TOPIC 3

The Demand Side of the Economy

Road Map

- What drives business investment decisions?
- What drives household consumption?
- What is the link between consumption and savings?
- Does consumption theory accurately match the data?
- What theories of consumption seem to match the data?
- What role can the government play in shaping spending?

Part I: Consumption

An Introduction to Consumption

- **Consumption =** demand for consumer goods and services by households

- Why Consumption is an important macroeconomic variable?

1. **C is the major component of demand** (more than 2/3 of GDP in US!)

1. **Household consumption decision is closely linked to saving decision**. (For given level of disposable income, deciding how much to consume = deciding how much to save!)

- We are interested in Aggregate levels of Consumption and Saving.

Old School Consumption

- **Keynesian Consumers** (from John Maynard Keynes)

  $\mathbf{C = a + b{*}Y_d}$ (ignoring Taxes and Transfers: $Y_d = Y$)

  a = 'subsistence' level of Consumption
  b = marginal propensity to consume = MPC

  Key: Consumption is based solely on current income.

- Based on **cross-country** and **long run time series** data: **a ~ 0 , MPC = ΔC/ ΔY ~ 0.90**

- Problem: In Micro Data (**household data**) over short term, **MPC << 0.90**

- People run a regression: $\Delta C = \beta_0 + \beta_1 \Delta Y + \text{error}$. With household data β_1 around 0.40!

- **Keynesian consumption function does not seem to match short run (household) data, although it does match long run (country level) data.**

What is missing?

- Drawbacks to Keynesian Consumption Functions (aside from not matching data):
  - Does not Include **Expectations** <<this is important!>>
  - Does not Distinguish Between **Different Types of Income Changes** (one-time increase vs. permanent increase)
  - Does not allow for the role of **interest rates**
  - Does not result from **optimizing household behavior**
- Is there another theory which allows us to look at household Consumption Behavior?
- Yes - Lifecycle/Permanent Income Hypothesis!

Permanent Income Hypothesis (PIH)

Milton Friedman/Franco Modigliani:

- Consumers like Smooth Consumption

- Optimize 'lifetime' utility (over consumption and leisure)

  Today, you plan your consumption based upon what you observe today and what you expect to happen tomorrow!

- People like to smooth 'marginal utility' across seasons, business cycles and life cycles.

- Think about it: Retirement, Job Loss, Summer Vacations, etc.

- Does much better at matching data – (although not perfect)

Model Set-Up

- Assumptions:

  1. Time horizon = 2 periods (think at working age and retirement)

  2. Current income, future income, and wealth are given

  3. Agents can borrow and lend at the same given real interest rate **r**

- Notation:

  y = current real income
  y^f = future real income
  a = real assets (wealth) at the beginning of the current period
  c = current real consumption
  c^f = future real consumption

- Question: How **c and c^f** are chosen?

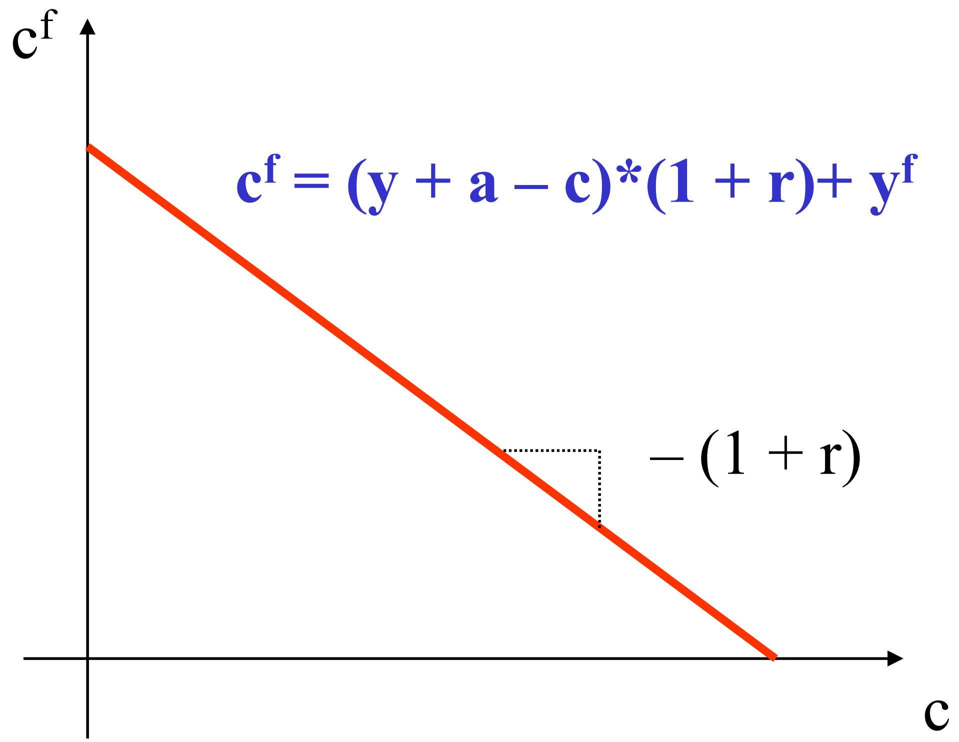
The Budget Constraint

- How much the consumer can afford?
- For given resources, current consumption affects future consumption!
- Current resources: $y + a$
- Leftover after consumption: $y + a – c$
- Total resources in the future: $(y + a – c)*(1 + r) + \mathbf{y^f}$
- The future period is the last period, then consume all resources!

$$\mathbf{c^f = (y + a – c)*(1 + r) + y^f}$$

- This is the budget constraint = combination of current and future consumption that the agent can afford for given current, future income and wealth

The Budget Constraint: Graphical Representation



Downward sloping: trade-off between current and future c

Slope = 1 + r (1 unit increase in consumption, reduces savings by 1 unit and hence future consumption by 1 + r units !)

In terms of present value …

- The **present value** measures the payment to be made in the future in terms of today dollars. It depends on the interest rate!

- If you have to pay \$110 tomorrow and the interest rate is 10%, then you have to save \$100 today! The present value of x is x / (1 + i)

- If payments are measured in nominal terms you use the nominal interest rate i, if in real terms (as in our model) then you use r!

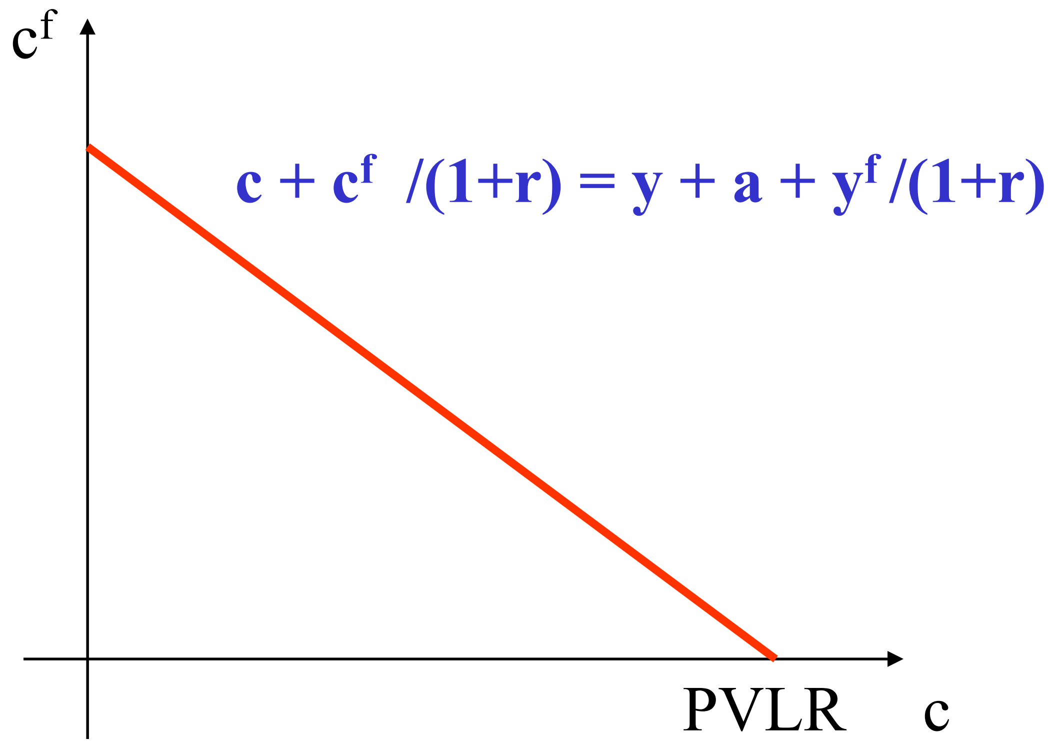
- PVLR = present value of lifetime resources, PVLC = present value of lifetime consumption

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

- The budget constraint can be rewritten as

$$\mathbf{PVLC = PVLR}$$

The Budget Constraint: Graphical Representation



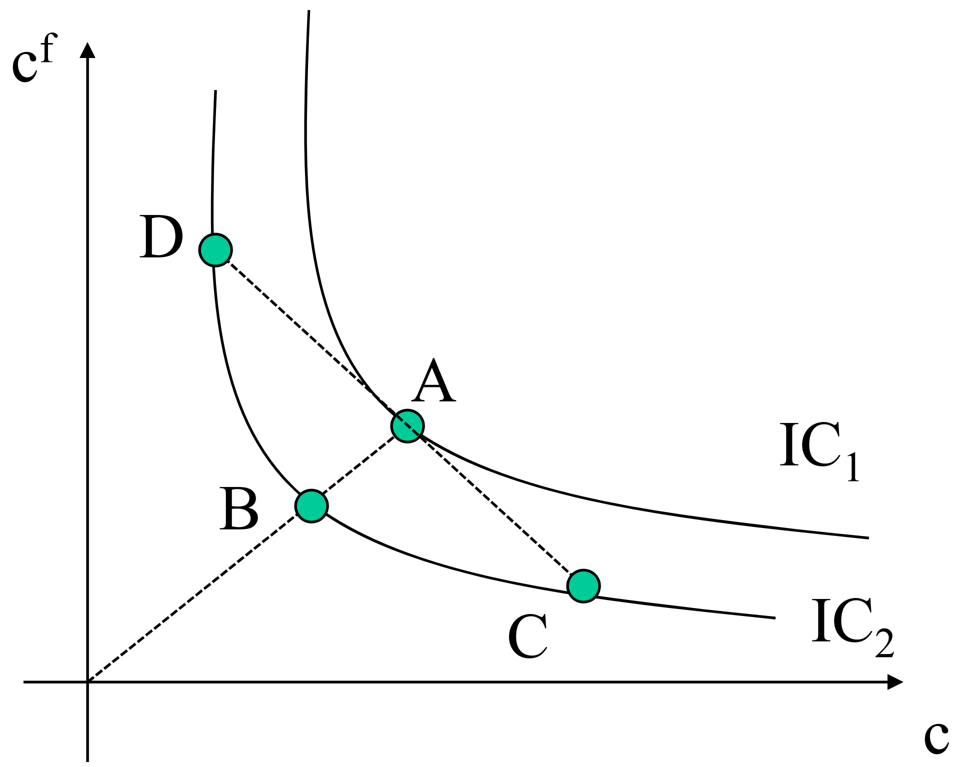
PVLR = current consumption if you consume everything today!

$$c = \text{PVLR if } c^f = 0$$

Consumer Preferences

- Given the available combinations of current and future consumption, what is the one preferred by the agent?
- **Utility** describes the satisfaction of an agent!
- **$U(c , c^f)$** represents the utility Veronica gets from consuming **c** units of current consumption and **c^f** units of future consumption
- For simplicity forget about leisure!
- **Indifferences curves** = graphical representation of all the combinations of current and future consumption that yield the same utility level

Indifference Curves



IC_1 corresponds to higher level of utility than IC_2

More on Indifference Curves …

Three main characteristics of the indifference curves:

1. **They slope downward**

   If you reduce the level of current consumption you want to increase the level of future consumption to keep your lifetime utility constant!

