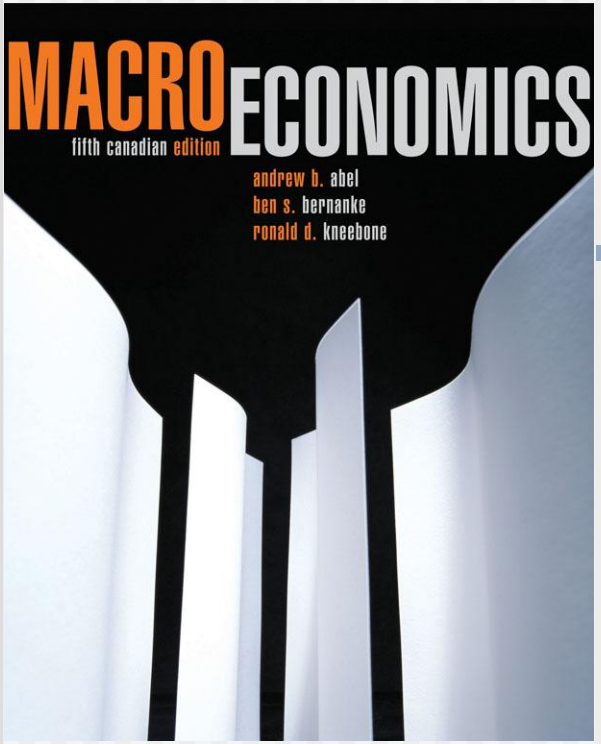


Chapter 4

Consumption and Saving

Where we are going?

- Here we will be looking at two major components of aggregate demand:
  - Aggregate consumption or what is the same thing aggregate saving; and
  - Investment by firms (in the next lecture).
- We want to develop a view as to how goods market equilibrium is determined.
- In Chapter 3 we saw how the supply of goods is determined we now turn to demand for those goods and services.

Consumption and Saving

- Changes in consumers' willingness to spend have major implications for the behaviour of the economy.
  - Consumption accounts for about 60% of total spending.
  - The decisions to consume and to save are closely linked.

Consumption and Saving (continued)

- Desired consumption (C^d) is the aggregate quantity of goods and services that households want to consume, given income and other factors.
- Desired national saving (S^d) is the level of national saving that occurs when aggregate consumption is at its desired level.
- If you know one, you know the other.

Consumption and Saving (continued)

- When *NFP*=0, national saving is:

$$S = Y - C - G$$

- Then, desired national saving is:

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

- Remember this is the total of private and government saving.

The Consumption and Saving Decision – some preliminaries

- A lender can earn, and a borrower will have to pay, a real interest rate of r per year.
- 1 dollar's worth of consumption today is equivalent to $1 + r$ dollar's worth of consumption in the next time period.
- If I consume $1 today, my saving is lower by that amount and I will have $1(1 + r) less to consume in the future.
- Therefore $1 + r$ is the price of a dollar of current consumption in terms of future consumption – it is what you give up tomorrow when you consume today.

The Consumption and Saving Decision (continued)

- The consumption-smoothing motive is the desire to have a relatively even pattern of consumption over time.
- This seems to be consistent with observed behaviour.
- A good part of a one-time income bonus is likely to be saved and the income earned on that saving spread over time.

Changes in Current Income

- Marginal propensity to consume (*MPC*) is the fraction of additional current income that is consumed in the current period.
- When Y rises by 1:
  - C^d rises by less than 1;
  - S^d rises by the fraction of 1 not spent on consumption.

A Formal Treatment of Desired Consumption

- This part of the lecture follows closely Appendix 4.A (in the 4th edition and on the course website).
- We will treat a simple economy with two periods, the present and future, and a representative agent who seeks to maximize utility by choosing between present and future consumption.

The Budget Constraint

- Suppose that I have the following
  - y = real income today
  - y^f = real income in the future
  - a = assets at the beginning of the period
  - c = current consumption
  - c^f = future consumption
  - r = the real interest rate (for both borrowing and lending)
- I can use this information to figure out my possible consumption combinations of c^f and c by examining extremes and points in between:

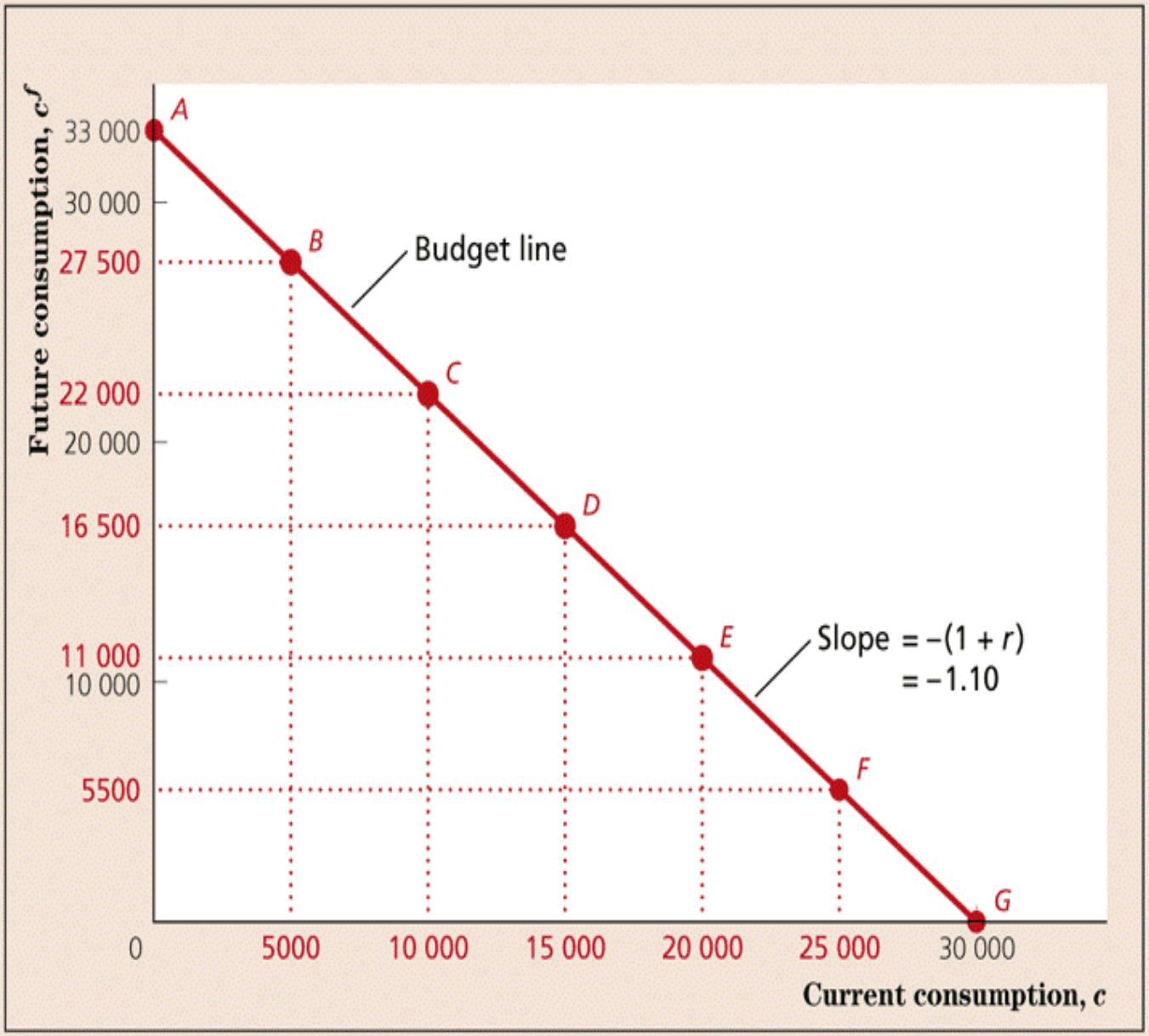
  eq (1) $$c^f = (y + a - c)(1 + r) + y^f$$

