EC213 Macroeconomics

Dr Aidan Kane

Topic 2:
Intertemporal budget constraints

Chapters 3,4 Burda + Wyplosz

Outline

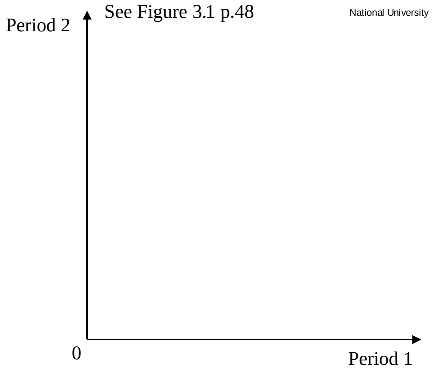
- The consumer's intertemporal budget constraint …private sector
- Public sector budget constraints
- Consolidated public and private sector constraints
- The Ricardian Equivalence proposition
- National Intertemporal budget constraints
- Optimal Consumption/Consumption smoothing
- Impact of temporary vs. permanent changes in income on savings
- Impact of changes in interest rates on savings

Budget constraints

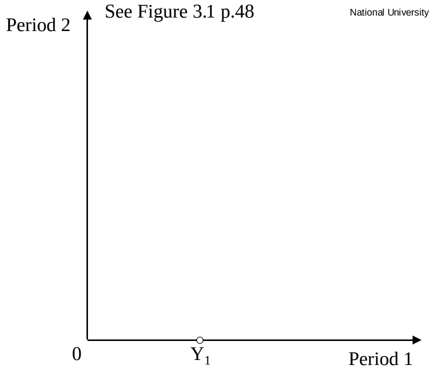
- Real analysis
- Microeconomic foundations
- Intratemporal vs. intertemporal
- 'Robinson Crusoe' model:

Two time periods
Income in both periods (endowment) *Y*
Ability to lend or borrow at rate *r*

See Figure 3.1 p.48



See Figure 3.1 p.48



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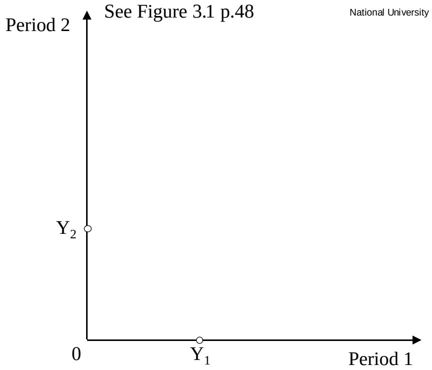

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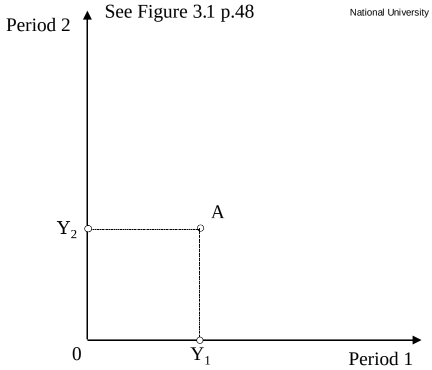

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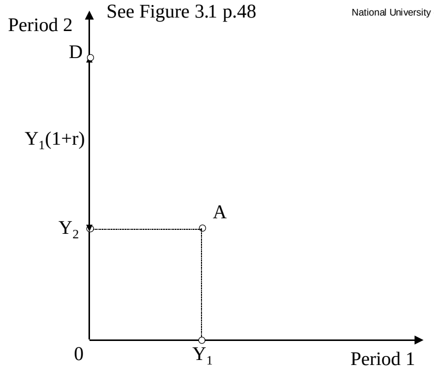

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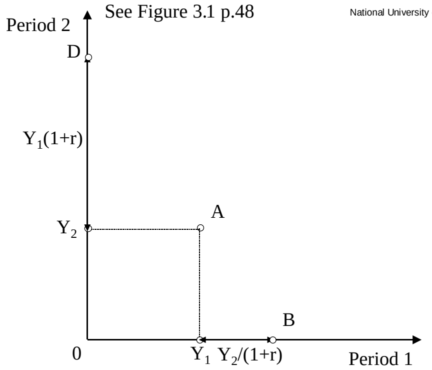

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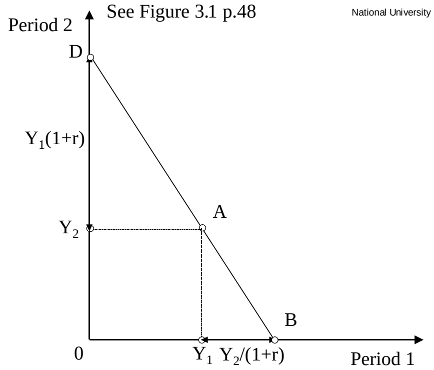

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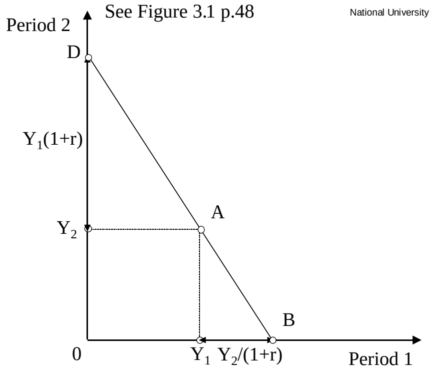