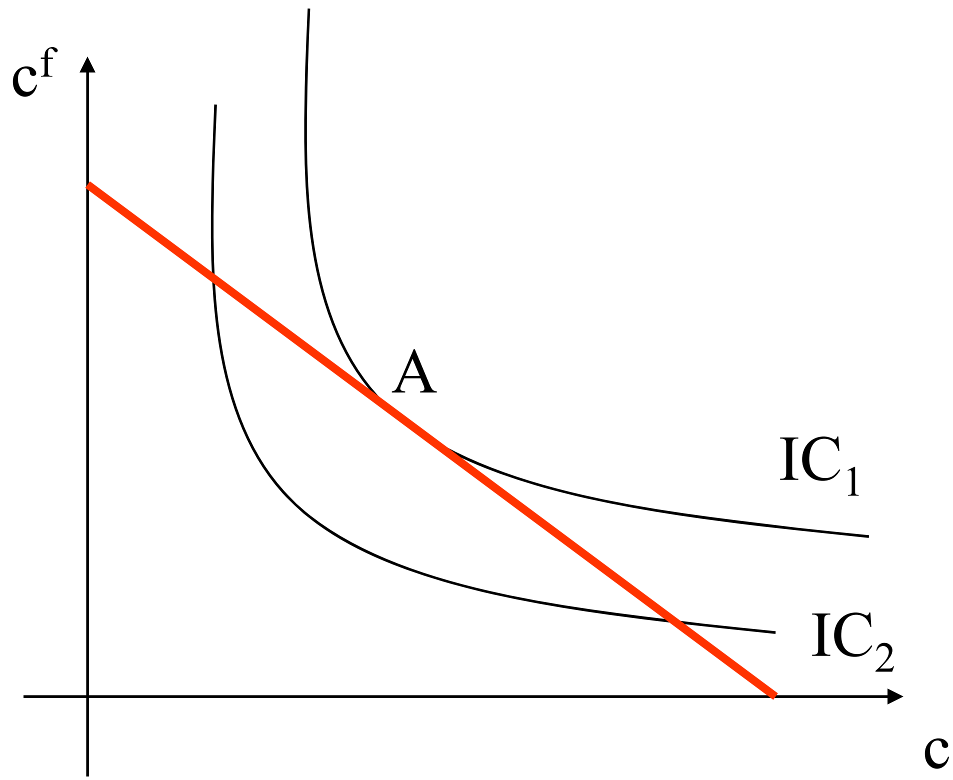
2. **The ones above and to the right represent higher level of utility**

   The higher level of both current and future consumption, the higher is your utility!

3. **They are bowed toward the origin**

   People prefer smoother patterns of consumption (Consumption Smoothing Motif)

The Optimal Level of Consumption



The best consumption combination is the one such that the budget constraint is tangent to an indifference curve!

An Example

- **Preferences**

  $U(c, c_f) = \ln(c) + \beta \ln(c_f)$ (**log utility** - for simplification)

  Discount Factor = $\beta \leq 1$: how much you like eating today versus tomorrow

- **Budget constraint**

  $c_f = (y + a - c)(1 + r) + y_f$ (Budget Constraint)

- **Simple optimization**:

  maximize $U(c, c_f)$ subject to budget constraint.

An Example (continued)

- Maximize Utility. We get

$$\partial U(c)/\partial c = (1/c) - \beta\,(1+r)\,(1/c_f) = 0$$

<<Process: a) Use budget constraint and substitute out c_f from utility function (utility function is only a function of c now (not c and c_f).

b) Take derivative of utility function with respect to c

c) Set derivative equal to zero (this is how we maximize!)

d) Substitute c_f back into the second term using the budget constraint. >>

- Example: assume that $\beta = 1$ and $r = 0$ (for simplicity, not realism)
- **Solution: $c = c_f$ (Households want equal consumption each period).**
- Suppose: $y = 1$, $y_f = 9$, $a = 0$: What is Optimal c, c_f?
- We know that c is smoothed over time (optimizing behavior)
- We also know that $c_f = (a + y - c)(1 + r) + y_f$ (budget constraint)
- **Solve, we get $c = (a + y + y_f)/2 = PVLR/2 = 5$**

An Example (continued)

Period	***1***	***2***
Income	1	9
Consumption	5	5
Saving	-4	4

- Expected Income Increase is already included in Today's consumption plan:
  - **Only news today (about today or the future) affects our consumption plan!!!!**
  - The fact that income rises from 1 to 9 between periods 1 and 2 is already included in my consumption plan.
- Unexpected News about income, life spans, etc ***WILL*** affect consumption decisions.

Unexpected Increase in Transitory Income

- Suppose **today** (period 1) I find out that my income is higher by \$2. What is the new consumption plan?

- $c = c_f = 6$ <<still smooth consumption across periods>>

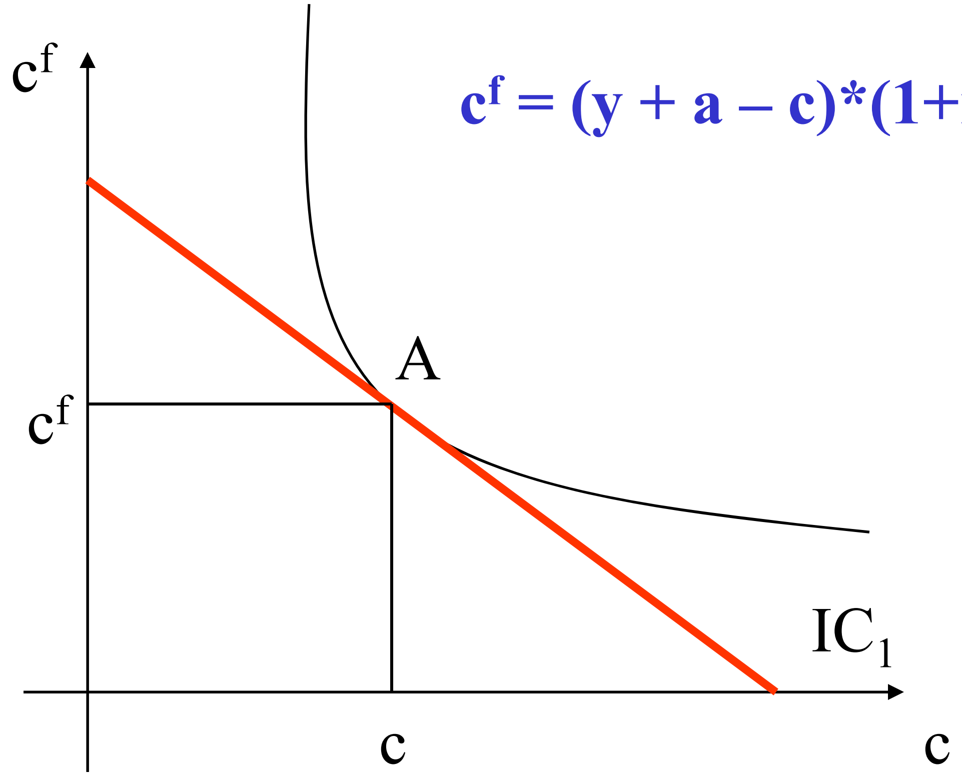
- $s_1 = -3, \ s_2 = 3$

- **Consumption increases by a little today (and in future), saving increases today!**

  – Saving increases today so consumption tomorrow will be higher (transfer some of the transitory income shock towards the future)

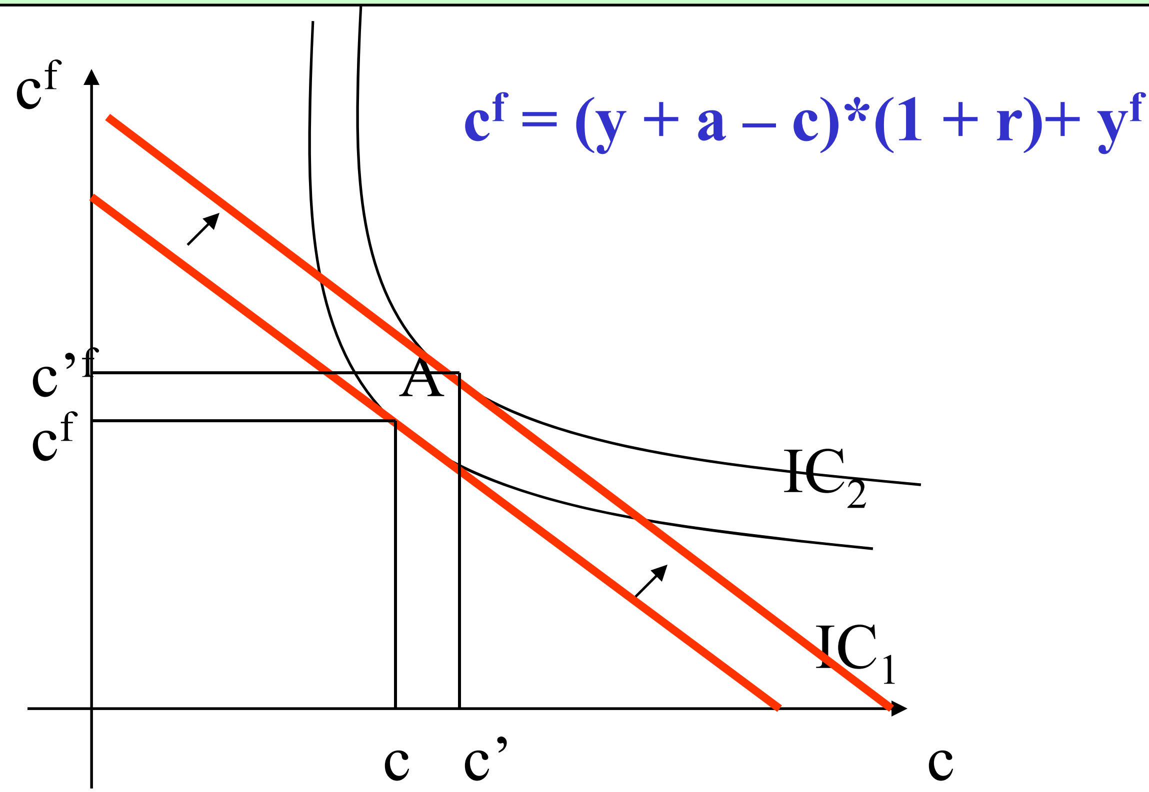
- MPC = ΔC (today) / ΔY (today) = ½ = 0.5

Unexpected Increase in Transitory Income



How does the budget constraint move?

Unexpected Increase in Transitory Income



If y increases, the budget constraint shifts to the right. You can get higher utility!

Unexpected Increase in Permanent Income

- Suppose today I find out that my income will **permanently** increase by $2 (in both period 1 and period 2). What is the new consumption plan?

