

# Chapter 5 : Consumption-Savings Decision and The Credit Market

EE312

Macroeconomics, Stephen Williamson, Chapter 9

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# 1. Two-Period Model

- Macroeconomics studies how key economic variable evolve over time
- The simplest way to think about intertemporal decision is in a two-period model
  - the first period is current period (or today)
  - the second period represents the future (or tomorrow)
- The consumer makes **intertemporal choice** between current consumption and future consumption.
  - Saving (lending) and dissaving (borrowing).
  - **The real interest rate** is the relative price of future consumption in terms of current consumption.
- Key trade-off : consuming today or consuming tomorrow or the consumption-saving decision
- Decisions to be affected by changes in the real interest rate and in current and future incomes.

## 2. Consumers

- Assume the consumer receives exogenous income.
- To keep this simple, we will omit labour/leisure choice.
- The consumer's budget constraint:
  - $c$  = current consumptions
  - $s$  = current saving
  - $y$  = current income
  - $t$  = current lump-sum taxes
- The current disposable income ( $y - t$ ) equals consumption plus saving ( $c + s$ ).

$$c + s = y - t$$

- Assuming bonds directly traded in the credit market.
- If  $s > 0$ , the consumer is saving. The consumer is a **lender** in the credit market.
- If  $s < 0$ , the consumer is disaving. The consumer is a **borrower** in the credit market.

- Assume one single real interest rate ( $r$ ) for borrowers and lenders.
- A bond is a promise to pay  $1 + r$  units of consumption goods tomorrow in exchange for 1 unit of consumption goods today.
- $r$  is the real interest rate on bonds.
- Consumer can exchange one unit of current consumption for  $(1+r)$  units of future consumption in the credit market.
  - Consumer can exchange  $(1+r)$  unit of future consumption for one unit of current consumption in the credit market.
- Consumer can exchange 1 unit of future consumption for ..... unit of current consumption in the credit market.
- **The relative price of future consumption in terms of current consumption is  $\frac{1}{(1 + r)}$ .**

## Future budget constraint

- The consumer's future budget constraint:
- If  $s < 0$ , the consumer pays the interest and principal on loan.

$$c' = y' - t' + (1 + r)s \quad (1)$$

- consumption must equal disposable income in the future period ( $y' - t'$ ) plus gross return on savings.

## 2.1 The consumer's lifetime budget constraint

**Lifetime budget constraint :** use  $c' = y' - t' + (1 + r)s$  and

$$c + s = y - t$$

$$c' = y' - t' + (1 + r)s$$

$$s = \frac{c' - y' + t'}{(1 + r)}$$

since  $c + s = y - t$

$$\begin{aligned} c + \frac{c' - y' + t'}{(1 + r)} &= y - t, \\ c + \frac{c'}{(1 + r)} &= y + \frac{y'}{(1 + r)} - t - \frac{t'}{(1 + r)}. \end{aligned}$$

The PV of lifetime consumption = PV of lifetime income minus PV of lifetime taxes.



$$c + \frac{c'}{(1+r)} = \left( y + \frac{y'}{(1+r)} \right) - \left( t + \frac{t'}{(1+r)} \right) \quad (2)$$

- The PV of lifetime consumption equals PV of lifetime income minus PV of lifetime taxes.
- The lifetime disposable income is the same as **lifetime wealth (we)**.

$$we = y + \frac{y'}{(1+r)} - t - \frac{t'}{(1+r)}.$$

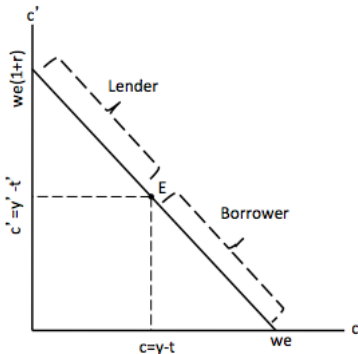
$$c + \frac{c'}{(1+r)} = we$$

$$c' = -(1 + r)c + we(1 + r) \quad (3)$$

- $we(1 + r)$  = what could be consumed in the future period if the consumer saved all of his or her current-disposable income and consume lifetime wealth (after earning the real interest rate  $r$  on savings) in the future period.
- $(1 + r)c$  = future value of current consumption
- plot  $c'$  (future consumption) against  $c$  (current consumption)

**Life time budget constraint :  $c' = -(1+r)c + we(1+r)$**

- E = endowment point where  $s = 0$ ;
- $c = y - t$ ;
- $c' = y' - t'$ .
- Above E, the consumer is a lender.
- Below E, a borrower.

