CAPITAL MARKETS

Perfect Capital Markets

Present (an assumption) in many macro models, e.g. OLG
Implicitly present in IS/LM, IS/MP, ...

Means everyone in economy can borrow/lend as much money as he chooses at one, economy-wide r $(= i - \pi^e)$
always repays/is repaid, no default/bankruptcy.

One result of this:

each firm sets $MPK = r$

so $MPK_{FIRM\,A} = MPK_{FIRM\,B} = \ldots$

Efficient! (Pareto optimal).

If $MPK_{FIRM\,A} > MPK_{FIRM\,B}$,

we could increase output just by reallocating capital from B to A.

Another result:

Slope of IS curve (effect of Δr on spending) reflects diminishing MPK (for investment) or utility function parameters (for consumption)

CAPITAL MARKETS (cont.)

Reality

1) Default/bankruptcy

2) Potential borrowers who might default

must pay extra-high r

can't borrow as much as they want, } "Credit
perhaps can't borrow at all } rationing"

3) Forms of borrowing/lending

Equity (stock, shares): borrower promises to pay share of profit, not fixed amount of \$

versus

Debt + bankruptcy: borrower promises to pay fixed amount of \$ unless he declares bankruptcy. If borrower declares bankruptcy, lender can seize his assets.

4) Credit crunch

Sometimes it is especially hard to borrow, credit rationing tightens.

"Financial market imperfections"

CAPITAL MARKETS (cont.)

Asymmetric information

General definition: one party to a potential deal knows/observes things other party(ies) can't ~~or~~ or can learn only at a cost

In Financial markets, models with asymmetric info can account for lots of Financial mkt imperfections etc.

Model in Romer 10.2 shows:

1) Why debt + bankruptcy contracts exist

2) Why Δr has big effect on spending (IS curve flat), bigger than effect of diminishing MPK

3) Why economy dies, credit crunch if potential borrowers lose net wealth (assets − existing debts)

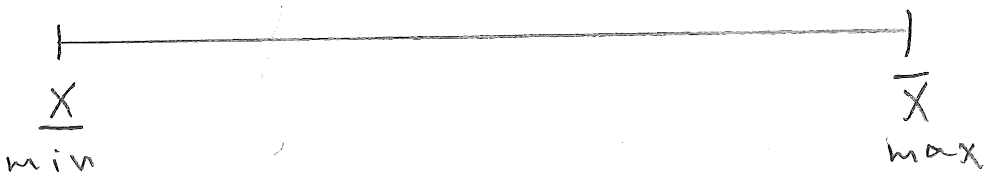
— Fall in prices of houses, stocks

— "debt deflation"
Real burden of existing \$ debts ↑ if P↓

CAPITAL MARKETS

For Romer 10.2: uniform distribution

Random variable X



$$E[X] = \tfrac{1}{2}(\underline{X} + \overline{X})$$

Consider a number Z.

For $Z \geq \overline{X}$, prob. $X \leq Z$ $\quad F\{Z\} = 1$

$Z < \underline{X}$, prob. $X < \underline{X}$ $\quad F\{Z\} = 0$

For $\underline{X} \leq Z \leq \overline{X}$,

$$F\{Z\} = \frac{X - \underline{Z}}{\overline{Z} - \underline{Z}}$$

$$E[X / X \leq Z] = \tfrac{1}{2}(\underline{X} + Z)$$

$$E[X / X \geq Z] = \tfrac{1}{2}(\overline{Z} + X)$$

IMPERFECT FINANCIAL MARKETS

Romer 10.2

General assumptions

Two agent types:

- Entrepreneurs ("Es")
- Investors ("Is")

both "risk neutral": act to maximize expected value of income.

Es can initiate & control business projects, but don't have enough wealth to pay for required capital investment.

Is have wealth to invest in business projects, but can't initiate & control business projects.

Hence E & I must pool wealth, cooperate to initiate a project, share returns.

Both Es & Is have alternative to project: put wealth in risk-free investments that earn return r.

Many Is compete for investment opportunities, so E can get funds from I as long as E can credibly promise I **expected** return $= r$

recall risk neutrality

IMPERFECT FM

Romer 10.2

General assumptions (cont.)