- $c = c_f = 7$

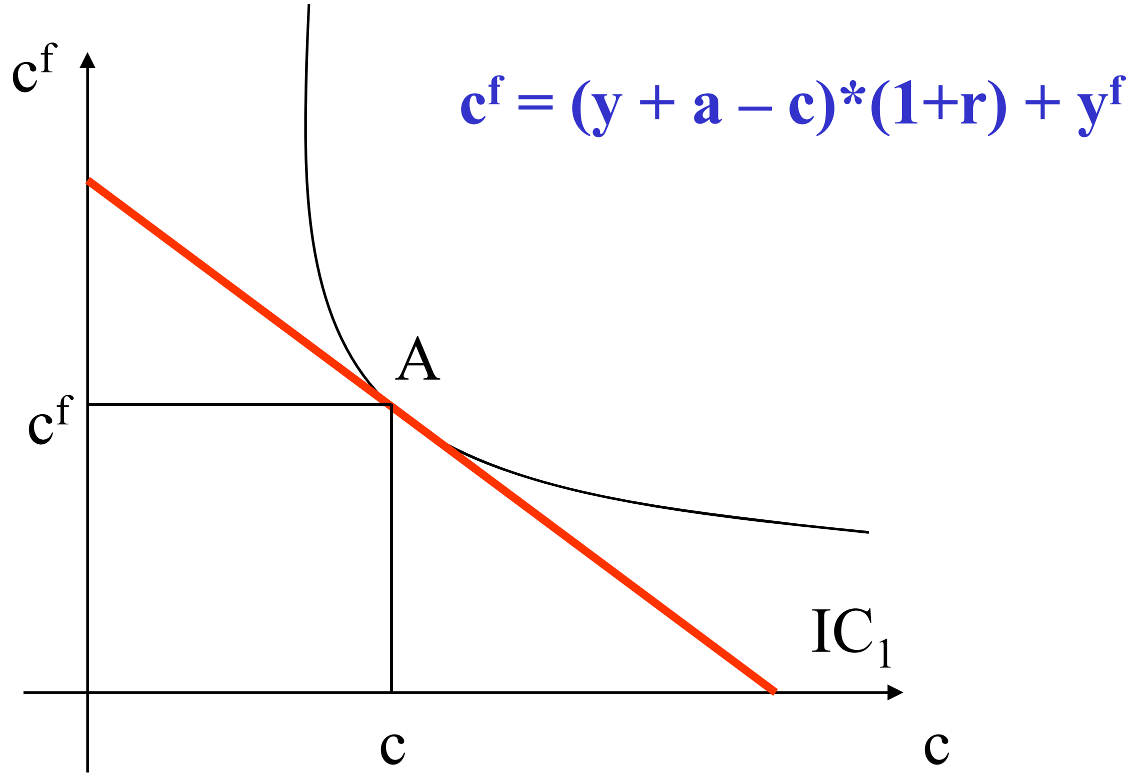
- $s_1 = -4, \; s_2 = 4$

- **Consumption increases today and in future (more than in the case of a transitory shock), and saving remains constant!**

- MPC = ΔC (today) / ΔY (today) = 2/2 = 1

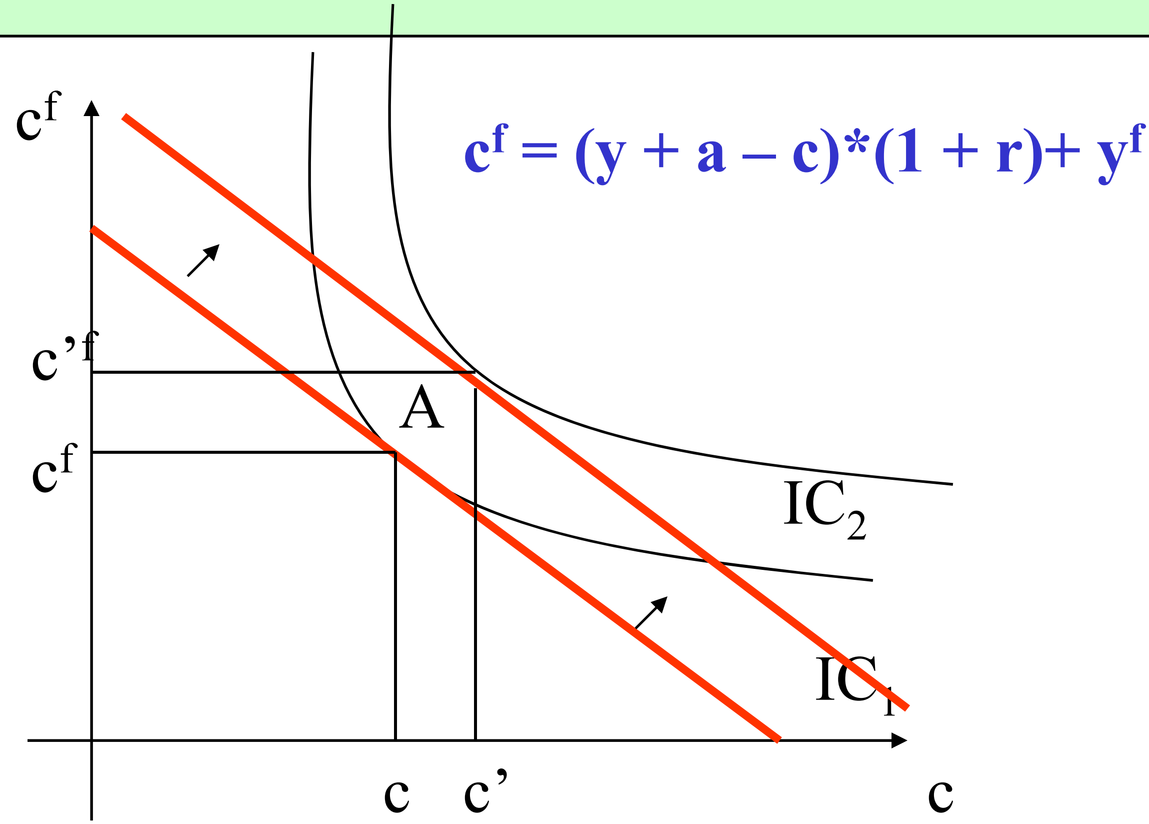
With permanent changes in income, consumption and income move 1 for 1.

Unexpected Increase in Permanent Income



How does the budget constraint move?

Unexpected Increase in Permanent Income



If y and yf increase, the budget constraint shifts to the right even more. You can get even higher utility!

Unexpected One Time Increase in Wealth

- Suppose today I find out that my wealth increased by $2 prior to period 1 (a one-time unexpected stock market gain). What is the new consumption plan associated with this unexpected increase in a?

- $c = c_f = 6$

- $s_1 = -5$ (y – c), $s_2 = 3$ (increase in PVLR due to wealth = 2)

- Consumption increases today (and in future), and saving falls.

- One time increases in wealth are identical to one time (transitory) changes in income.

Some Evidence Consistent with PIH Behavior

- Business Cycles are likely to be associated with ***temporary*** **shocks to income**.

  - We find **consumption to be more stable than income** over the business cycle.
  - And the **saving rate is procyclical**.

- Micro studies find the MPC out of income changes to be much less than **0.9** (C does not track Y one for one)

- Micro Studies find a MPC out of changes in wealth of about **0.05**. (Unexpected capital gains in housing/securities are like one time increases in income).

- Household consumption responds more to permanent shocks to income

However……

If the PIH theory is true, consumption of the economy should not respond that much during recessions

Why?

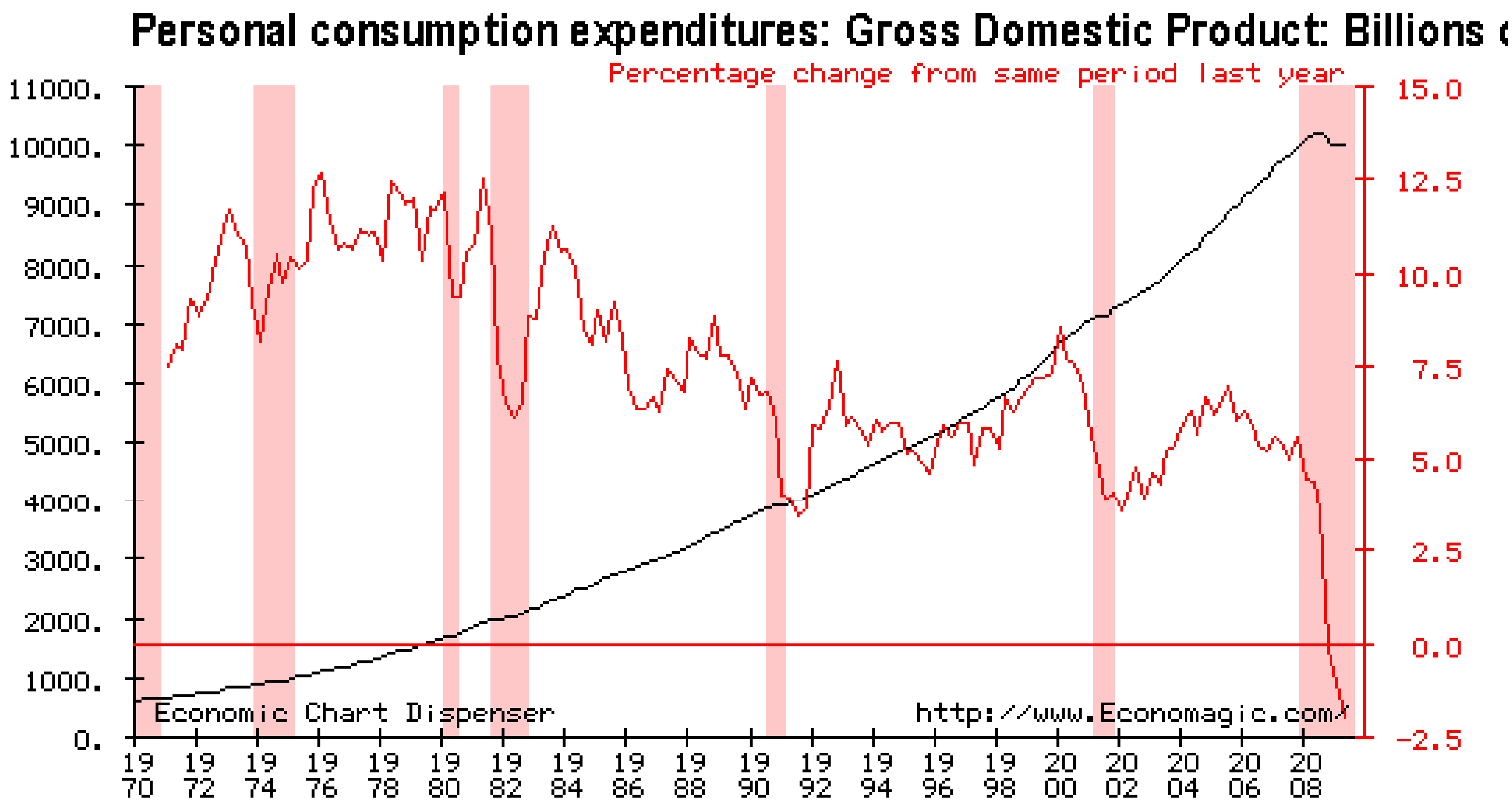
1. recessions have **little effect on our lifetime incomes**

2. we should **prepare for recessions** and as a result, have savings to buffer our low income.