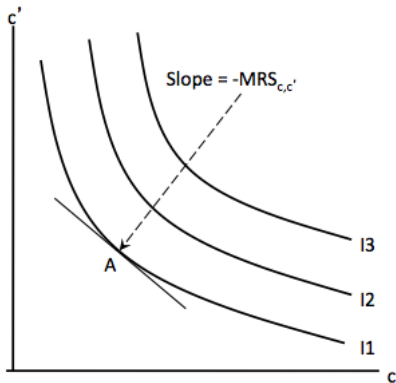


## 2.2 The consumer's preferences

- A **consumption bundle** is a combination of current and future consumptions.
- Properties of consumer preference:
  - More is preferred to less.
  - **Diversity** in the consumption bundle is preferred (consumption smoothing).
  - Current and future consumptions are **normal goods**.

## The consumer's indifference curves

- The ICs are downward-sloped and convex.
- Slope =  $-MRS_{c,c'}$  = the marginal rate of substitution of  $c$  for  $c'$ .
- $MRS_{c,c'}$  is falling as  $c$  increases.



## 2.3 Consumer optimization

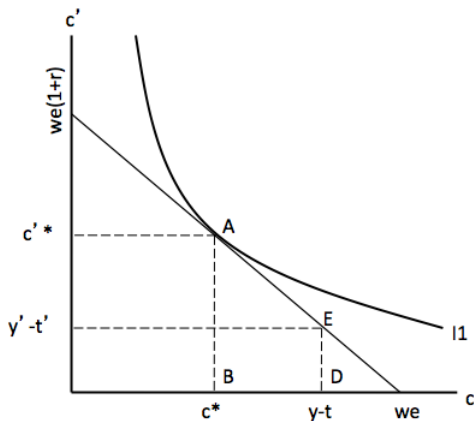
- The consumer chooses  $c, c'$  to maximize utility subject to the life time budget constraint.
- Consumer chooses a consumption bundle on the BC. The indifference curve is tangent to the life time budget constraint.
- The optimization condition:

$$\frac{MU_c}{MU_{c'}} = MRS_{c,c'} = (1 + r)$$

- The consumer is optimizing where the marginal rate of substitution of  $c$  for  $c'$  equals the relative price of  $c$  in terms of  $c'$ .
  - The willingness to trade  $c$  for  $c'$  equals the market rate of trading  $c$  for  $c'$ .
- The optimized consumption bundle is  $(c, c') = (c^*, c'^*)$ .

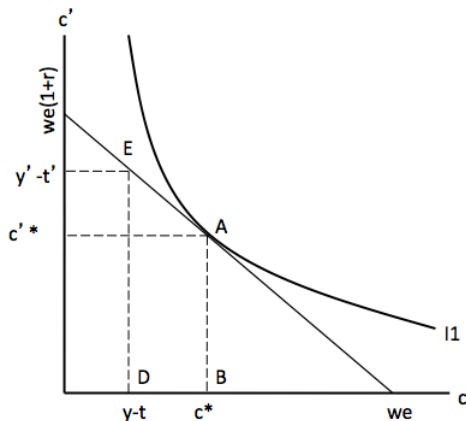
### 2.3.1 The consumer is a lender.

- At A,  $(c, c') = (c^*, c'^*)$  and  $c^* < (y - t)$ .
- $s = y - t - c^* = BD > 0$ .



## 2.3.2 The consumer is a borrower.

- At A,  $(c, c') = (c^*, c'^*)$  and  $c^* > (y - t)$ .
- $s = y - t - c^* = BD < 0$ .