- The line is the budget constraint and slope of the line is $-(1+r)$.

FIGURE 4.A.1

THE BUDGET LINE

The budget line shows the combinations of current and future consumption, c and c^f, available to Prudence. The slope of the budget line is $-(1 + r) = -1.10$. The horizontal intercept is at $c = PVLR = 30\,000$. You can verify that the combinations of current and future consumption at each of the lettered points (as well as any point on the budget line) satisfy $c + c^f/(1 + r) = PVLR = 30\,000$.



The Concept of Present Value

- Suppose that I have future income (Y^f) of $13 200 (one year from now) but I want to spend it all now.
- I can get a bank loan but how much can I borrow given my Y^f?
- The loan (L) at 10% has to satisfy:

  L(1 + 0.10) = $13 200 (my ability to pay in the future)

  L = $13 200/1.1 = $12 000
- If I was a saver and wanted to have $13 200 in the future, I would need to invest only $12 000 today to achieve that goal.
- The bank loan has effectively converted my future income into present income or given my Y^f a value that I can get my hands on today; *i.e.*, a present value (PV).
- In the same way, the financial markets have valued my target saving as worth $12 000 in today's dollars.

The Concept of Present Value (continued)

- Some points to make:
  - Implicitly we are assuming no constraints on borrowing or lending.
  - If the interest rate rises and assuming that I wanted to borrow for current consumption, I would be able to borrow only something less than the $12 000.
  - If I were a saver, worried more about future consumption, then I would be able to achieve my future spending goal with less saving.

What am I worth today?

- Based on the simplified two period model, today I am worth my current income (y) and the discounted value of my future income (y^f), plus my existing assets (a):

eq (2) $$PVLR = y + y^f/(1+r) + a$$

- Where PVLR represents the PV of my lifetime resources.

Going a Step Further

- Go back to eg (1) and divide both sides by (1+r) and add c to both sides as well:

$$\text{eq(3)} \quad c + c^f/(1+r) = y + y^f/(1+r) + a$$

$$PVLC = PVLR$$

- The budget constraint has been rearranged to show that the PV of lifetime consumption equals the PV of lifetime resources.
- In this form, it is called the "inter-temporal budget constraint" and it is an important and useful concept.

Going a Step Further (continued)

- We have simply re-arranged the budget constraint (eq 1).
- If we choose to consume all the resources today (set $c^f = 0$), then we would get:

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

- This is the length of the horizontal axis on the budget constraint graph.
- Once again, it is also *PVLR*, which is how much I am worth today.

Going a Step Further (continued)

- To get the length of the vertical axis, I simply set $c = 0$ and ask the question: how much c^f I could have if I consumed nothing today.
- The answer is:

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

- That is, I would have available the amount I saved (in this case, all of y), with interest, plus my future income.
- This is how I get the budget constraint in Fig4.A.1 above (slide 11).

Figuring Out What the Consumer Wants

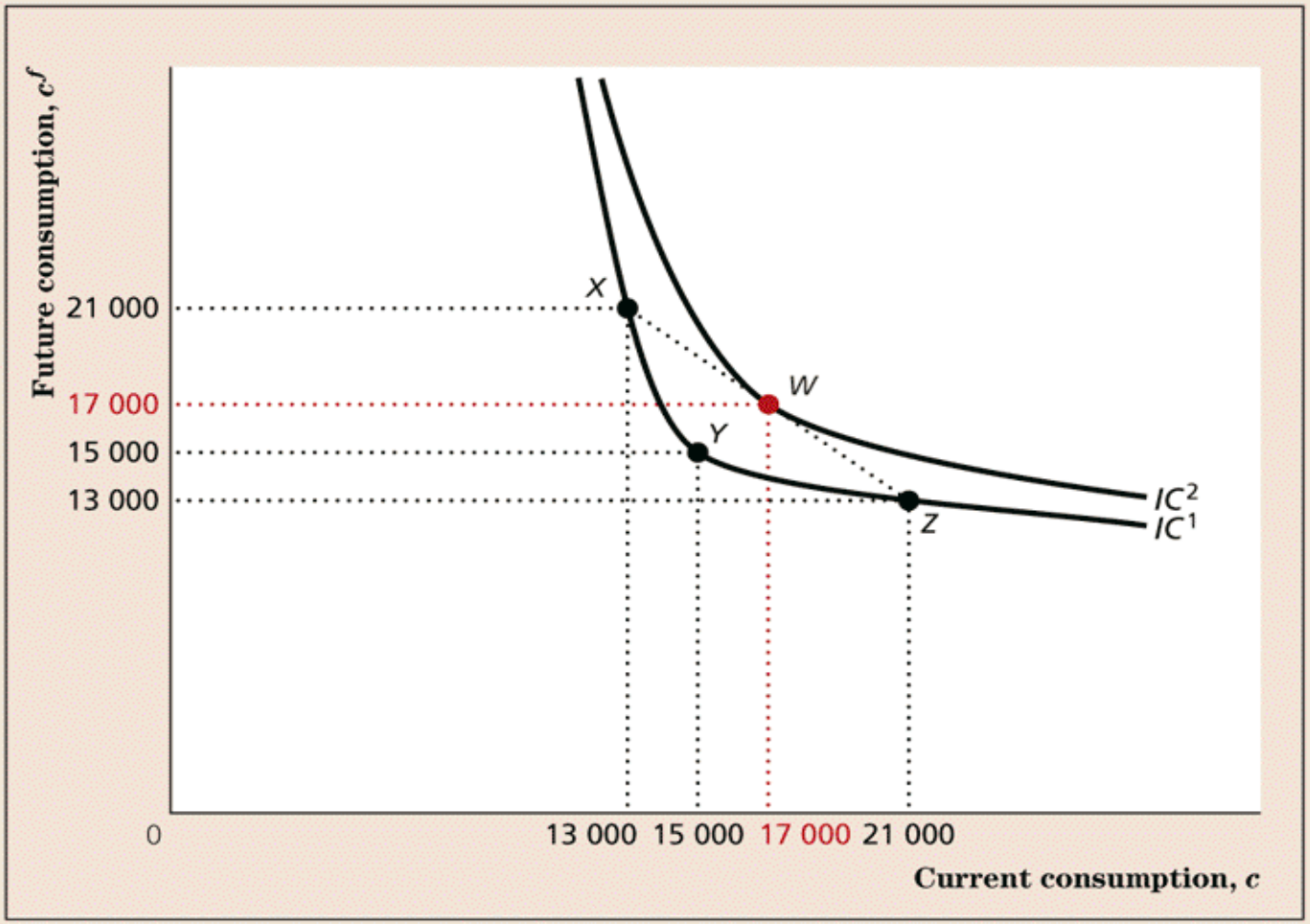
- So far so good but we don't know where on the budget line the consumer will end up.
- To find that point, we need to know the consumers utility curve, which shows preferences for various combination of c and c^f.
- These curves have three important properties:

1. *Slope downward from left to right.*
2. *Farther away from origin represents more utility.*
3. *Utility curves are bowed towards the origin because we assume consumption smoothing (a preference for smooth changes to consumption).*

FIGURE 4.A.2

INDIFFERENCE CURVES

All points on an indifference curve represent consumption combinations that yield the same level of utility. Indifference curves slope downward because a consumer can be compensated for a reduction in current consumption by an appropriate increase in future consumption. All points on IC^2 represent consumption combinations that are preferred to all consumption combinations represented by points on IC^1. Indifference curves are bowed toward the origin to reflect the consumption-smoothing motive. Prudence prefers the consumption combination at point *W*, which is an average of the combinations at point *X* and *Z*, because *W* represents a smoother pattern of consumption. Thus the indifference curve containing *W* (IC^2) lies above and to the right of the indifference curve containing *X*, *Y*, and *Z* (IC^1).



A Formal Treatment of the Optimal Level of Consumption

- This and the following four slides are to show students how c and c^f are determined using the model.
- The optimum level of total consumption (c) is the point where the budget constraint (eq 1) just touches the highest indifference curve it can reach. It is shown in Fig 4.A.3 below as point D.
- Recall that the budget constraint shows all the combination of *c* and c^f that are possible given the income available.
- Utility is described by $U(c,c^f)$ = constant.

A Formal Treatment of the Optimal Level of Consumption (continued)

- At the point of tangency, the lost marginal utility from giving up a unit of *c* equals the marginal utility of c^f times (1+*r*).
- In symbols, noting that $U'(\bullet)$ is the first partial derivative of *U* wrt to either *c* or c^f (represented by the symbol "•9 :

$$U'(c) = U'(c^f)(1 + r), \text{ or}$$

$$U'(c)/U'(c^f) = (1 + r)$$

- The ratio of the two marginal utilities, known as the *marginal rate of inter-temporal substitution* (*MRIS*), is the slope of the indifference curve (*i.e.*, $\Delta c^f/\Delta c$). That ratio equals $(1 + r)$ in equilibrium (that is, point D in Fig.A.4.3, or the slope of the budget line).

A Formal Treatment of the Optimal Level of Consumption (continued)

- Turn first to the slope of the utility curve. Suppose that the utility curves look like a "Cobb-Douglas-type" function. That is:

$$U(c,c^f) = c^{\alpha}c^{f(1-\alpha)}$$

- Then $U'(c)/U'(c^f) = -[\alpha/(1-\alpha)](c^f/c)$
- Note that "α" represents the weight placed on present consumption (and $1-\alpha$ on future consumption).
- Since the ratio of the two marginal utilities equals the MRIS (note the minus signs cancel), we can write:

$$c^f = \{[(1-\alpha)/\alpha](1+r)\}c$$

- We now have another relationship between present and future consumption.

A Formal Treatment of the Optimal Level of Consumption (continued)

- Given the relationship between c and c^f, we can use the inter-temporal budget constraint to figure out consumption.