In contrast to the predictions of the PIH,

consumption does vary a lot with temporary income changes!
EXCESS SENSITIVITY OF C

Real Household Spending: 1970Q1 – 2009Q2 (Consumption)



Black Line – Level of Spending (Left Axis)
Red Line – Percentage Change in Spending over Prior 12 months (Right Axis)
Shaded Areas – Recession Years

Refinements to Consumption Theory

- These are refinements to consumption theory that we will not spend much time on (there is a lot of active research on that)
  - **Liquidity Constraints << borrowing constraints - maybe cannot smooth income!!!!!!!!!!!>>**
  - **Uncertainty** (Precautionary Savings)
  - Little is known about **preferences** (time preference rates - β and risk aversion).
  - **Bequests** explain a large portion of wealth accumulation
  - **Portfolio Choice** makes a difference
  - Large **variation in wealth accumulations** across individuals (we will discuss this more).
  - **Life Cycle** Shocks.
  - **Home production** (including shopping for bargains)

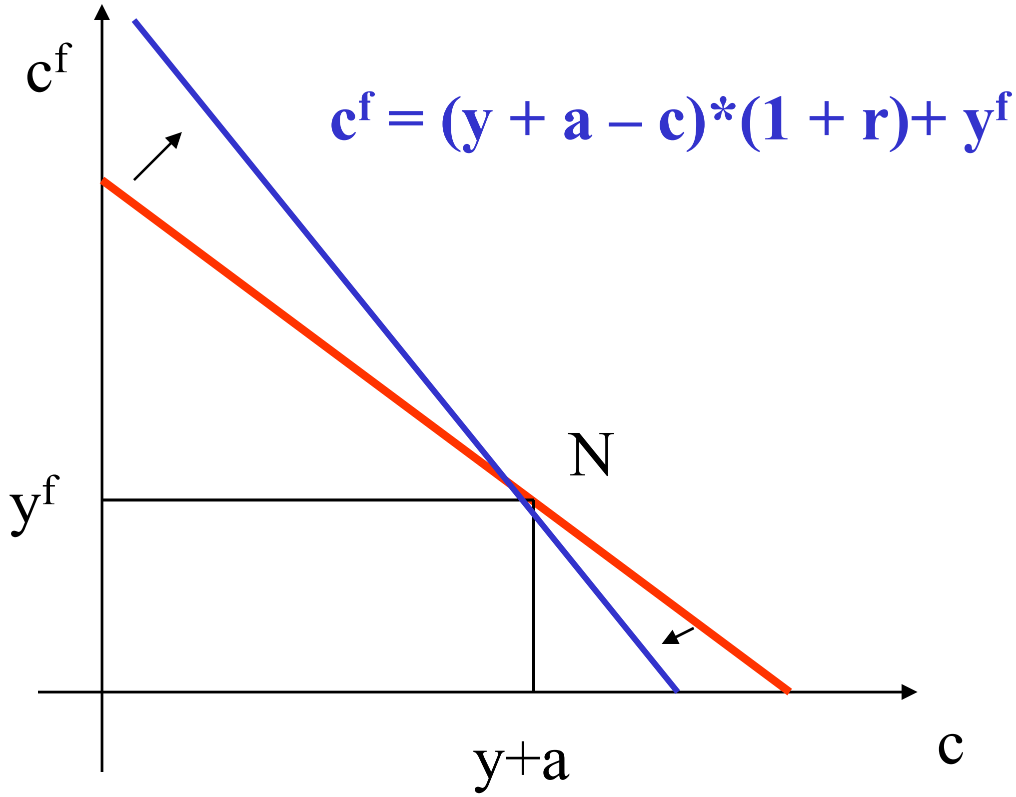
Liquidity Constraints

- **Liquidity Constraints** refer to the fact that sometimes a **household (or a firm) optimally wants to borrow to smooth consumption (or for investment), but lenders are unwilling to lend to that household.**
  - Why will lenders refuse to lend? Lender may be afraid of **default**.
- In recessions, in order to smooth consumption, households who receive a negative income shock either have to **draw down savings or borrow**. If they are prevented from borrowing, household will have no choice but to cut their consumption. As a result, C will fall during recessions.
- **Liquidity constraints make households look Keynesian when income falls (C falls when Y falls – for those with no savings and who cannot borrow).**
- However, when Y is high, households look like PIH households – nothing prevents them from saving. If Y is temporarily high, households would want to save some of that income. Liquidity constraints prevent borrowing NOT saving…….

Consumption and Interest Rates

- The real interest rate affects the consumption/saving decision
- **The price of current consumption in terms of future consumption is 1 + r**
- If you increase consumption today by 1 unit you are saving 1 unit less and you will be consuming 1 + r units less in the future!

Increase in Interest Rate



N = No Borrowing No Lending Point: it stays on the Budget Line when the interest rate changes

Now current consumption is more expensive! (Price = 1 + r)

Increase in Interest Rates

- **Substitution effect:**

  Higher r lowers C. Think of people saving more to reap the higher return, or people borrowing less b/c it is more expensive. Higher interest rate today, makes saving more beneficial (price of future consumption falls). Households will switch away from consumption today (i.e., **C today falls, C tomorrow increases, and S today increases**)

- **Income effect:**

  1. **Net Savers**: for every dollar saved, you get higher income. When richer, you buy more of the things you like. What do you like? Consumption today and consumption tomorrow. As a result, you can save less and get more of both.

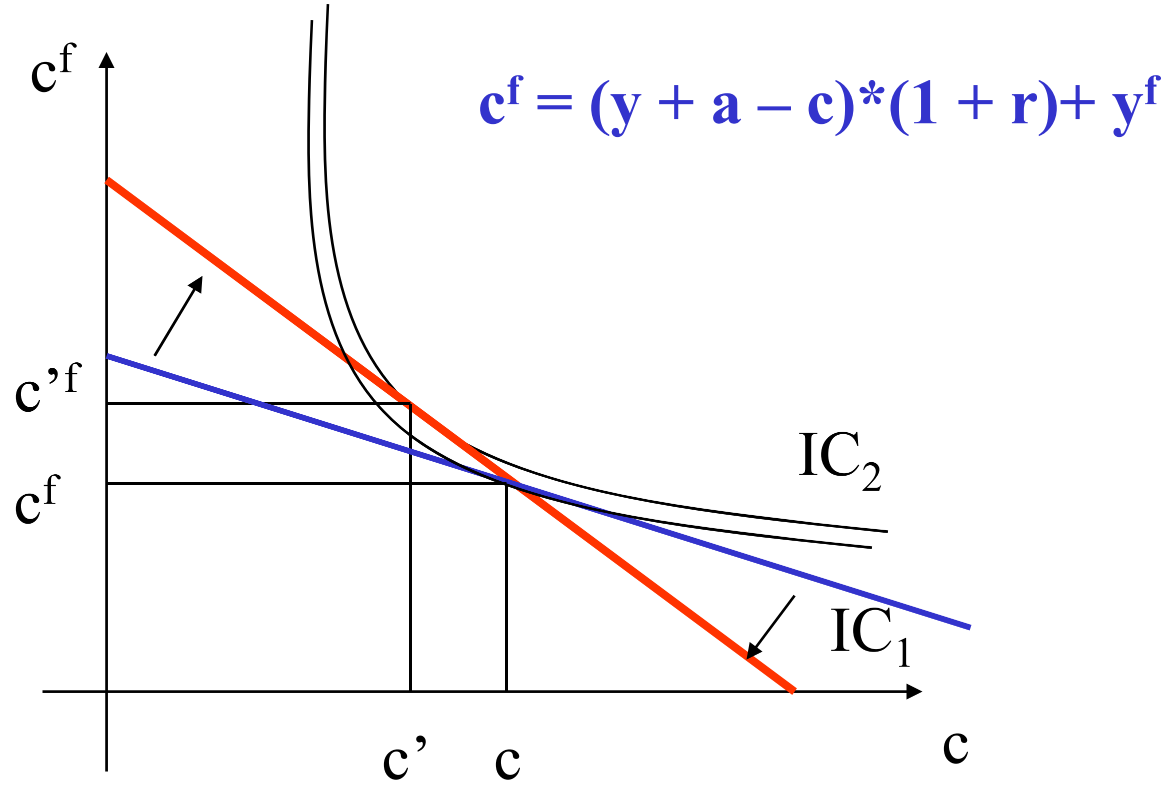
     (**C today increases, C tomorrow increases, and S today falls**)

  1. **Net Borrowers**: they have to pay higher interest payments! They are poorer. Then **C today will fall, C tomorrow will fall and S today will increase**.

- **Evidence:**

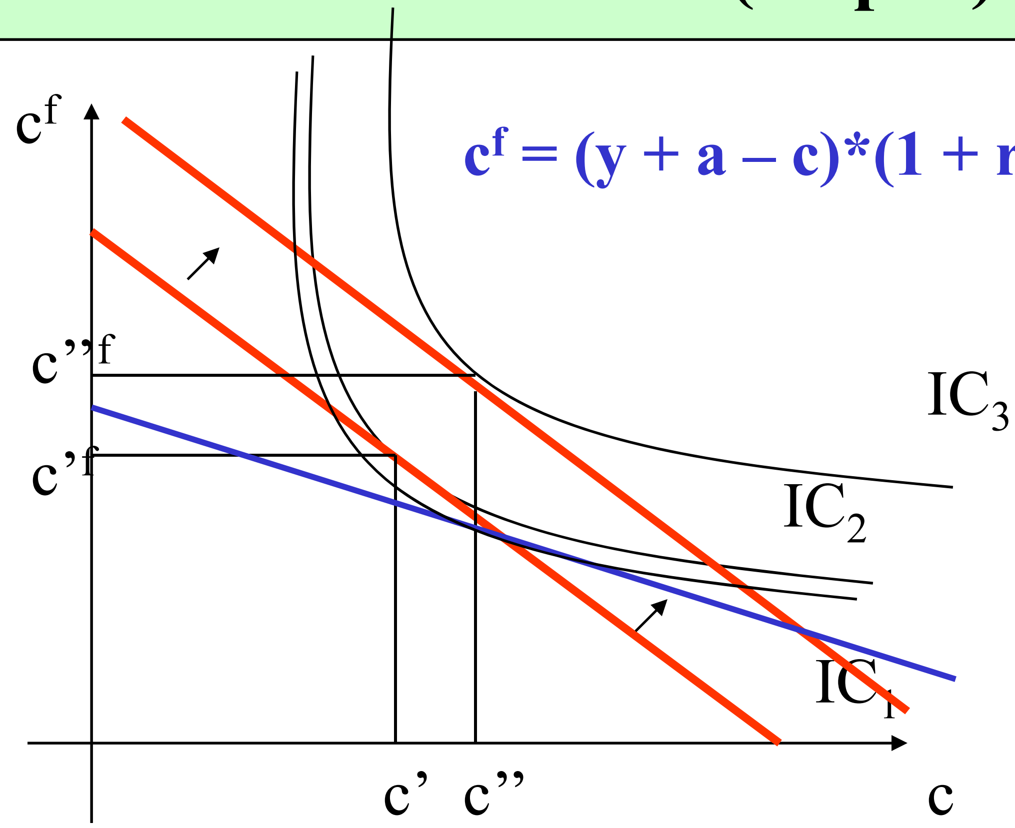
  Some studies find the substitution effect stronger, others find they are the same.

Increase in interest rate (Step I)



Substitution effect : **More savings today!**

Increase in interest rate (Step II)



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

Income effect : consume more both today and tomorrow!

This example: Substitution effect dominates on Savings

Consumption and Income Taxes

Assume households **maximize U(C, L),** where C is consumption and L is the fraction of time spent on leisure. Households are happier by consuming more and working less.

The budget constraint has to hold:

(1) $\mathbf{P_C * C = W * (1 – t) * (1 – L),}$

where (1-L) is the fraction of time worked, t is the income tax rate and W is the Wage.

The foc is:

(2) $\mathbf{MU_L / MU_C = P_L / P_C}$,

where MU = marginal utility and $P_L / P_C = W(1\text{-}t)/P$

This is the equilibrium condition for all utility optimization over two goods.

Consumption and Income Taxes (continued)

Suppose income taxes fall. What happens to consumption and leisure?

Income Effect (Equation 1)

When income taxes fall – all else equal, households will be richer [i.e., W(1-t) will increase].
When households are richer, they will buy more of the things they like, that is, both C and L.

So, according to income effect, C and L will increase when income taxes fall.

Substitution Effect (Equation 2)

When income taxes fall, all else equal, after tax wages will increase [i.e., W(1-t) will increase].
As the price of leisure increases, MU_L must increase AND/OR MU_C must fall.
As L falls, MU_L increases (law of diminishing marginal utility of L). As C increases, MU_L must fall

So, according to substitution effect, C will increase and L will fall when income taxes fall.

Putting two effects together: Effect on L is ambiguous. C will definitely increase!

Summary: What affects consumption?