## 2.4 An increase in current income

- An increase in **current income** results in an increase in **lifetime wealth**.
- **A pure income effect.**
- The budget line shifts horizontally to the right

$$we_1 = y_1 + \frac{y'}{(1+r)} - t - \frac{t'}{(1+r)}$$

$$we_2 = y_2 + \frac{y'}{(1+r)} - t - \frac{t'}{(1+r)}$$

$$\Delta we = we_2 - we_1$$

$$= y_2 - y_1$$

- Both current and future consumptions increase (normal goods).
  - The increase in  $c$  is **smaller** than the increase in  $y$ .
  - Saving increases; hence,  $c^*$  increases.
  - The consumer prefers diversity in the consumption bundle — **consumption smoothing**.

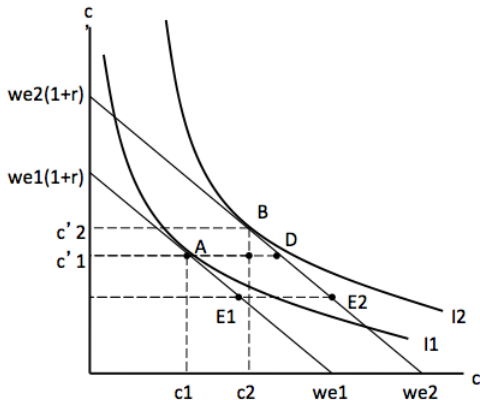
$$\Delta s = \Delta y - \Delta t - \Delta c$$

and because  $\Delta t = 0$ , and  $\Delta y > \Delta c > 0$ ,

$$\Delta s > 0.$$

## Increase in current $y$ for a lender.

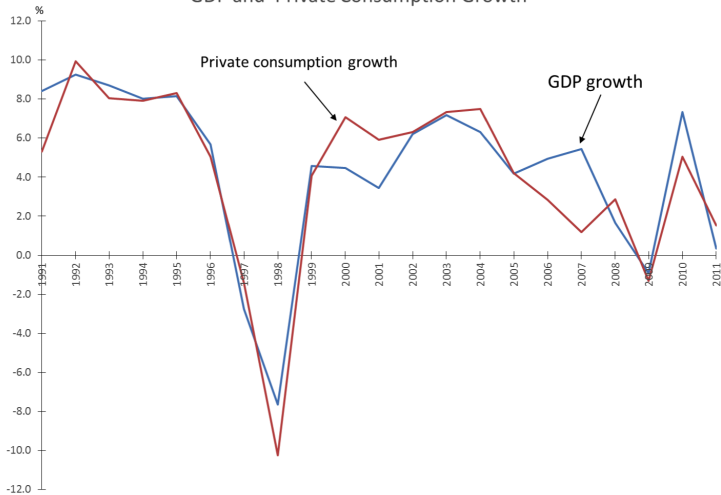
- Both  $c$  and  $c'$  increase (A to B).
- $\Delta c = c_1 c_2 < \Delta Y = AD$
- $\Delta s > 0$
- $s = y - t - c^*$
- $\Delta s = \Delta y - \Delta t - \Delta c = BD > 0$ .



## Consumption smoothing

- **An increase in current income causes an increase in consumption in both periods and an increase in savings.**
- This behaviour arises because of the consumer's desire to **smooth consumption over time.**
- The theory **predicts aggregate consumption is less volatile than aggregate output.**
- Theory is qualitatively consistent with data
  - Aggregate consumption is less variable than GDP.
  - Consumption of **nondurables and services** is even less variable.
  - Consumption of **durables** is more volatile.
    - Durable consumption is more like investment.
    - Returns of service flow from durable goods.
- While consumption is less volatile than GDP, it is still not smooth enough to be in line with the theory.

## GDP and Private Consumption Growth



## 2.5 Increase in future income

### An increase in future income ( $y'$ )

- An increase in **future income** results in an increase in **lifetime wealth**.
- The budget line shifts vertically to the top.