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

$$c + [(1-\alpha)/\alpha]c = y + y^f/(1+r) + a$$

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

$$c = \alpha[y + y^f/(1+r) + a] = \alpha PVLR$$

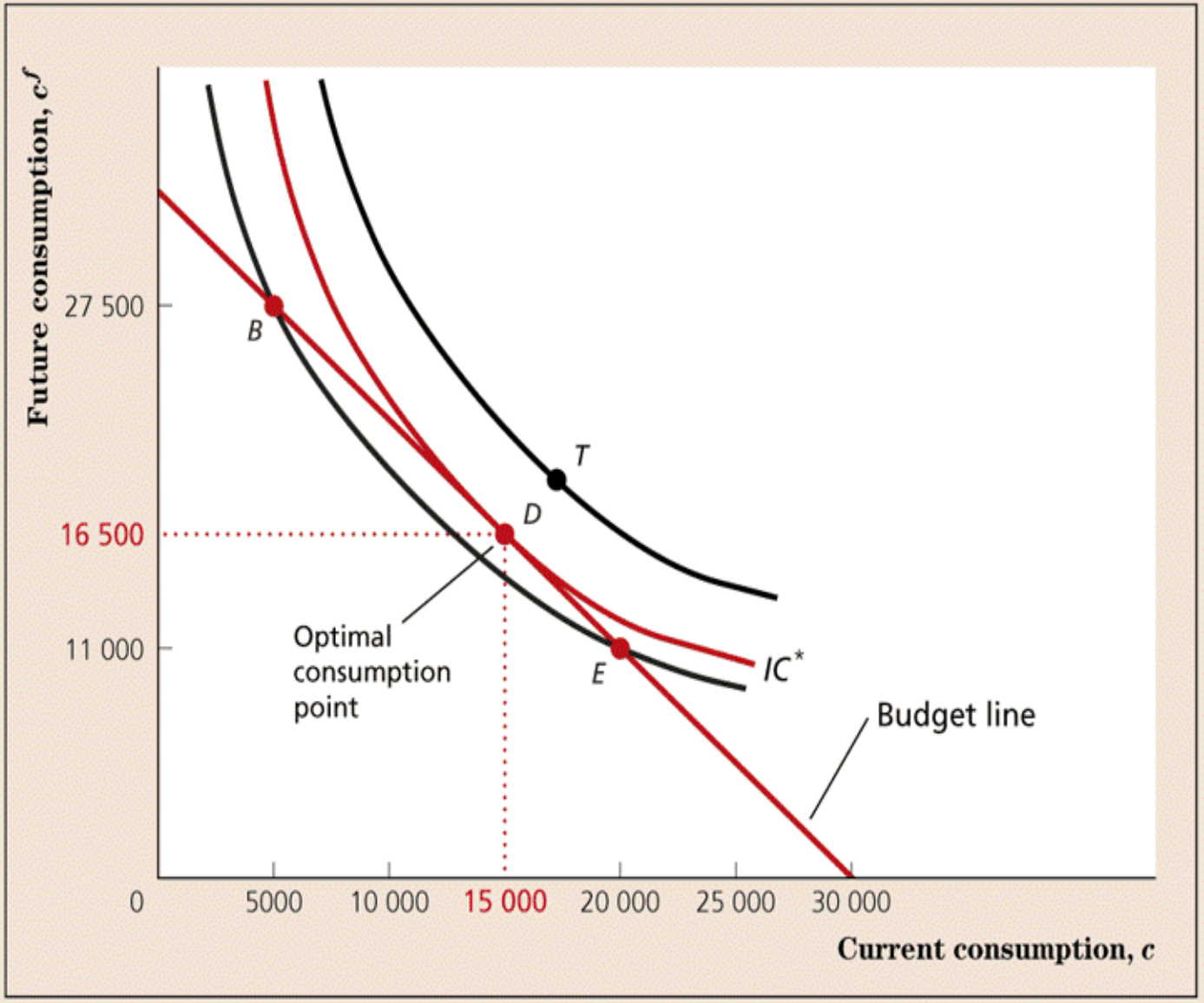
A Formal Treatment of the Optimal Level of Consumption (continued)

- While we had to plough through some algebra, the final result is simple and intuitive:
  - *Consumption today depends on my income and wealth today as well as the PV of my future income (the amount I can borrow against).*
  - *Together these two items represent the PVLR.*
  - *The whole thing is multiplied by α the utility weight that the individual puts on present consumption.*
  - *This is the foundation of the permanent income and life-cycle hypothesis of consumption.*

FIGURE 4.A.3

THE OPTIMAL CONSUMPTION COMBINATION

The optimal (highest utility) combination of current and future consumption is represented by the point of tangency between the budget line and an indifference curve (point *D*). All other points on the budget line, such as *B* and *E*, lie on indifference curves below and to the left of indifference curve *IC** and thus yield lower utility than the consumption combination at *D*, which lies on *IC**. Prudence would prefer the consumption combination at point *T* to the one at *D*, but as *T* lies above the budget line she cannot afford the consumption combination that *T* represents.



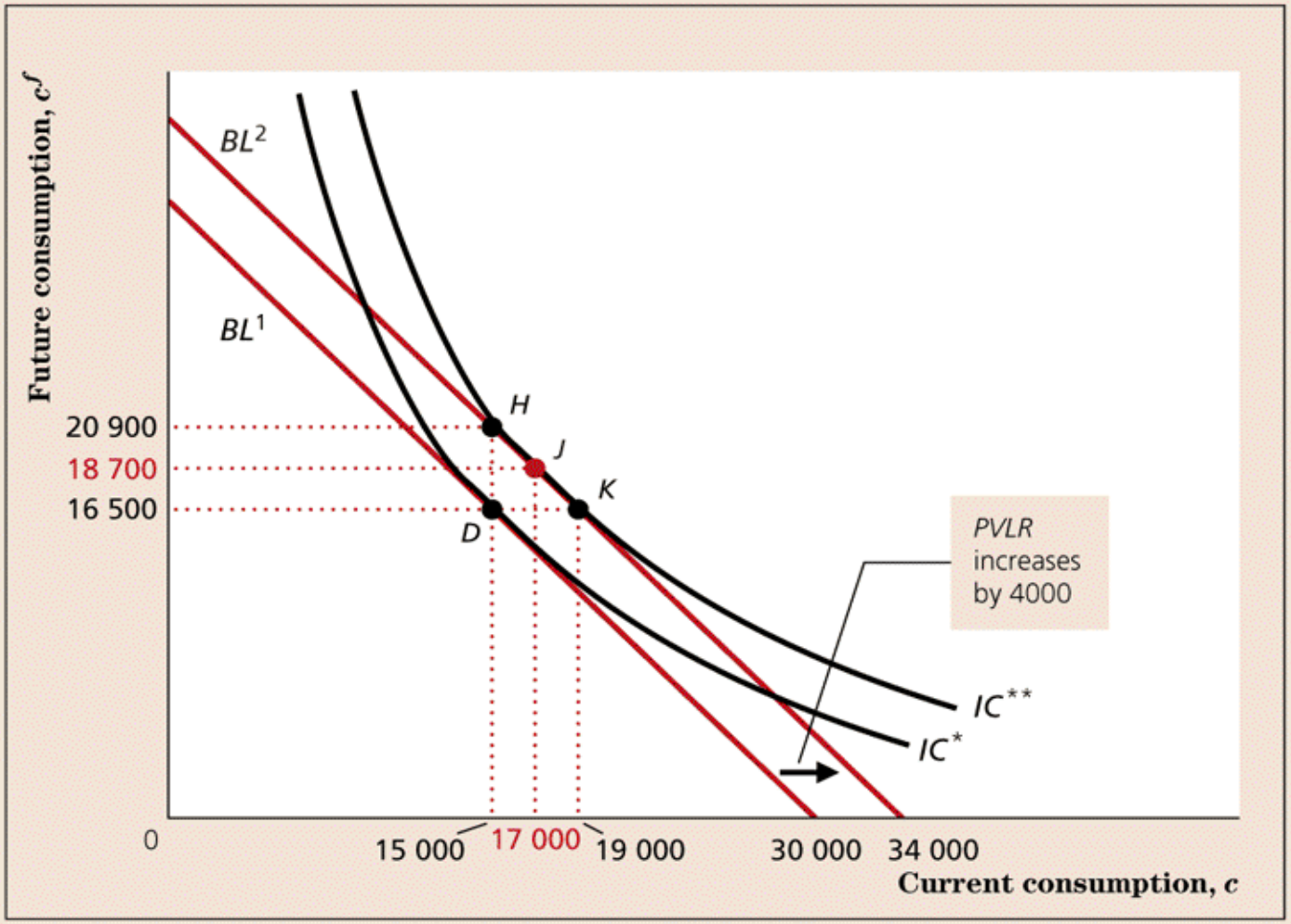
What Happens When There Are Temporary Changes to Income and Wealth?