- Current Income (Both PIH and Keynesian Theories)
- Expectations of Future Income (Only PIH theory)
- Wealth
- Tax Policy
- Interest rates (slightly)
- Preferences (**beta**)

- The magnitude of the results depend on whether consumers follow Keynesian or PIH consumption rules and whether or not liquidity constraints exist

Part II: Investment

An Introduction to Investment

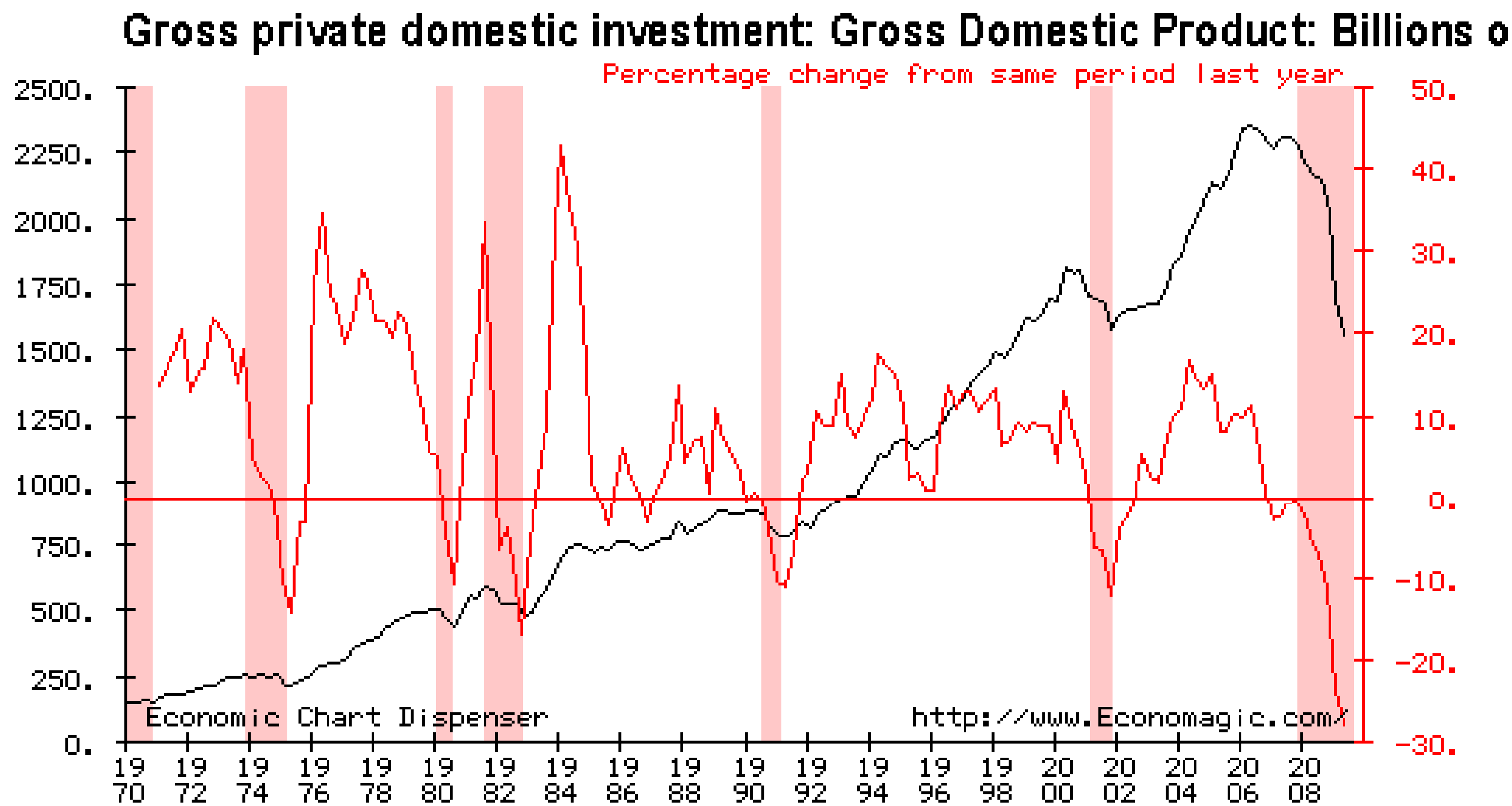
- **Investment =** purchase or construction of capital goods (residential and non-residential buildings + equipment + software) and additions to inventory stocks.

- Why Investment is an important macroeconomic variable?

1. **Fluctuates sharply over the business cycle** (more than any other spending component! Only 1/6 of total GDP, but in the typical recession accounts for more than ½ of total decline in spending)

1. **Plays a crucial role in determining the long-run productive capacity of the economy** (K affects Y*!!!)

Real Business Spending: 1970Q1 – 2009Q2 (Investment)



Black Line – Level of Spending (Left Axis)

Red Line – Percentage Change in Spending over Prior 12 months (Right Axis)

Shaded Areas – Recession Years

How does capital evolve?

- Firms optimize the amount of capital to have (just like they optimize the amount of labor).

- Capital evolves as follows: **$K_{t+1} = (1-\delta)\, K_t + I_t$**

  Tomorrow's capital is increased by investing today (less depreciation)

- Remember: For the optimal amount of labor, firms equate the MPN with the real wage (cost of an additional unit of labor).

- **For the optimal amount of capital, firms equate the MPK^f (future benefit of one more unit of capital) with the cost of an additional unit of capital**.

- What is the cost of an additional unit of capital?

User Cost of Capital

- ***User Cost of Capital = expected real cost of using a unit of capital for a period***
  Capital is long lived - so user costs include not only current, but future costs

- **Real Purchase Price of capital per unit** <<Symbol = p_K>>

- **Real Interest Rate** (cost of Funds). Usually have to **borrow** to buy equipment. If you do not borrow and instead use **retained earnings**, you give up the interest payments you would have received if you invested that money instead of buying new equipment. (Assume borrowing rates = lending rates = r = real interest rate).

- **Depreciation Rate** (percentage that depreciates, on average, per year) <<Symbol = δ>>

- ***User Cost (per period) = UC*** $= r * p_K + \delta * p_K$
  <<interest rate is key!!>>

Optimal Capital

- First order condition from profit maximization:

$$P * MPK^f = p_K (r + \delta)$$

- Benefits of investing are more output tomorrow – so, it is the *future* MPK that is important. P is the price of output, p_K is the price of capital. If **$P = p_K$**, then:

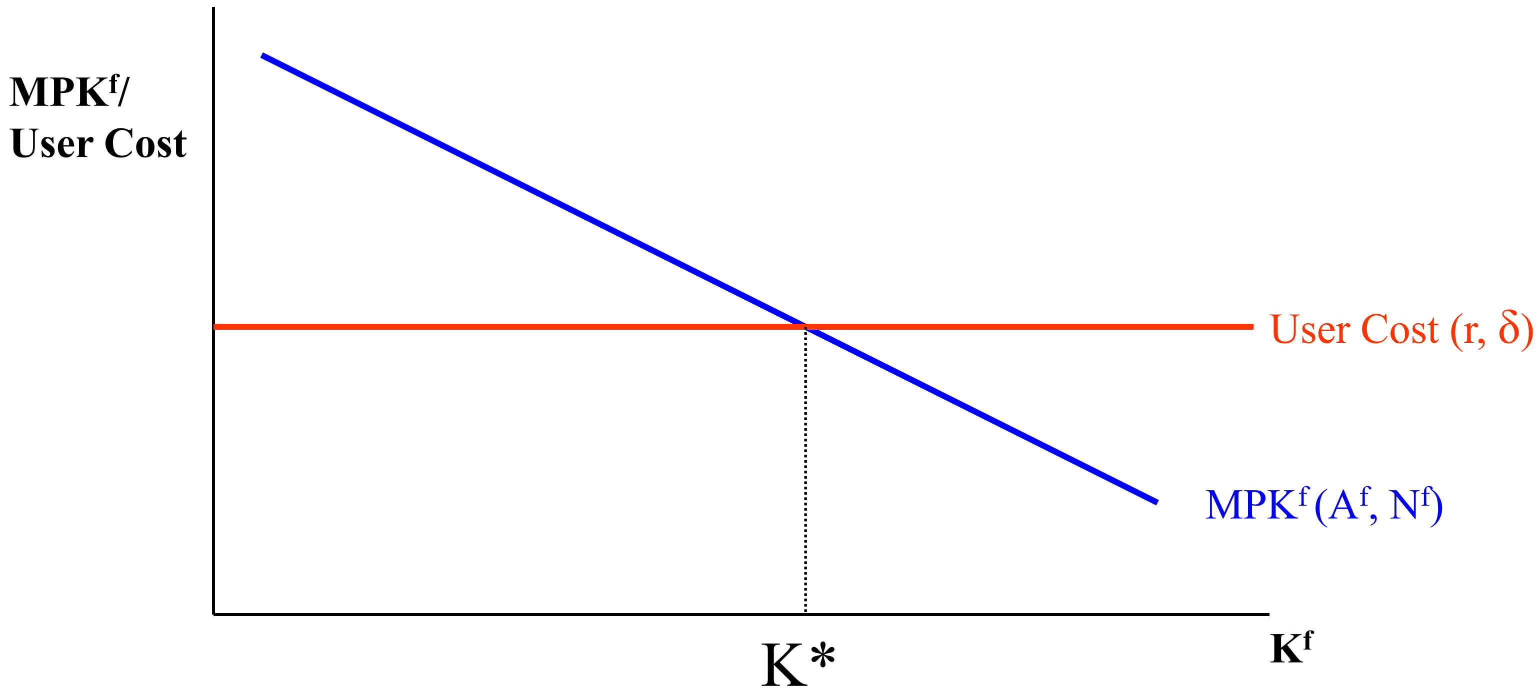
$$MPK^f = r + \delta = \text{per dollar user cost}$$

- Rationale: **Investment decisions today have effects on the capital stock tomorrow**. It takes time to build, install, train workers, etc.

- If **User Cost of Capital > MPK^f**, then it is profitable to decrease the capital stock K^f: Invest less than what necessary to replace the depreciated capital

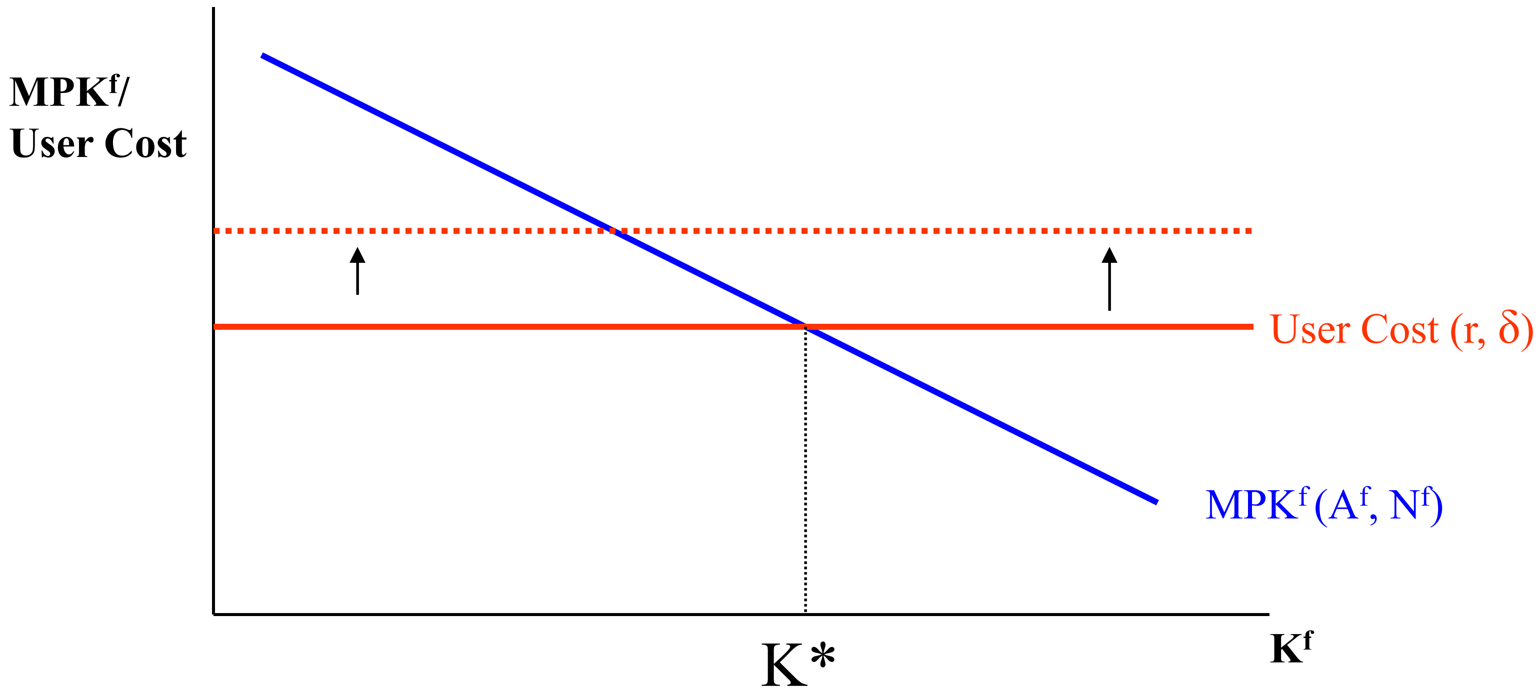
- If **User Cost of Capital < MPK^f**, then it is profitable to increase the capital stock K^f: Invest more than necessary to replace the depreciated capital.