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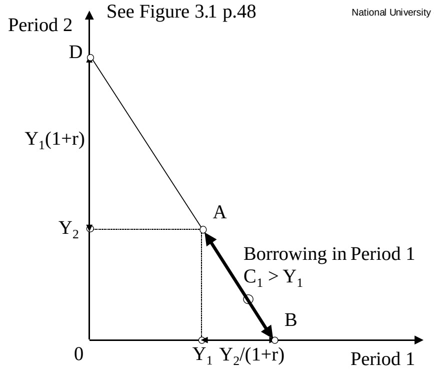

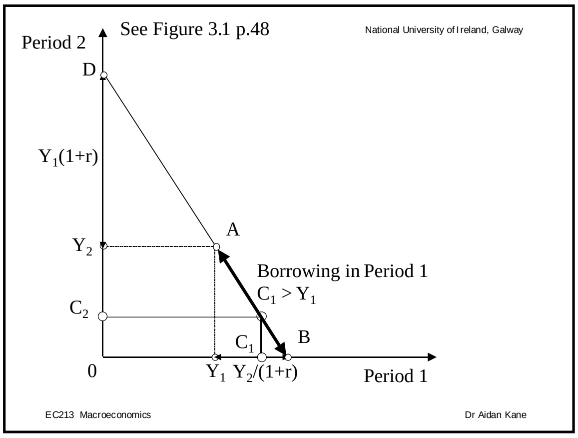
See Figure 3.1 p.48
National University of Ireland, Galway
Period 2
D
Y1(1+r)
Y2
A
Borrowing in Period 1
C1 > Y1
C2
C1
B
0
Y1 Y2/(1+r)
Period 1
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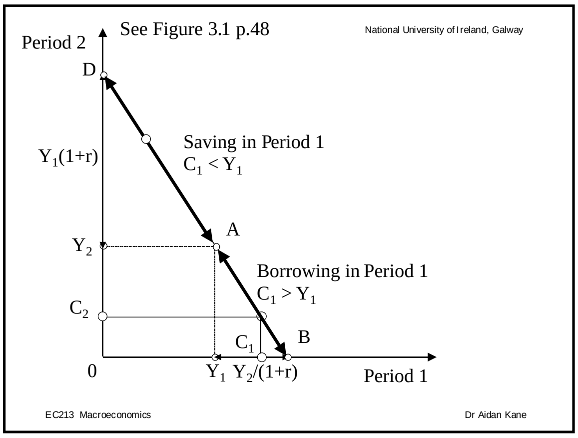
See Figure 3.1 p.48
National University of Ireland, Galway
Period 2
D
Y1(1+r)
Saving in Period 1
C1 < Y1
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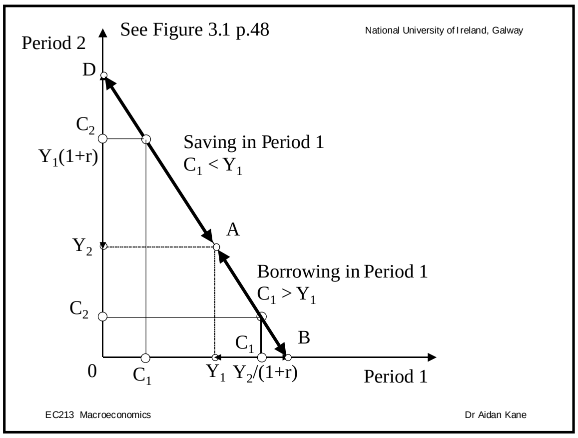
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National University of Ireland, Galway
Period 2
D
C2
Y1(1+r)
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C1 < Y1
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Y2
Borrowing in Period 1
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Period 1
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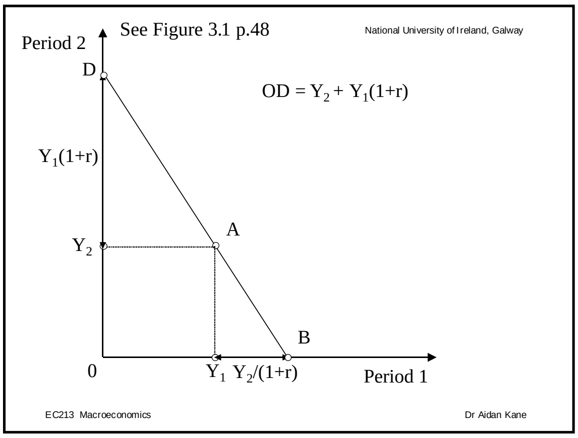
See Figure 3.1 p.48
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Period 2
D
OD = Y2 + Y1(1+r)
Y1(1+r)
A
Y2
B
0
Y1 Y2/(1+r)
Period 1
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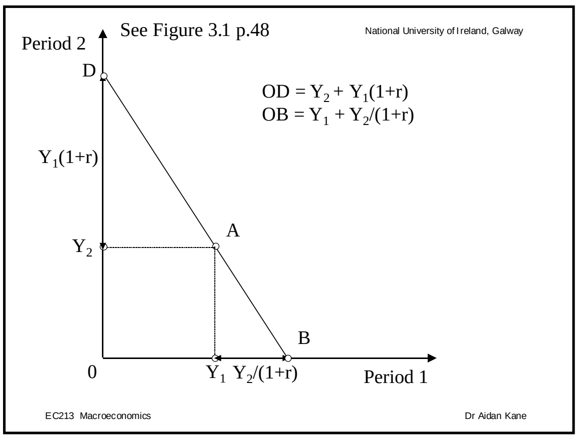
See Figure 3.1 p.48
National University of Ireland, Galway
Period 2
D
OD = Y2 + Y1(1+r)
OB = Y1 + Y2/(1+r)
Y1(1+r)
A
Y2
B
0
Y1 Y2/(1+r)
Period 1
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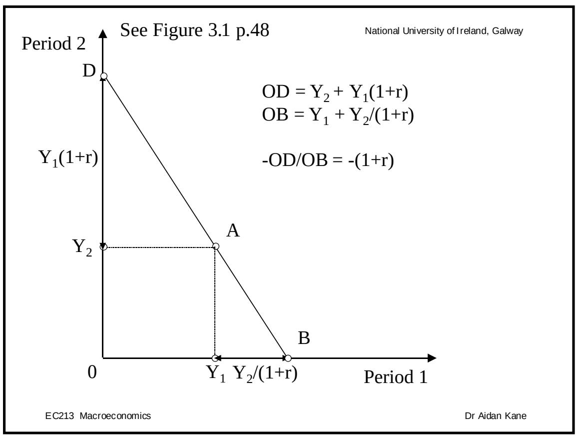
See Figure 3.1 p.48
National University of Ireland, Galway
Period 2
D
OD = Y2 + Y1(1+r)
OB = Y1 + Y2/(1+r)
-OD/OB = -(1+r)
Y1(1+r)
A
Y2
B
0
Y1 Y2/(1+r)
Period 1
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Intertemporal budget constraint