- In this model, the effect will depend on how the PVLR is changed when either y, y^f or a is changed.
- All three changes move the PVLR line without changing its slope (1+r). It is an ***income effect*** and it is shown as a parallel shift in the budget constraint.
  - The change in y raises both c and current saving (y-c).
  - The changes in y^f and wealth (a) raises c but *lowers* current saving since *current* income (y) is not affected.
- The consumer moves to point J from either H or K because of consumption smoothing.

FIGURE 4.A.4

AN INCREASE IN INCOME OR WEALTH

An increase in current income, future income, and/or initial wealth that raises Prudence's *PVLR* by 4000 causes the budget line to make a parallel shift to the right by 4000, from BL^1 to BL^2. If Prudence's original consumption plan was to consume at point *D*, she could move to point *H* by spending all the increase on future consumption and none on current consumption; or she could move to point *K* by spending all the increase on current consumption and none on future consumption. However, if Prudence has a consumption-smoothing motive she will move to point *J*, which has both higher current consumption and higher future consumption than *D*. Point *J* is optimal because it lies where the new budget line BL^2 is tangent to an indifference curve, IC^{**}.



The Permanent Income Theory

- In terms of the model, a temporary change in income is represented by a change in y with y^f held constant.
- A permanent change would assume both components (y and y^f) change.
- This would have a larger effect on PVLR and so on both c and c^f.
- The theory that emphasizes this relationship (the permanent income hypothesis) is attributable to Milton Friedman.
- Its formal expression is the final equation on Slide 23 above and reproduced here.

$$c = \alpha[y + a + y^f/(1 + r)]$$

The Life-Cycle Hypothesis

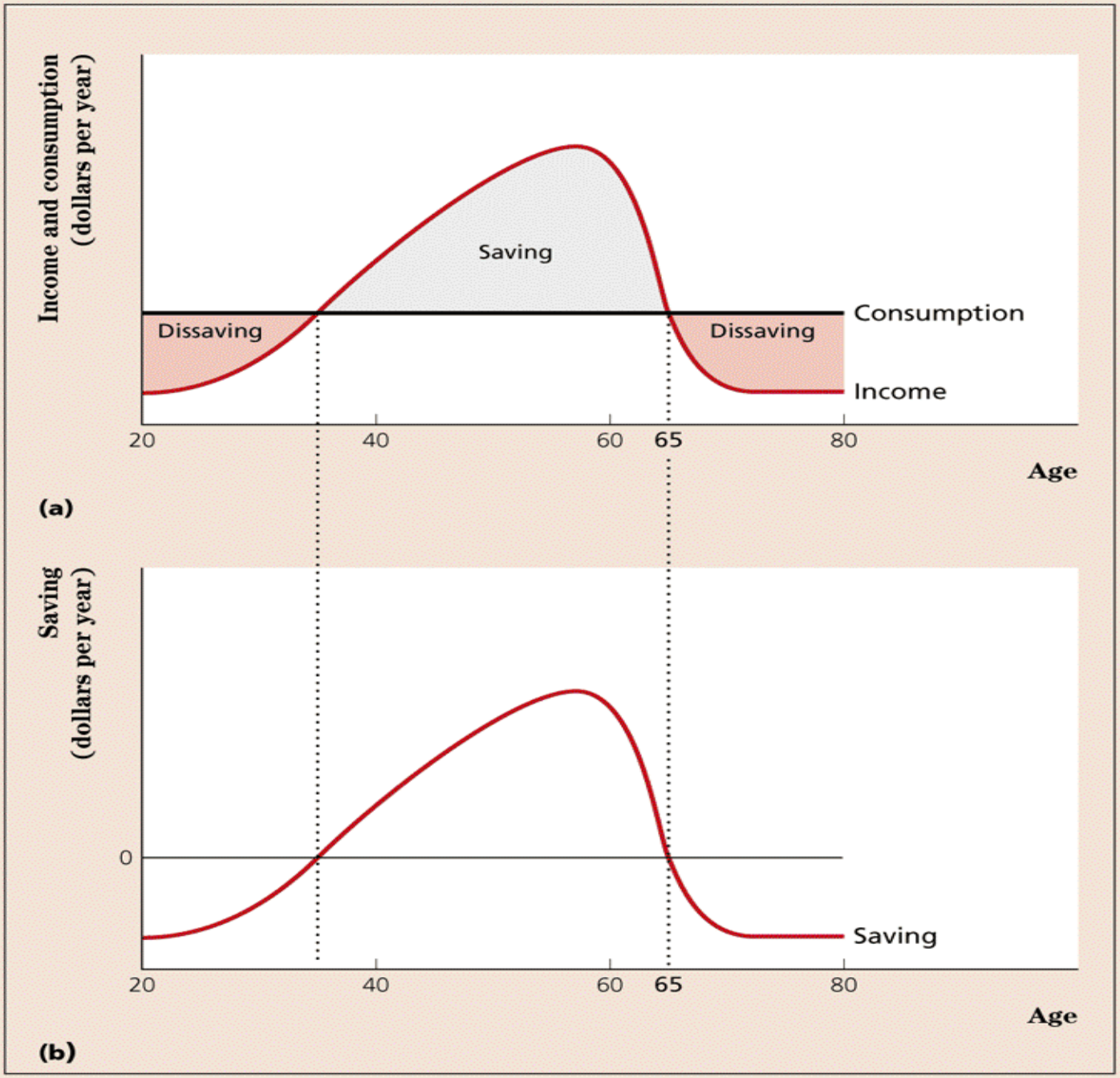
- The two period model can be generalised to many periods which capture more real world phenomena.
  - Income tends to follow a pattern over the life of the economic agent, rising from early years and then peaking between ages 50 to 60.
  - After retirement, income falls sharply.
  - Consumption patterns tend to be smoother (which is consistent with consumption smoothing).
- Saving as a result is at first negative, then positive and then negative.
- The Life-Cycle theory is attributable to Franco Modigliani (he won a Nobel Prize for this).