Optimal Capital: Graphical Representation



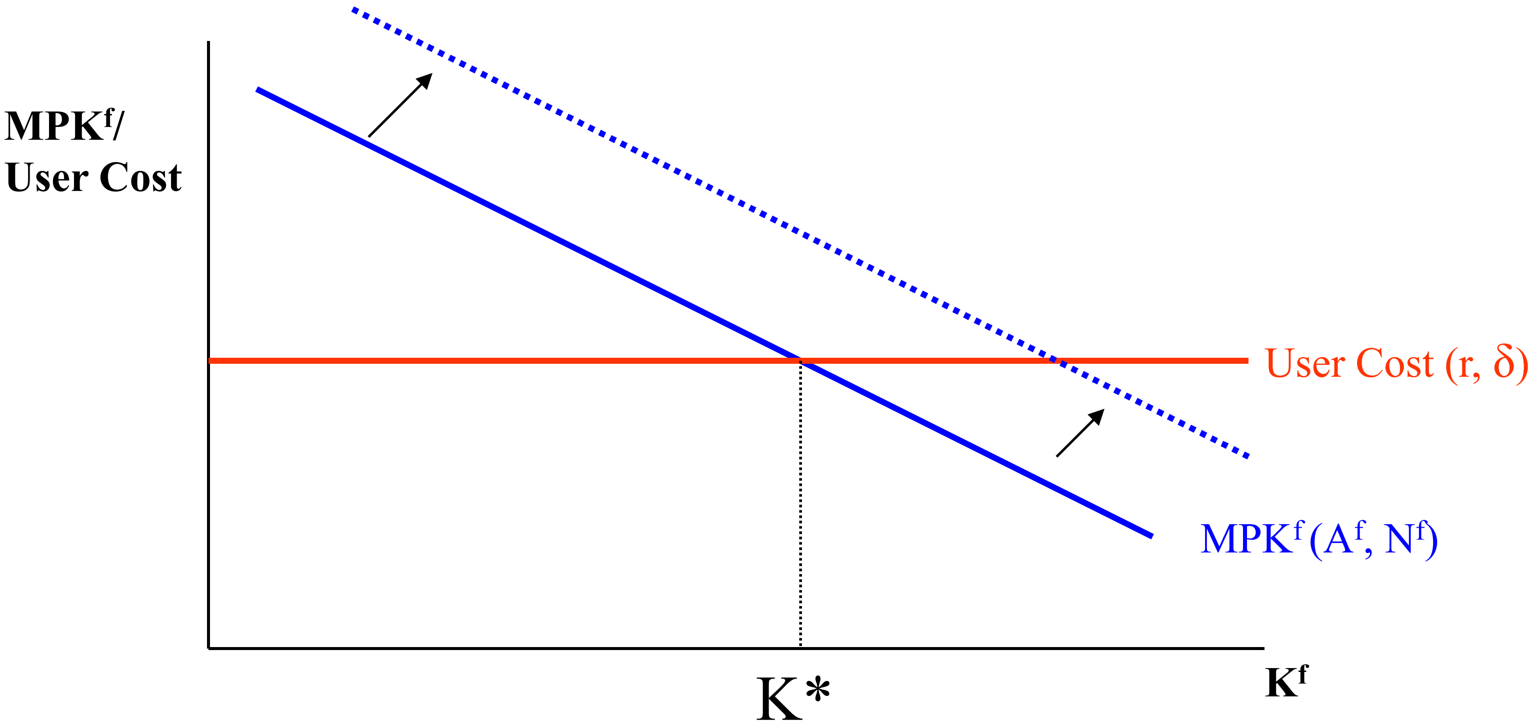
An increase in interest rate

Imagine r' > r



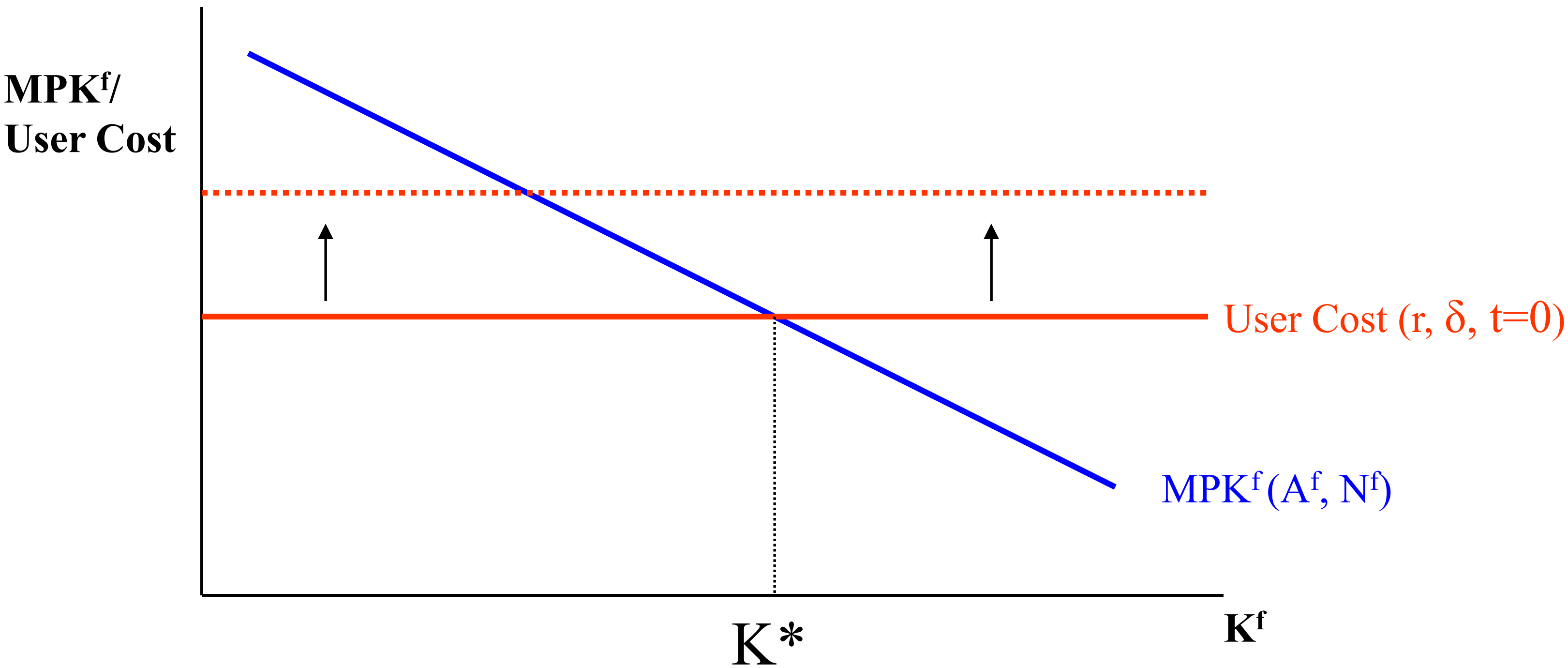
An Increase in Future TFP

Imagine $A^{f'} > A^{f}$



An increase in Tax on Firm Revenues

Imagine t' > t = 0



The desired Capital Stock equates the **AFTER-TAX MPK^f** to the user cost of capital, or **$MPK^f = (r + \delta)/(1 – t)$** = tax-adjusted user cost of capital

From Capital to Investment

- Gross Investment:

$$I_t = \delta\, K_t + K^* - K_t$$

- 2 components:

  1. Investment needed to replace depreciated capital $\delta\, K_t$

  2. Desired net increase in the capital stock over the year $K^* - K_t$

- The first part is determined by the depreciation rate and the initial level of capital

- The second part depends on everything that affect the desired capital stock K* (MPK^f, interest rate, taxes)

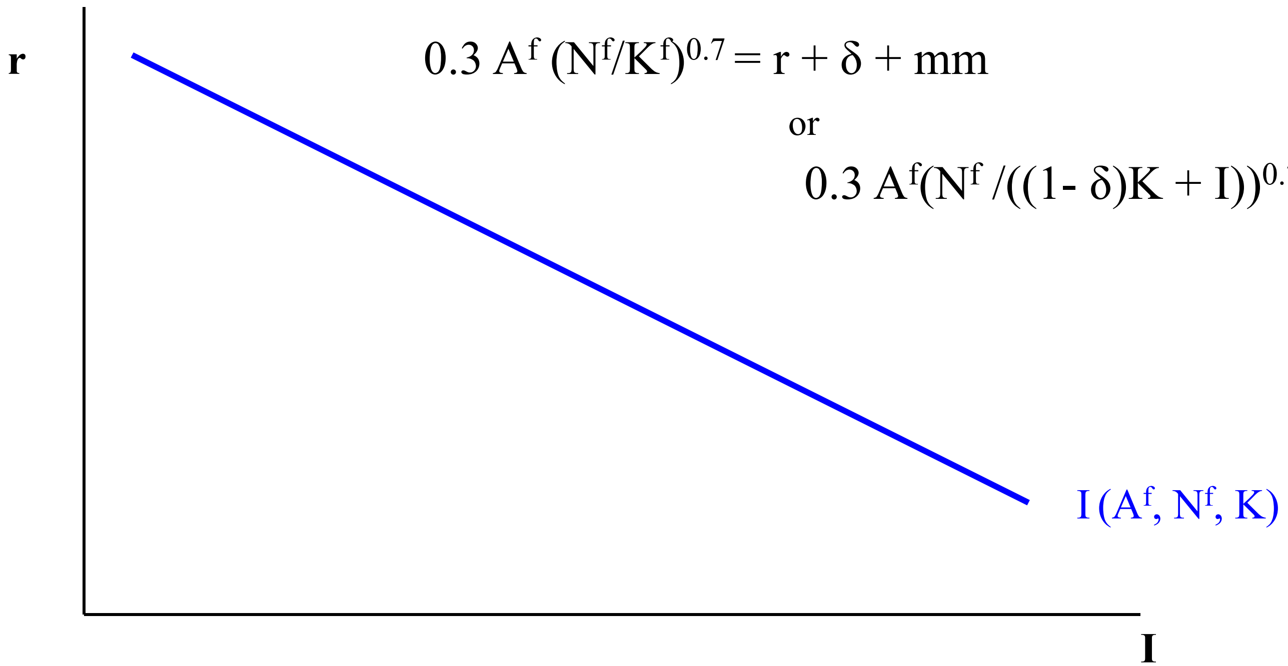
Investment (I) and real interest rates (r)

Investment Demand Curve (I)

$$0.3\,A^f\,(N^f/K^f)^{0.7} = r + \delta + mm$$

or

$$0.3\,A^f(N^f/((1-\delta)K + I))^{0.7} = r + \delta + mm$$



Key: As r increases, desired capital stock falls, then **investment decreases!**

Some Caveats

- Investment **takes time** to plan.
- Investment tends to be **'irreversible'** (costly to change if you over invest).
- Firms - like individuals - are **forward looking**. If interest rates fall today, I may not invest today because I believe interest rates can be even lower tomorrow.
- Investment **returns are uncertain** (returns are in the future - which is unknown).