$$we_1 = y + \frac{y'_1}{(1+r)} - t - \frac{t'}{(1+r)}$$

$$we_2 = y + \frac{y'_2}{(1+r)} - t - \frac{t'}{(1+r)}$$

$$\Delta we = we_2 - we_1$$

$$= \frac{y'_2 - y'_1}{1+r}$$

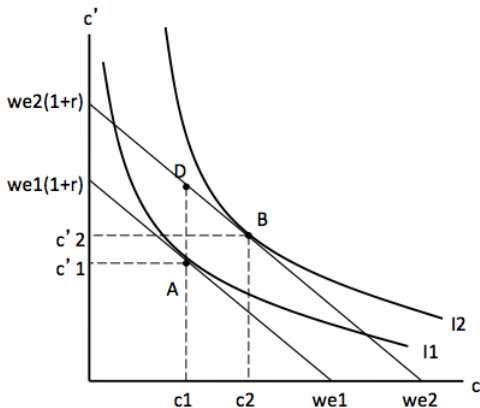
- Future consumption increases, but by a lesser amount than the increase in future income.
  - **Saving decreases; current consumption increases.**
- The increase in future income is smoothened into increases in both future and current consumption.

$$\Delta s = \Delta y - \Delta t - \Delta c$$

and because  $\Delta t = 0$ , and  $\Delta y = 0$ ,

$$\Delta c > 0, \Delta s < 0.$$

- Both  $c$  and  $c'$  increase (A to B).
- $\Delta c' = c'_1 c'_2$
- $\Delta c' < \Delta y' = AD$
- $\Delta s < 0$



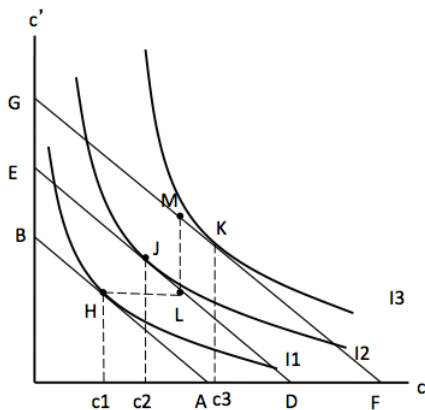


## 2.6 Temporary and permanent increases in income

- Consumer's response will be different when they face temporary or permanent changes in income
- **A permanent increase** in income has a larger positive effect on lifetime wealth and current income than a **temporary increase**.
  - **Milton Friedman's 'permanent income hypothesis'**: the level of current consumption depends on the level of permanent income'.
- The consumer will tend to save most of the **temporary increase** in income.
- Temporary changes in income yield small changes in permanent income, hence will have small effects on current consumption.
- Permanent increase: increase both  $y$  and  $y'$

## Temporary versus Permanent $\Delta y$

- HJ = effect of temporary rise in  $y$ .
- HK = effect of permanent rise in  $y$ .



- **A temporary increase in  $y$  = HL:** the budget line shifts from AB to ED.
  - The consumption bundle rises from H to J.
  - Current consumption rises less than current income; saving increases — **consumption smoothing**.
- **A permanent increase in  $y = y_2 - y_1 = y'_2 - y'_1$ :** the budget line shifts from AB to GF.
  - $y_2 - y_1 = HL = y'_2 - y'_1 = LM$ .
  - The consumption bundle rises from H to K.
  - Larger effect on current consumption: c1c3

## 2.7 Effect of a tax cut?

- The effect of the government's tax cut on consumption depends on whether the cut is temporary or permanent.
- **If temporary**, the increase in consumption will be small; most of the increased income is saved.
- **If permanent**, the increase in consumption will be large.

## 2.8 An increase in the real interest rate

- $\frac{1}{1+r}$  is the relative price of future consumption in terms of current consumption.
  - The slope of the budget line is  $-(1+r)$ .
  - A change in the real interest rate causes the budget line to rotate.
  - Changes in intertemporal decision between current and future consumptions.
  - Analysis of the substitution effect and income effect.

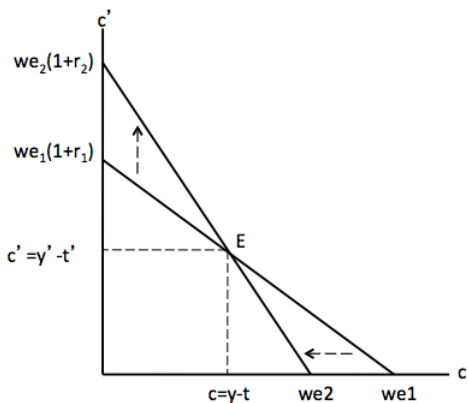
$$we = y + \frac{y'}{(1+r)} - t - \frac{t'}{(1+r)}$$

$$we(1+r) = y(1+r) + y' - t(1+r) - t'$$

- The budget line rotates upwards as the real interest rate increases.
- 'we' decreases (horizontal intercept).
- $we(1+r)$  increases if  $r$  increases (vertical intercept).
- The endowment point (E) remains the same (no change in the initial endowment of  $y - t, y' - t'$ ).
- E is the pivot point.