FIGURE 4.A.5

LIFE-CYCLE CONSUMPTION, INCOME, AND SAVING

(a) Income and consumption are plotted against age. Income typically rises gradually throughout most of a person's working life and peaks shortly before retirement. The desire for a smooth pattern of consumption means that consumption varies less than income over the life cycle. Consumption here is constant.

(b) Saving is the difference between income and consumption; the saving pattern is hump-shaped. Early in a person's working life consumption is larger than income, so saving is negative. In the middle years saving is positive; the excess of income over consumption is used to repay debts incurred earlier in life and to provide for retirement. During retirement people dissave.



How Well Does the Model Fit the Data – The Role of Borrowing Constraints

- Studies confirm that y, y^f and a all affect consumption and that permanent income changes are more important than transitory ones.
- Other studies point out that the volatility of consumption is greater than the theory suggests.
- Possible reasons:
  - *People are short sighted.*
  - *Borrowing constraints are important when they are binding.*

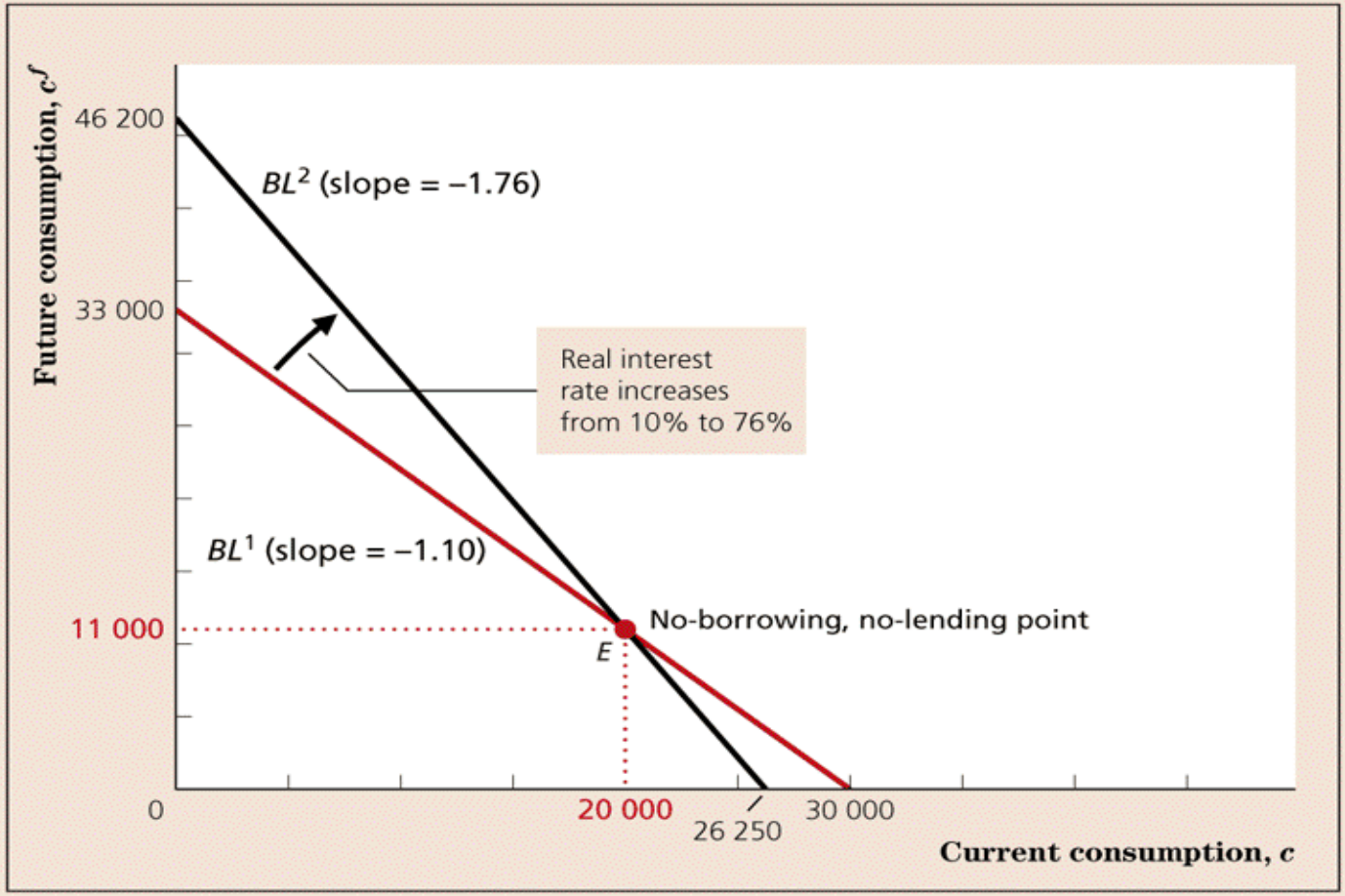
The Real Interest Rate and the Budget Line

- First what happens to the budget line when the real rate increases.
- It rotates around a point (E in the figure) where there is neither borrowing or lending. That is $c=y + a$ and $c^f = y^f$.
- Since such a point involves neither borrowing nor lending, it remains on the budget line no matter what the interest rate (remember we are not changing y, y^f or a so this point, where $c = y + a$ and $c^f = y^f$, stays the same after we change r).
- Since an increase in r causes the line to become steeper, it must rotate around E.
- It is the only point where agents are not affected by changes in the interest rate since they are neither borrowing nor lending.

FIGURE 4.A.6

THE EFFECT OF AN INCREASE IN THE REAL INTEREST RATE ON THE BUDGET LINE

The figure shows the effect on Prudence's budget line of an increase in the real interest rate, r, from 10% to 76%. Because the slope of a budget line is $-(1 + r)$ and the initial real interest rate is 10%, the slope of Prudence's initial budget line, BL^1, is –1.10. The initial budget line, BL^1, also passes through the no-borrowing, no-lending point, E, which represents the consumption combination that Prudence obtains by spending all her current income and wealth on current consumption. Because E can still be obtained when the real interest rate rises, it also lies on the new budget line, BL^2. However, the slope of BL^2 is –1.76, reflecting the rise in the real interest rate to 76%. Thus, the higher real interest rate causes the budget line to pivot clockwise around the no-borrowing, no-lending point.