  As economic uncertainty increases, investment decisions can become delayed.
- Firms, like individuals, may be **financially constrained**.

  The role of banks in the economy may be important. Financial constraints means that it is costly to access external finance.

Current Recession

- Two main possible/complementary reasons why Investment decreases:

1. **bad expectations** about the economy: expected lower future marginal product of capital $\longrightarrow$ lower I

2. **banks loans decrease** $\longrightarrow$ tighter financial constraints $\longrightarrow$ lower I

- Are loans lower because of demand or supply?

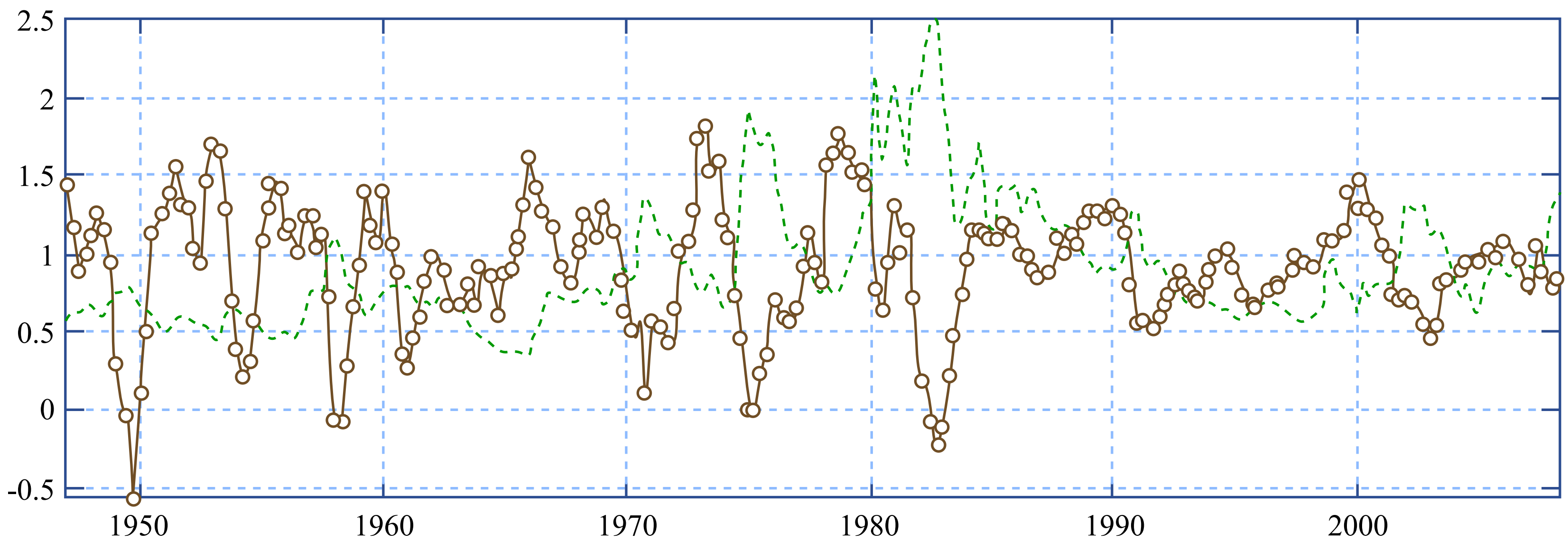
- To understand what happens is relevant for policy recommendations:

  how effective is the banking crisis? How much the government should intervene to recapitalize banks, if at all?

- Many studies try to understand how relevant are **financial constraints** for investment.

Baa-Aaa spreads and Business Cycle

Financial frictions may amplify the reaction of the economy to shocks.



Notes: Premium is measured by the difference between the yield on the lowest rated corporated bonds (Baa) and the highest rated corporate bonds (Aaa). Bond rate data obtained from St. Louis Fed Website. GDP data obtained from Balke and Gordon (1986). Filtered output data are scaled so that their standard deviation coincide with that of the premium data.

Figure by MIT OpenCourseWare.

Testing for Financial Constraints

- Regress:

$$I_{i,t} / K_{i,t} = \alpha + \beta X_{i,t} + \gamma \text{ CASH FLOW}_{i,t} / K_{i,t}$$

- If cash flow captures availability of **internal funds**, then $\gamma > 0$ symptom of financial constraints

- Problem: cash flow also contains information on future MPK!

- Alternative:

$$I_{i,t} / K_{i,t} = \alpha + \beta X_{i,t} + \gamma Y_{i,t}$$

- $Y_{i,t}$ = some **exogenous windfall /outlay** unrelated to MPK

- Example: regulatory funding requirements for pension plans (Rauh)
  $Y_{i,t}$ = funding status of pension fund

Testing for Financial Constraints (continued)

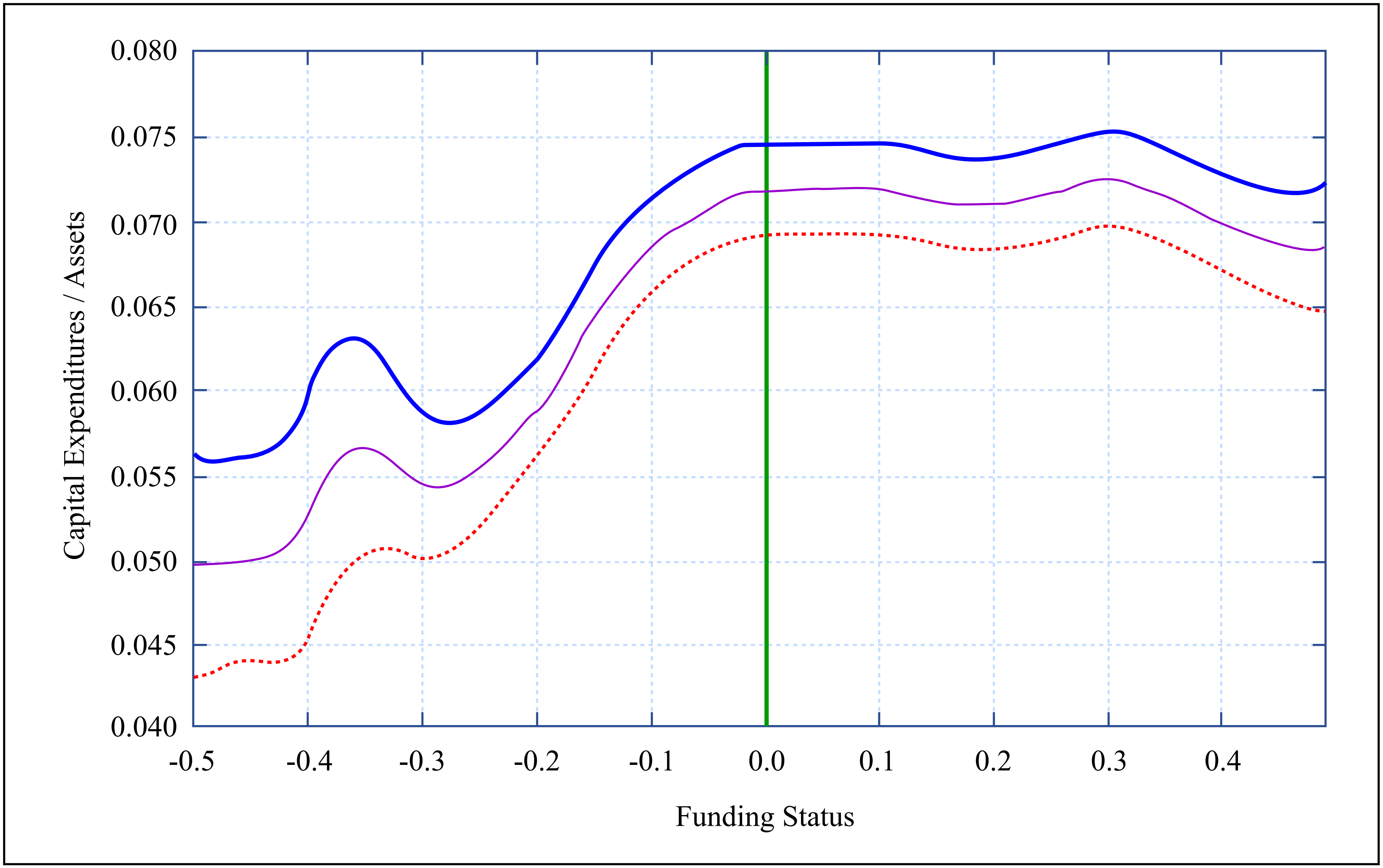


Figure by MIT OpenCourseWare.

Testing for Financial Constraints (continued)

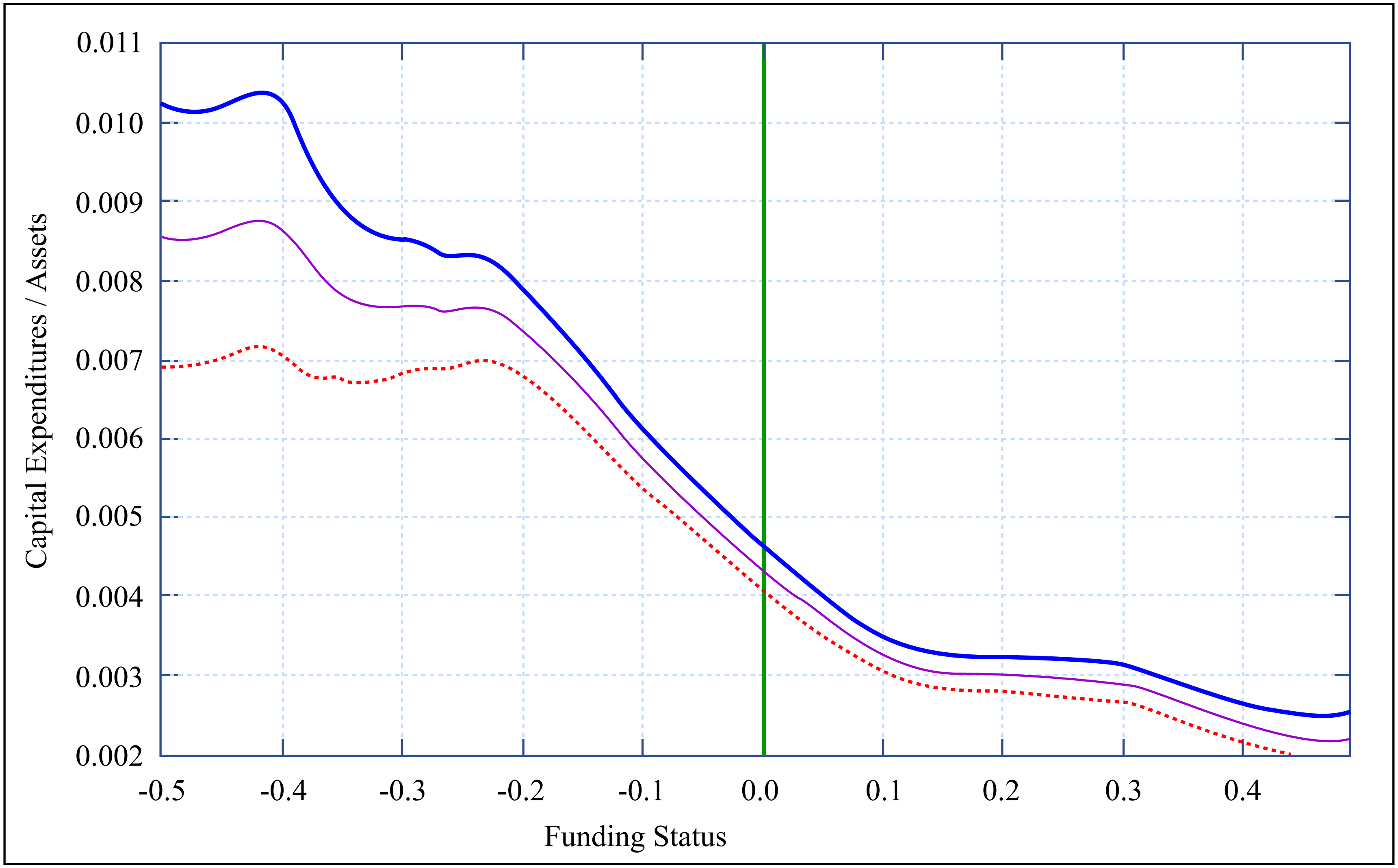


Figure by MIT OpenCourseWare.