- First period: Y_1 income, C_1
- Savings/borrowings: $Y_1 - C_1$
- Second period:

$$C_2 = Y_2 + (Y_1 - C_1)(1+r)$$
$$C_1(1+r) + C_2 = Y_1(1+r) + Y_2$$
$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r)$$

Lifetime income(wealth) constrains consumption

- $C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r)$
- present value of consumption = present value of income
- = wealth Ω
- = OB

Discounting and present values

- An example
- bond pays £100 in 1 year's time
- interest rate is 5%
- price of bond now i.e. present value
- $B(1 + 0.05)=100$
- $B = 100/(1.05) =$ £95.24
- For 2 year bond, $B = 100/(1.05)^2 =$ £90.7

More generally...

- A stream of payments $a_1, a_2, ..., a_n$
- Present value =
- $a_1/(1+r) + a_2/(1+r)^2 + ...+ a_n/(1+r)^n$
- when payment = a for ever,
- present value = a/r

The public sector buget constraint

- Assume two period, no initial debt
- Spending G_1 and G_2
- Taxation T_1 and T_2
- All debts must be paid off (government does not default)
- $T_2 = G_2 + (G_1 - T_1)(1 + r_G)$
- $G_1 + G_2/(1 + r_G) = T_1 + T_2/(1 + r_G)$

Deficits and primary deficits

- Given initial debt D_0, and interest payments $r_G D_0$
- Total deficit = $(G_1 - T_1) + r_G D_0$
- i.e. primary deficit + interest payments
- Then..
- $D_0 + (G_1 - T_1) + (G_2 - T_2)/(1+r_G)=0$

Consolidated private and public budget constraints

$C_1 + C_2/(1+r) = (Y_1-T_1) + (Y_2-T_2)/(1+r)$

$G_1 + G_2/(1 + r_G) = T_1 + T_2/(1 + r_G)$

$(C_1 + G_1) + (C_2 + G_2)/(1+r)=Y_1 + Y_2/(1+r)$

- present value of domestic spending = present value of domestic income
- leads to Ricardian equivalence proposition

Ricardian Equivalence

Given:

$(C_1 + G_1) + (C_2 + G_2)/(1+r)=Y_1 + Y_2/(1+r)$

(1) private sector internalises public sector budget constraint: deficits have no real effects

(2) public debt is **not** net wealth for the private sector

Contrast with Keynesian ‘multiplier’ effect

Ireland 1987-88: an ‘Expansionary Fiscal Contraction’?

Example: a tax cut

- $C_1 + C_2/(1+r) = (Y_1-T_1) + (Y_2-T_2)/(1+r)$
- $= C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) - [T_1 + T_2/(1+r)]$