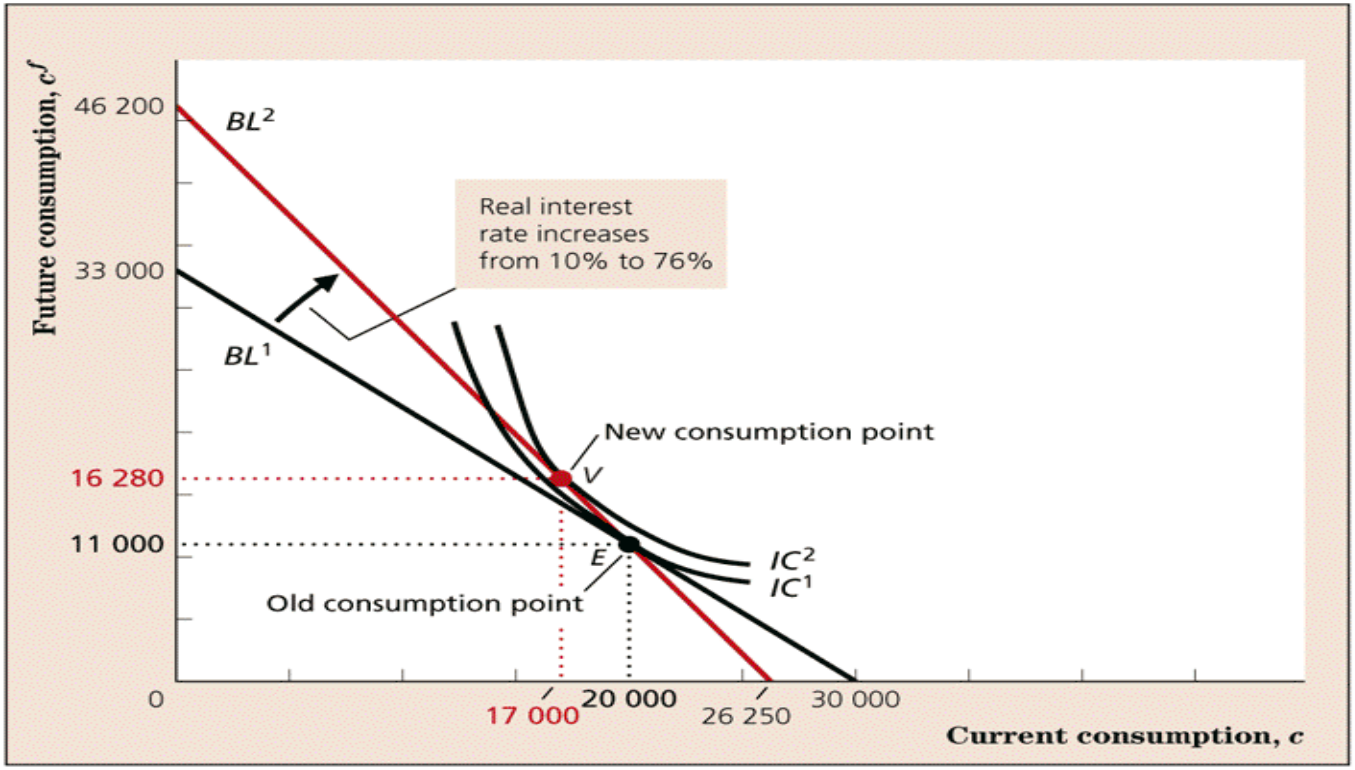
The Substitution Effect

- Recall that an increase in *r* raises the price of *c* in terms of c^f.
- Starting from a no-borrowing/lending point, the increase in *r* will cause consumers to lower *c* (and increase *s*).
- They do this because they get more utility.
- The increase in saving is measured along the horizontal axis as a drop in c (remember y and y^f are unchanged).
- Because we started from a no-borrowing/no-lending position, the rotation of the curve reflects a (pure) substitution effect.

FIGURE 4.A.7

THE SUBSTITUTION EFFECT OF AN INCREASE IN THE REAL INTEREST RATE

We assume that Prudence's preferences are such that when the real interest rate is 10% she chooses the consumption combination at the no-borrowing, no-lending point *E*, on the initial budget line BL^1. Point *E* lies on the indifference curve IC^1. An increase in the real interest rate to 76% causes the budget line to pivot clockwise from BL^1 to BL^2, as in Figure 4.A.6. By substituting future consumption for current consumption along the new budget line, BL^2, Prudence can reach points that lie above and to the right of IC^1; these points represent consumption combinations that yield higher utility than the consumption combination at *E*. Her highest utility is achieved by moving to point *V*, where the new budget line, BL^2, is tangent to indifference curve IC^2. The drop in current consumption (by 3000) and the resulting equal rise in saving that occur in moving from *E* to *V* reflect the substitution effect of the increase in the real interest rate.



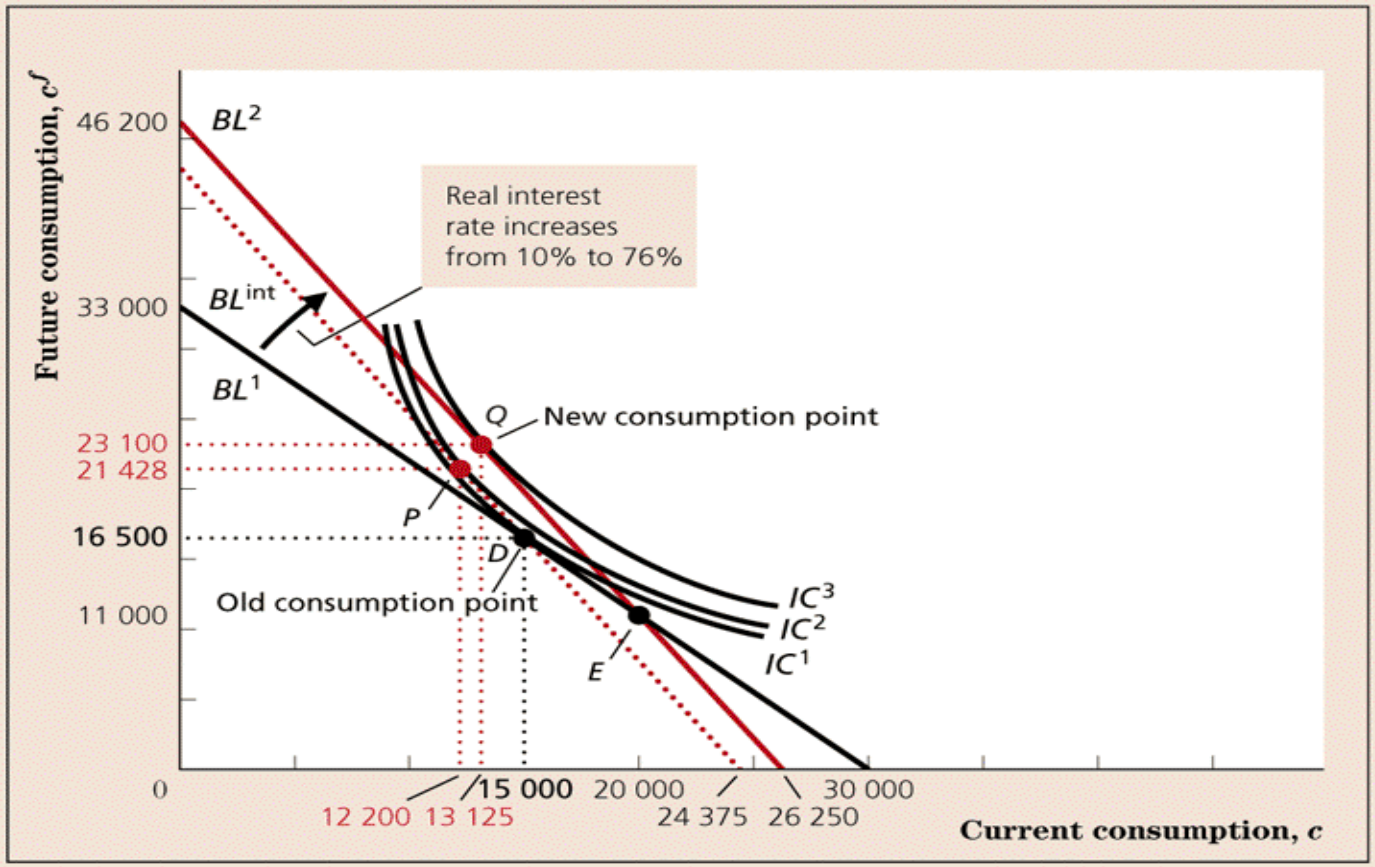
Income and Substitution Effects Together