Other components of Investment

- So far, focus on business fixed investment (I by firms in structure, equipment and software)

- Other 2 components of Investment:

  1. **Inventory Investment** = increase in firms' inventories of unsold goods, unfinished goods or raw material

  2. **Residential Investment** = construction of housing

- Same concepts of future marginal product and user cost of capital apply!

- Example: **apartment building**
  Future marginal product = real values of rents – taxes and operating costs
  User cost of capital = depreciation + interest cost (mortgage payment)

Part III: Goods Market

Supply and Demand of Goods

- **C** is a function of PVLR (Y, Y^f, W), taxes, expectations, liquidity constraints…
- **I** is a function of r, d, A^f, K, expectations, investment taxes…
- **G** is government spending (we will discuss fiscal policy later in the class)
- **NX** we will model this at the end of the course (for the U.S., NX is small)
- We are moving towards a model of **Goods Aggregate Demand**:

  C(.) + I(.) + G + NX (We will get to NX later in the course)

- In the previous lectures we have studied the **Goods Aggregate Supply**:

  Y = AF(K,N)

Goods Market

- **The Good Market** is in equilibrium when the quantity of goods supplied is equal to the quantity of goods demanded:

(1) $$Y = C + I + G + NX$$

- For the moment assume there is no other country and **NX = 0**

- Recall the definition of **national savings:**

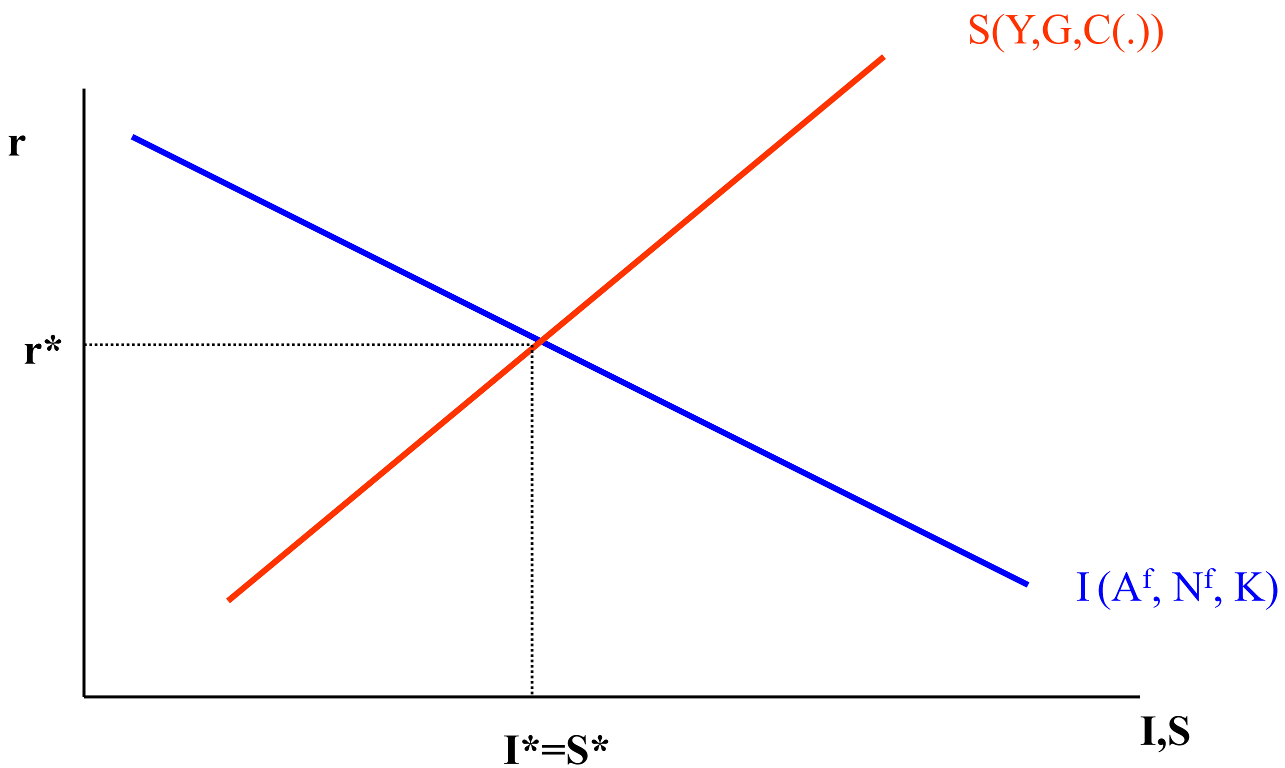
(2) $$S = Y - C - G$$

- From (1) and (2) the equilibrium in the goods market can be represented by:

$$\mathbf{S = I}$$

- The interest rate will adjust to bring the market in equilibrium!

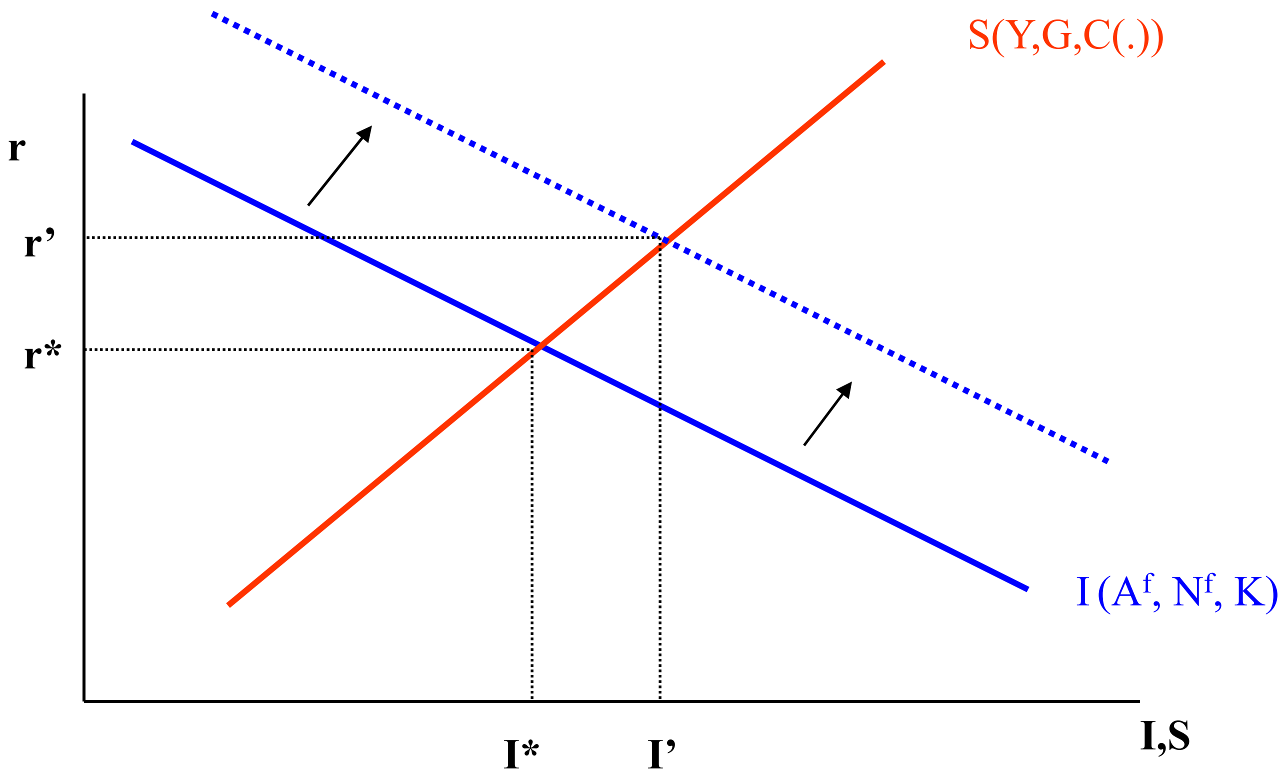
Goods Market Equilibrium



The interest rate adjust to guarantee the equilibrium: I=S

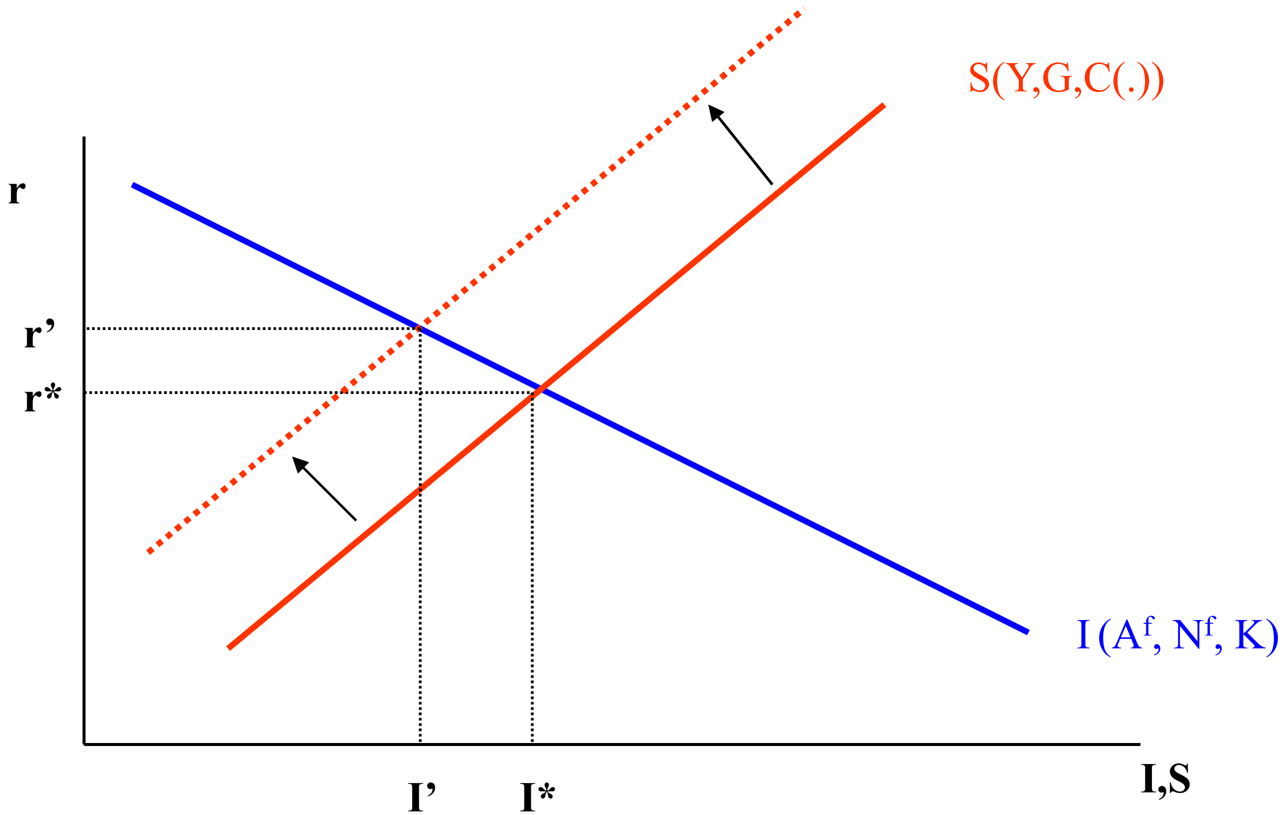
Shift on the Investment Curve

Example: increase in A^f



Shift of the Saving Curve

Example: increase in G



14.02 Principles of Macroeconomics
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