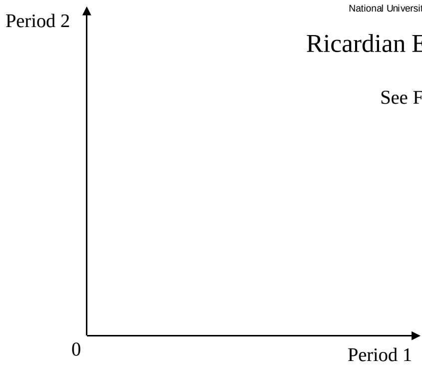
$\Delta T_1 = \Delta T$

$\Delta T_2 = (1+r)\Delta T$

change in PV of taxes = $\Delta T + (1+r)\Delta T/(1+r) = 0$

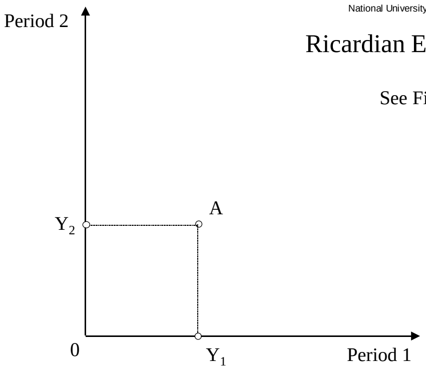
Ricardian Equivalence

See Figure 3.11 p.59



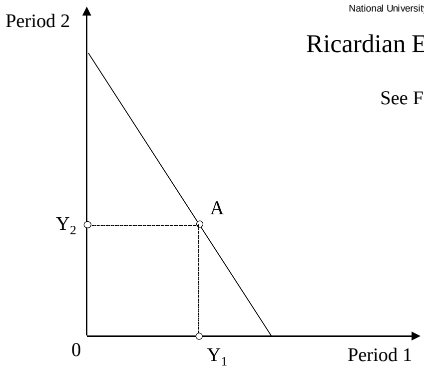
Ricardian Equivalence

See Figure 3.11 p.59



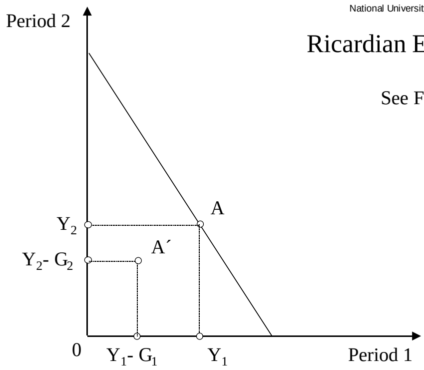
Ricardian Equivalence

See Figure 3.11 p.59



Ricardian Equivalence

See Figure 3.11 p.59



Ricardian Equivalence

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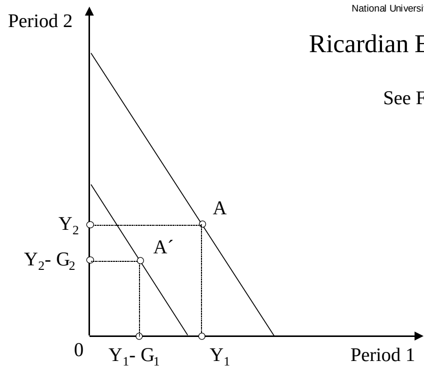


Problems with Ricardian Equivalence

- Different time horizons
- Different interest rates
- Liquidity contraints

Public and private interest rates

Table 3.1 p.60 % p.a. 1995

	Treasury Bonds	Corporate Bonds
Belgium	6.83%	7.33%

Public and private interest rates

Table 3.1 p.60 % p.a. 1995

	Treasury Bonds	Corporate Bonds
Belgium	6.83%	7.33%
France	7.17%	7.60%

Public and private interest rates

Table 3.1 p.60 % p.a. 1995

	Treasury Bonds	Corporate Bonds
Belgium	6.83%	7.33%
France	7.17%	7.60%
Italy	11.51%	10.09%

Different interest rates

If $r > r_G$ consolidated budget constraint:

Different interest rates

If $r > r_G$ consolidated budget constraint:

$$C_1 + \frac{C_2}{(1+r)} =$$

Different interest rates

If $r > r_G$ consolidated budget constraint:

$$C_1 + \frac{C_2}{(1+r)} = (Y_1 - G_1) + \frac{(Y_2 - G_2)}{(1+r)} +$$

Different interest rates

If $r > r_G$ consolidated budget constraint:

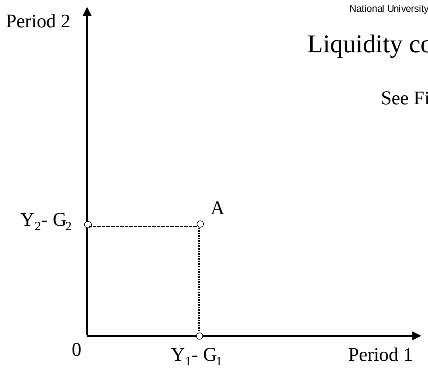
$$C_1 + \frac{C_2}{(1+r)} = (Y_1 - G_1) + \frac{(Y_2 - G_2)}{(1+r)} + \frac{(r - r_G)}{(1+r)} [G_1 - T_1]$$

Liquidity constraints

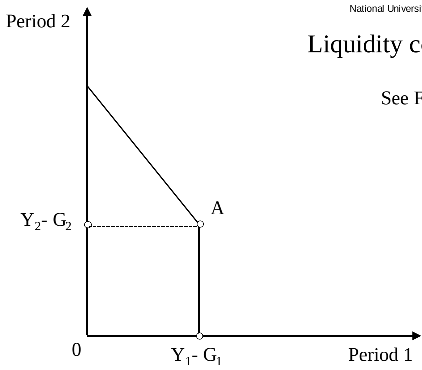
Liquidity constraints:
- inability to borrow against future income at any interest rate
- credit rationing
- a form of market failure e.g. in human capital market

