and early 2000s, as theory suggests.