- We can use the graphical model to separate the two effects:
  - Let the budget constraint pivot around the initial position (D). The drop in c (equivalent to a rise in s) from going from D to P is the substitution effect.
  - The income effect is measured by the movement from P back to Q.
- Note that if the initial position was one of dissaving, saving would unambiguously rise.

FIGURE 4.A.8

AN INCREASE IN THE REAL INTEREST RATE WITH BOTH AN INCOME EFFECT AND A SUBSTITUTION EFFECT

We assume that Prudence initially consumes at point D on the original budget line, BL^1. An increase in the real interest rate from 10% to 76% causes the budget line to pivot clockwise, from BL^1 to the new budget line, BL^2. We break the overall shift of the budget line into two parts: (1) a pivot around the original consumption point, D, to yield an intermediate budget line, BL^{int}, and (2) a parallel shift from BL^{int} to the final budget line, BL^2. The substitution effect is measured by the movement from the original consumption point, D, to point P on BL^{int}, and the income effect is measured by the movement from P to Q on BL^2. As drawn, the substitution effect is larger than the income effect so that the overall effect is for current consumption to fall and saving to rise.



Changes in the Real Interest Rate

- For a lender an increase in ***r*** has two opposite effects:
  - increase in current saving (***substitution*** effect);
  - decrease in current saving (***income*** effect).
- From our simple model, saving seems to rise nonetheless – this means that the substitution effect dominates.

Changes in the Real Interest Rate (continued)

- For a borrower when ***r*** increases the substitution and income effects both result in increased *S* – remember that borrowers now pay more on their outstanding loans.
- The empirical evidence is that an increase in ***r*** reduces *C* and increases *S*, but the effect is not very strong.

Taxes and the Real Return to Saving

- The expected after-tax real interest rate (r_{at}) is the after-tax nominal interest rate minus the expected inflation rate.

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

- By reducing the tax rate on interest the government can increase the real rate of return for savers and (possibly) increase the rate of saving in the economy.

Fiscal Policy

- Let's make an assumption that the economy's aggregate output (supply) is given, it is not affected by the changes in fiscal policy.
- Furthermore, we are interested in the effect of fiscal policy on national saving (S^d).
- The government fiscal policy has two major components: government purchases and taxes.

Government Purchases

- When government purchases increase temporarily:

  Indirect effects:

  C^d falls, because higher taxes and lower income are expected, but by less than the rise in taxes.

  S^d increases, because of the fall in C^d.

  Direct effect:

  S^d (national saving) falls, because G increases (from the definition).

- From the equation in slide 6 (reproduced) total effect on national saving (S^d) is a fall as the direct effect of the rise in G outweighs the indirect effect.

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

Taxes

- A government tax cut without a reduction of current spending should:
  - Increase income and, therefore, C^d by a fraction of the tax cut.
  - But expectations of higher taxes and lower after-tax income in the future are raised.
- According to the Ricardian equivalence proposition the positive and the negative effects of the tax cut without reduction of the current spending should exactly cancel.
- In reality it may not be so, since many consumers are likely to be not forward-looking.

Ricardian Equivalence in it's Strict Form

- The model of consumer behaviour emphasises the importance that changes in PVLR have on c and c^f. How do changes in taxes affect c?
  - *If the government cuts taxes today then y rises, which should raise c, other things being equal.*
  - *Assuming unchanged spending, the government must borrow the difference.*
  - *But taxpayers are on the hook for that borrowing so y^f will be lower.*
  - *Under certain conditions one offsets the other.*

Ricardian Equivalence in it's Strict Form (continued)

- For a more formal demonstration, start with *PVLR*, which is:

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

  - *In the first period, the government raises household income by giving them a lump sum tax rebate, which they use to buy government bonds (b).*
  - *The government, however, has to raise taxes in the future (t^f) by $b(1+r)$ to retire its debt with interest and in the model, these taxes are levied against households.*

Ricardian Equivalence in it's Strict Form (continued)

- From the information on the previous slide the PVLR becomes:

$$PVLR = (y + b) + (y^f - t^f)/(1+r)$$

- Since $t^f = b(1 + r)$, we get:

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

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

- Since this is the original value of PVLR, consumption doesn't change. In this case, as households are forward looking, they simply save the tax cut to pay off their future tax liabilities.

Summary: How Desired National Saving is Affected

All else equal, an increase in:	**Causes desired national saving to:**	**Reason**
Current output, Y	Rise	Part of change in y is saved for future C^f.
Expected future output	Fall	Anticipated Y^f raises C^d and lowers S^d.
Wealth	Fall	Some consumed and S falls for given Y.
Expected real interest rate, r	Probably rise	Increased return raises S^d outweighing income effect. For debtors, saving rises.
Government purchases, G	Fall	Higher G directly lowers S^d, offsetting indirect effect.
Taxes, T	Remain unchanged or rise	No change if account taken of T^f but could rise to extent that T^f is not fully taken into account.