## An increase in the real interest rates

- The increase in the real interest rate rotates the budget line upwards with the same E.



## 2.8.1 The dual effects of a higher $r$

An increase in the real interest rate ( $r$ ) causes a change in the relative price of current and future consumptions.

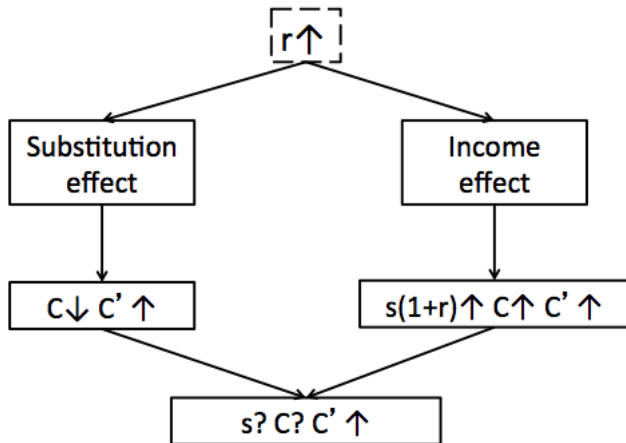
- **Future consumption** becomes cheaper; **current consumption** becomes more expensive.
- Higher return on savings; less sacrifice in current consumption is needed for given future consumption.
- **Lender**: cheaper future consumption.
- **Borrower**: more expensive current consumption



## 2.8.2 Effect of higher $r$ on the lender

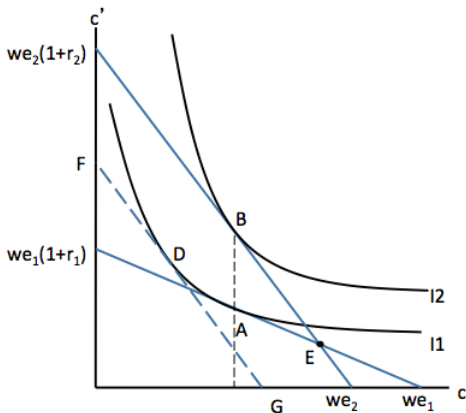
- Future consumption becomes cheaper in terms of current consumption.
- **The substitution effect:** more future consumption for less current consumption.
- **The income effect:** given savings yield more future income — higher current and future consumptions.
- Higher future consumption; unclear current consumption and savings, given  $y$  and  $y'$

## Effect of higher $r$ on the lender



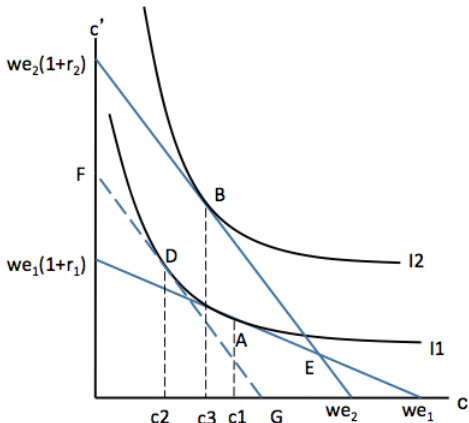
## An increase in $r$ for a lender.

- AD = substitution effect; lower  $c$  for higher  $c'$ .
- DB = income effect; higher  $c$  and  $c'$ .
- Net effect: higher  $c'$ ; unclear  $c$ .



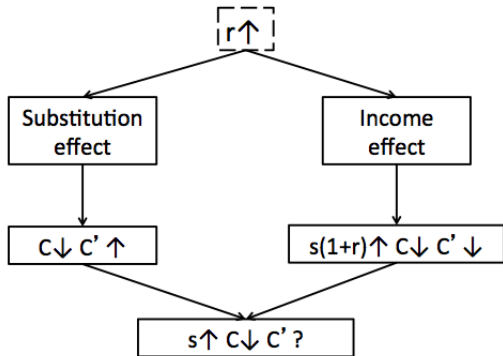
## Stronger substitution effect

- AD = substitution effect; lower  $c$ .
- DB = income effect; higher  $c$ .
- $AD > DB$ ; lower  $c$  at  $c_3$ , assuming **a lender**.