Liquidity constraints

See Figure 3.13 p.61

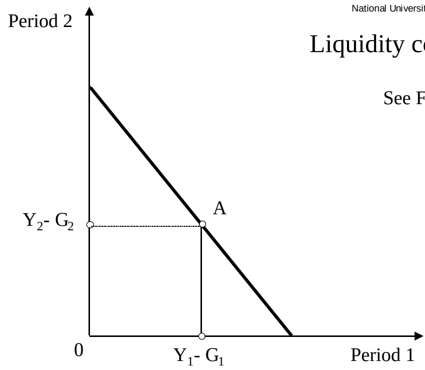


Liquidity constraints



See Figure 3.13 p.61

Liquidity constraints



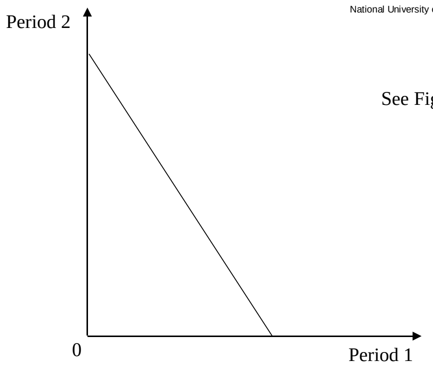
See Figure 3.13 p.61

National intertemporal budget constraint

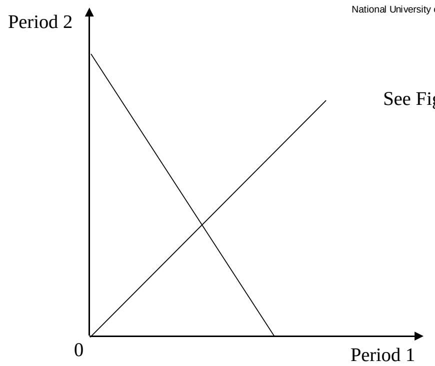
- Open economy not limited by domestic income
- (S-I) + (T-G) = CA
- Given F, net asset position with rest of world
- and r, return on net assets
- CA = Primary Current Account + net investment income
- CA = PCA + rF
- Ignoring any initial assets in a two-period model:
- $PCA_1 + PCA_2/(1+r) = 0$

Optimal consumption

- Preferences: indifference curves
- Consumption smoothing



See Figure 4.2 p.77



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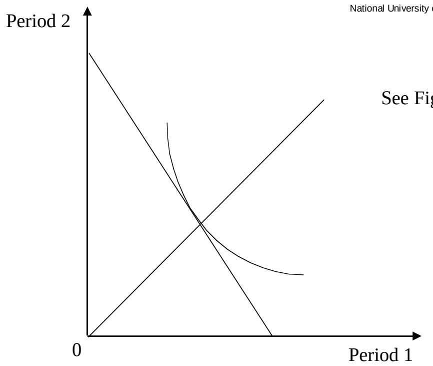

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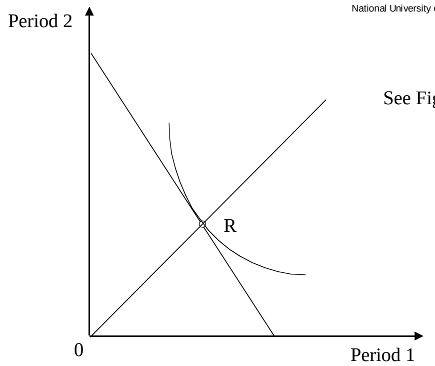

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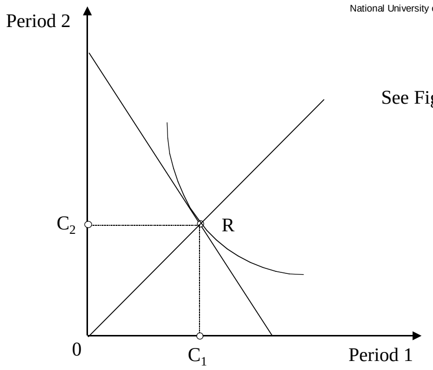

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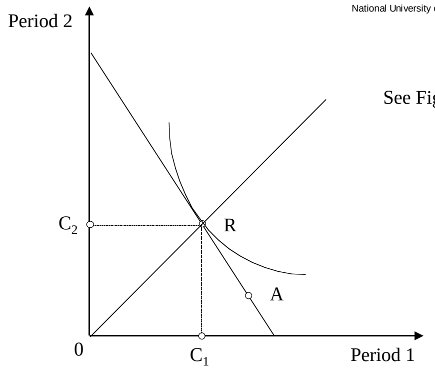

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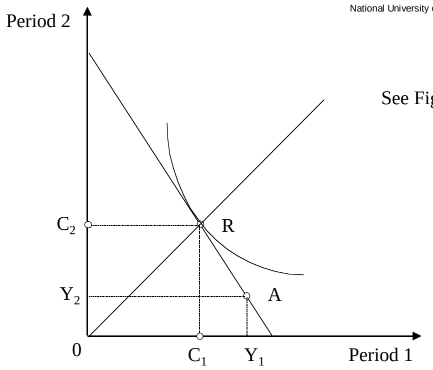