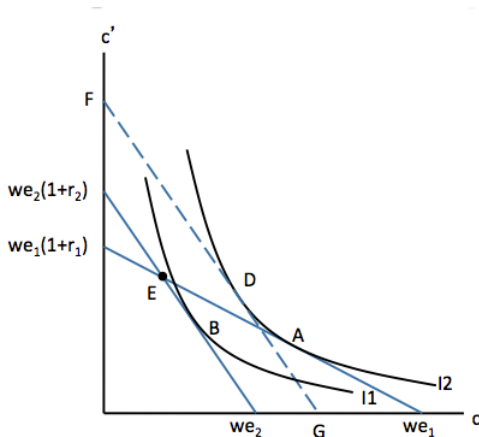
### 2.8.3 An increase in $r$ for a borrower

- Current consumption becomes more expensive in terms of future consumption.
  - **The substitution effect:** more future consumption and less current consumption.
  - **The income effect: loans** for future consumption become more expensive — reduced current and future consumptions.
- Current consumption decreases while saving increases; unclear future consumption.



## An increase in $r$ for a borrower

- AD = substitution effect; lower  $c$  and higher  $c'$ .
- DB = income effect; lower  $c$  and  $c'$ .
- Net effect: lower  $c$ ; unclear  $c'$ .



## 2.8.4 Conclusions on effects of $\Delta r$

- A higher real interest rate ( $r$ ) has an intertemporal substitution effect.
  - Future consumption is substituted for current consumption — saving increases.
- Positive income effect for lenders but negative income effect for borrowers.
- No certainty that current consumption will fall if the real interest rate rises.



### 3. The government sector

- $G$  = current government purchase of goods.
- $G'$  = future government purchase of goods.
- $T$  = current taxes collected by the government.
- $N$  = number of consumers, each paying the current tax of  $t$ ; so  $T = Nt$ .
- $T'$  = future taxes; and  $T' = Nt'$ .
- Government borrows by issuing bonds ( $B$ ) at the real interest rate of  $r$ .

## 3.1 Government's current budget constraint

- Government spending is financed by taxes and bond issue in each period.
- Government's current budget constraint:  $G = T + B$  or  $G - T = B$ .
  - $B > 0$  government is a borrower;
  - $B < 0$  government is a lender.
- Government's future budget constraint:  $G' + (1+r)B = T'$

## 3.2 Government present-value budget constraint

The present value of government purchases must equal the present value of taxes.

$$G = T + B$$

$$G' + (1 + r)B = T'$$

total government outlays  
in the future = future taxes

$$B = \frac{T' - G'}{1 + r}$$

$$G + \frac{G'}{1 + r} = T + \frac{T'}{1 + r}$$

### 3.3 Competitive equilibrium

- Consumers and government interact in the credit market.
  - Trading of future consumption goods for current consumption goods through the interest rate.
- Equilibrium condition:
  - Each consumer optimizes current and future consumptions and saving, given  $r$ .
  - Government budget constraint holds.
  - The credit market clears.

## The credit market clears.

- Private savings ( $s^p$ ) equals government borrowing ( $B$ ) or  $S^p = B$
- National saving is the sum of private savings and government savings;  $S = S^p + S^g$ .

$$S = S^p + S^g$$

$$S^p = B$$

$$S^g = -B$$

$$S = B - B = 0$$

## The income-expenditure identity

- The credit-market clearing implies that the income-expenditure identity holds.

$$Y = C + G$$

$$S^P = Y - C - T$$

$$B = G - T$$

$$Y - C - T = G - T$$

$$Y = C + G$$

## 4. The Ricardian Equivalence

- **A change in current taxes** with an equal and opposite change in the present value of future taxes has **no effect on the real interest rate and the consumption of individual consumers.**
  - Assume equilibrium in the credit market, given  $r$ .
  - Current and future government spending are held constant.
  - Consumers' life-time budget constraint and government's present-value budget constraint.

## 4.1 Algebraic formulation

$$G + \frac{G'}{1+r} = Nt + \frac{Nt'}{1+r}$$
$$t + \frac{t'}{1+r} = \frac{1}{N} \left[ G + \frac{G'}{1+r} \right] \quad \dots(\text{eq.9.25})$$

$$\text{From } c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \left[ t + \frac{t'}{1+r} \right]$$
$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{N} \left[ G + \frac{G'}{1+r} \right] \quad \dots(\text{eq.9.26})$$



$$t + \frac{t'}{1+r} = \frac{1}{N} \left[ G + \frac{G'}{1+r} \right] \quad \dots(\text{eq.9.25})$$

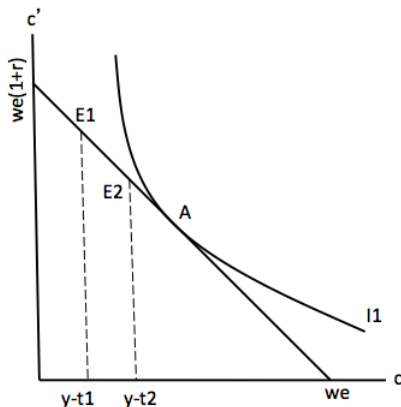
$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{N} \left[ G + \frac{G'}{1+r} \right] \quad \dots(\text{eq.9.26})$$

- The change in current taxes ( $\Delta t$ ) is matched by  $-(1+r)\Delta t$  so that equation 9.25 holds.
  - Equation 9.26 remains unchanged, given  $r$  (as  $y, y', G, G'$  and  $N$  are the same).
  - And  $Y = C + G$ ; the credit market clears.
  - No welfare change for consumers.

- But private and government savings do change due to the different timings of taxes.
  - A decrease in current taxes increases private saving and reduces government saving by the same amount ( $S^p = Y - C - T$  and  $S^g = T - G$ ).
- Consumers respond to a tax cut by increasing private saving by the same amount.
  - Private saving increases to pay for higher future taxes.
  - The consumption bundle remains the same.
  - $\Delta S^p = \Delta B = \Delta T$  so the credit market equilibrium remains.

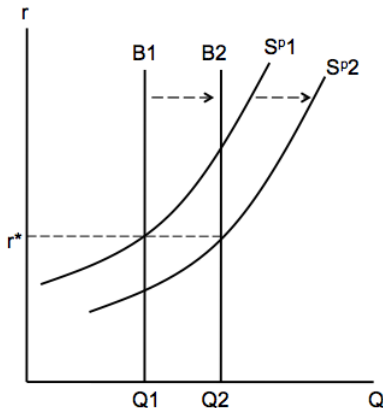
## 4.2 A current tax cut for a borrower

- A current tax cut equals a future tax increase.
- Lifetime wealth and consumption bundle (A) are the same.
- Only the endowment point changes from E1 to E2.



## Unchanged credit market

- Private saving and government borrowing increase by the same amount.
- Equilibrium  $r$  is the same.



## 4.4 A tax cut is not a free lunch!

- A current tax cut gives all consumers higher current disposable income.
- But consumers must bear higher future taxes by the same amount.
- No welfare gain for consumers!

## 4.5 Ricardian equivalence assumptions

- A tax change affects every consumer by the same amount so that the present-value tax burden is unchanged.
  - If some consumers receive higher tax cuts, then their lifetime wealth and consumption choices (and the real interest rate) change.
- Future tax burdens may be shared unequally.
- Government can redistribute wealth among income classes through tax policy!

- Government debt is paid off during the lifetimes of current consumers.
  - But the government can postpone debt payment (and future taxes) to next generations.
  - The old receive tax cuts and higher disposable incomes; the young pay higher future taxes.
- The government can redistribute wealth between generations!
  - The effect of the social security programs.

- The tax is lump-sum.
  - All taxes cause distortions in the relative prices and consumption choices.
  - Welfare loss is greater than tax revenues.
- **Perfect credit markets:** consumers can borrow and lend as much at the same interest rate.
  - But consumers have limits on borrowing.
  - The borrowing rate is higher than the lending rate.
  - Government borrows at a lower rate.
  - Credit-constrained consumers benefit from a tax cut.