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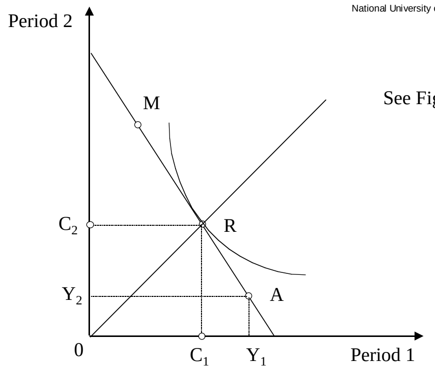

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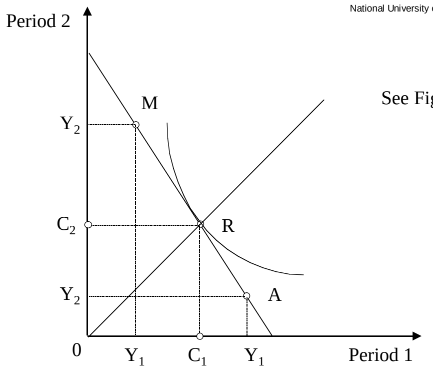
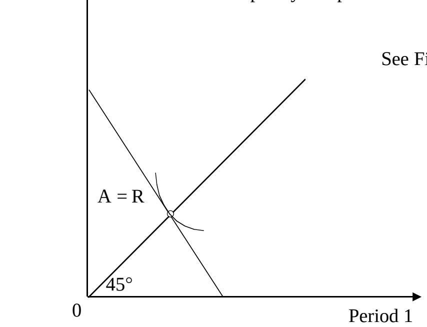


See Figure 4.2 p.77

Optimal consumption

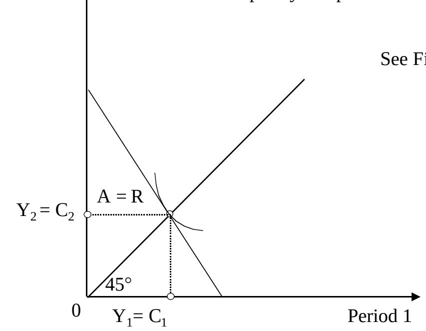
- Temporary and permanent income changes
- Effects of a change in *r*

Temporary and permanent income changes



See Figure 4.4 p. 78

Temporary and permanent income changes



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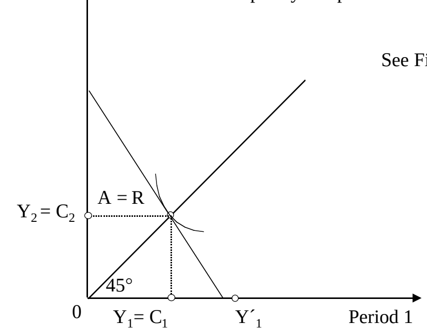
Temporary and permanent income changes



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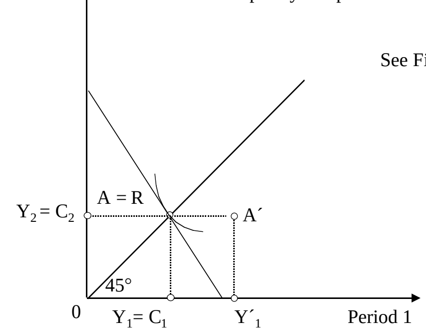
Temporary and permanent income changes



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Temporary and permanent income changes

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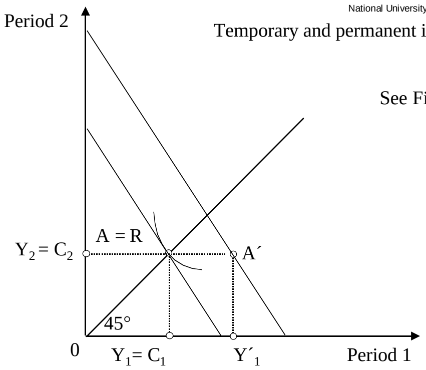

Temporary and permanent income changes

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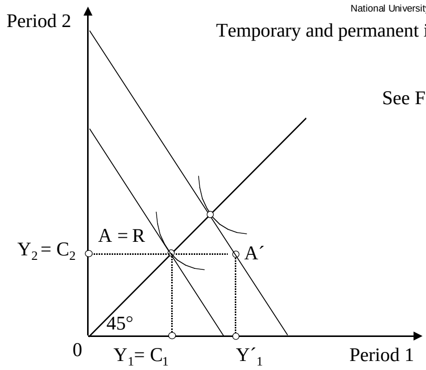

Temporary and permanent income changes

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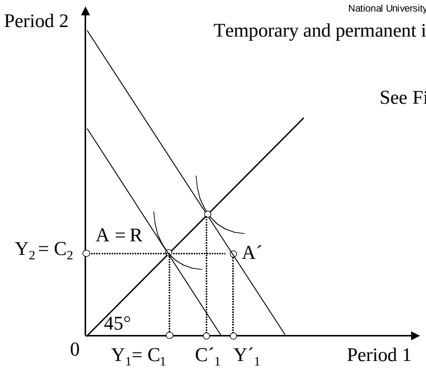

Temporary and permanent income changes

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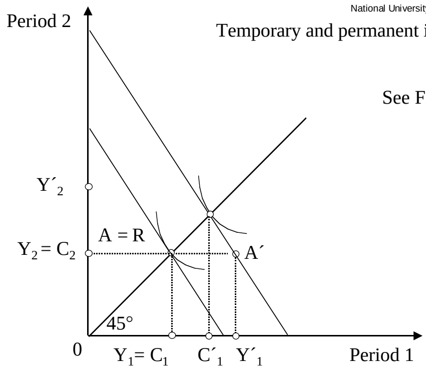

Temporary and permanent income changes

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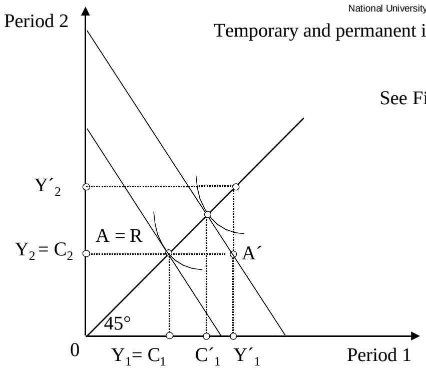

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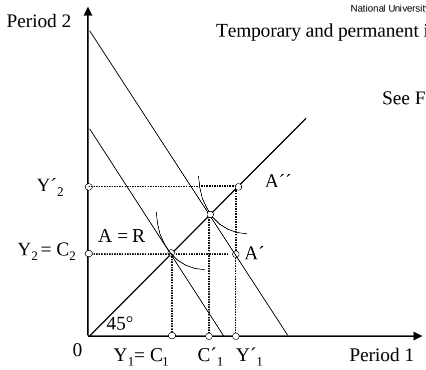

Temporary and permanent income changes

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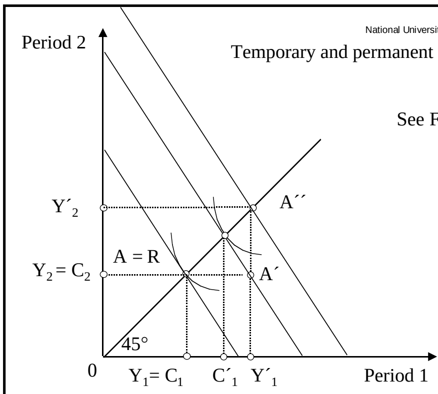

Temporary and permanent income changes

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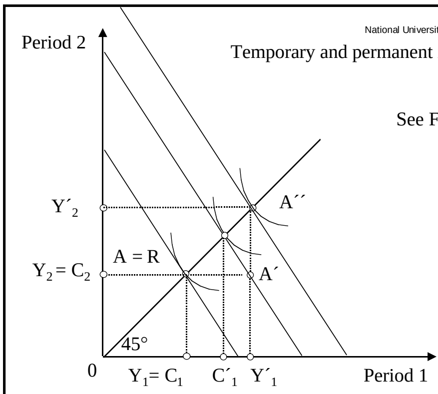
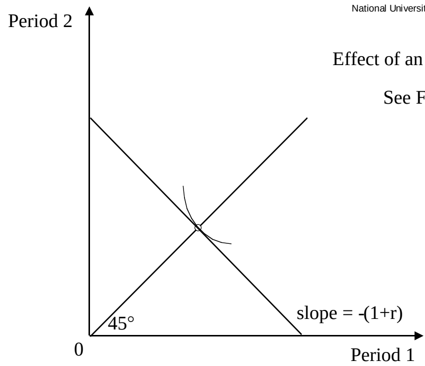


Effect of an increase in *r*

- i.e. effect on C_1, C_2
- result depends on whether individual is a borrower or lender
- we can say increased *r* reduces wealth
- $\Omega = Y_1 + Y_2/(1+r)$
- so $C = C(\Omega^+, Y_d^+)$

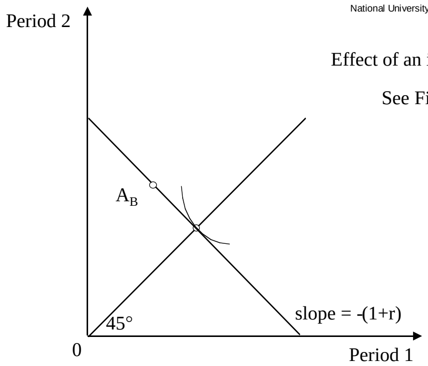
Effect of an increase in *r*

See Figure 4.8 p. 81



Effect of an increase in *r*

See Figure 4.8 p. 81



Effect of an increase in *r*

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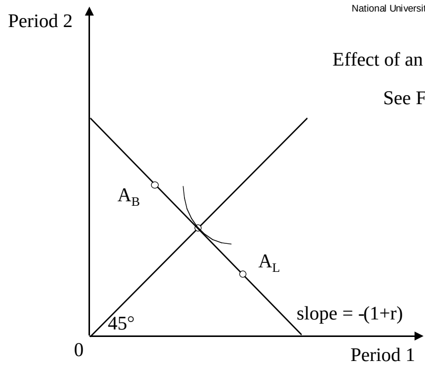
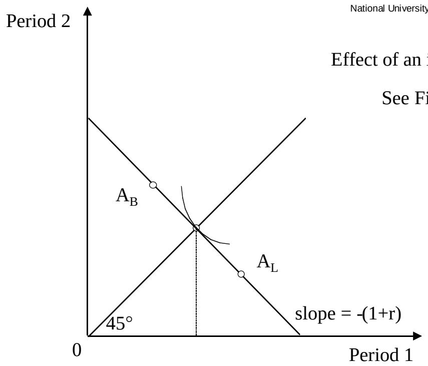


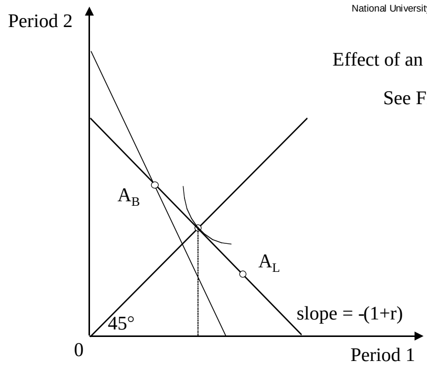
Effect of an increase in *r*

See Figure 4.8 p. 81



Effect of an increase in *r*

See Figure 4.8 p. 81



Effect of an increase in *r*

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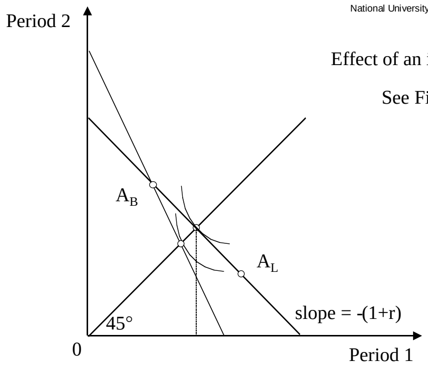
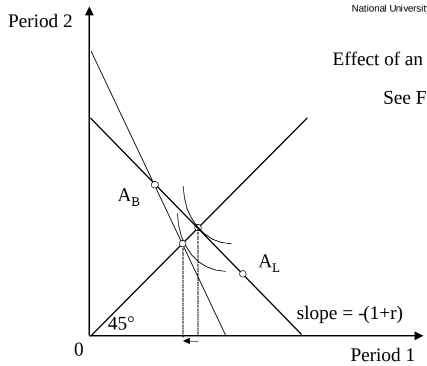


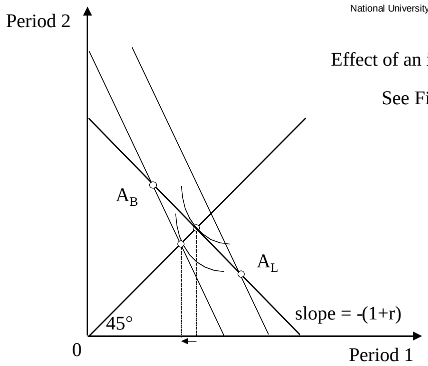
Effect of an increase in *r*

See Figure 4.8 p. 81



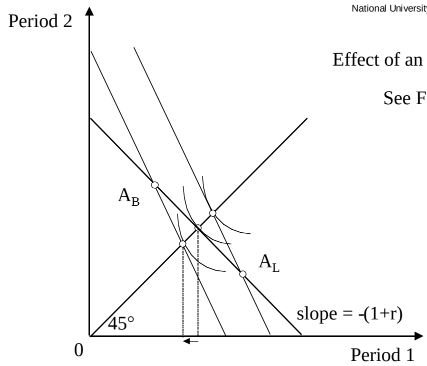
Effect of an increase in *r*

See Figure 4.8 p. 81



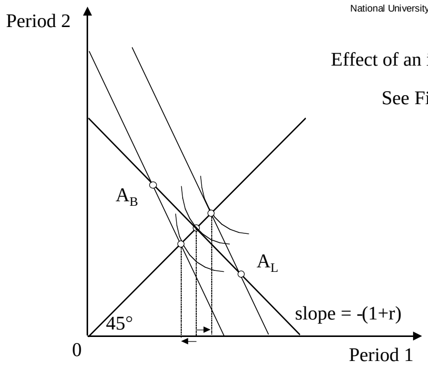
Effect of an increase in *r*

See Figure 4.8 p. 81



Effect of an increase in *r*

See Figure 4.8 p. 81



Optimal investment

- Additions to the capital stock, **not** portfolio changes
- Investment function:
- $I = I(r^-, \Delta Y^+, q^+)$

Investment and *r*

- Production function: Y = F(K)
- $\Delta Y/\Delta K$ = MPK (marginal product of capital)
- Opportunity cost of capital = (1+ r)
- Optimal capital stock K* when MPK = (1+r)
- Given diminshing marginal product...
- if r rises, MPK must also rise i.e. K* falls
- i.e. I lower

Investment and ΔY

- The accelerator principle:
- K* = vY
- $I = \Delta K = v\Delta Y$
- typically 2<v<3

Investment and Tobin's q

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$$\text{Tobin's q} = \frac{\text{market value of installed capital}}{\text{replacement cost of installed capital}}$$

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so I rises

so return on capital declines, until q = 1