Each E has one possible project

requires one unit of resources

has wealth $W < 1$ (can vary across Es

not in Romer

X Output generated by a project is random variable

Uniform distn $0 \quad \gamma \quad 2\gamma$

Expected value of output

can vary across Es/projects

To do project, E puts in his wealth W,

must get $(1-W)$ from I.

Each I's wealth $> (1-W)$, so E need

deal with just one I (just 2 people need to cooperate

Look at two cases:

1) Symmetric information

Both sides see γ and realized X

2) Asymmetric information

Both sides see γ but only E sees X,

unless I pays a cost.

Imp. F. M.

Romer 10.2

Symmetric information

A deal that will work:

I gives E $(1-w)$

E promises to pay I a share of X

promised share $s = \dfrac{(1-w)(1+r)}{\gamma}$

When X is realized, both sides observe it,

I gets $\dfrac{(1-w)(1+r)}{\gamma} X$

E gets $X - \dfrac{(1-w)(1+r)}{\gamma} X = \left(1 - \dfrac{(1-w)(1+r)}{\gamma}\right) X$

I takes deal because

$$E\left[\frac{(1-w)(1+r)}{\gamma} X\right] = (1-w)(1+r)$$

same as riskless alternative

E offers deal as long as

$$E\left[\left(1 - \frac{(1-w)(1+r)}{\gamma}\right) X\right] \geq w(1+r)$$

return from riskless alternative

$$\left(1 - \frac{(1-w)(1+r)}{\gamma}\right)\gamma \geq w(1+r)$$

$$\gamma - (1-w)(1+r) \geq w(1+r)$$

$$\gamma - (1+r) + w(1+r) \geq w(1+r)$$

$$\gamma \geq (1+r)$$

IMP. F. M.

Romer 10.2

Symmetric info (cont.)

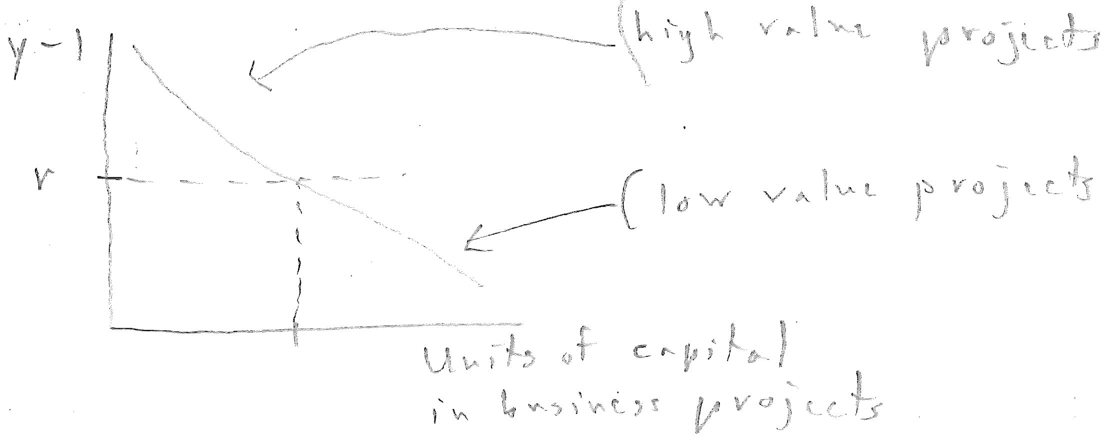
Recall project will be undertaken as long as

$$\gamma \geq (1+r)$$

cost

E[Marginal product] of an investment project is $\gamma - 1$

so this means project is undertaken as long as expected value of marginal product $\geq r$



Note this is analogue to $f'(k) = r$

It maximizes "net social benefit"

$(1+r)$ opportunity cost of putting one unit of resources or output (capital) into business investment project

Imp. K. M.

Romer 10.2

Asymmetric info

E observes realized X at no cost.

I sees X only if he pays cost $c < \gamma$

"Costly state verification" (Townsend 1979)

What will deal look like?

1) Shares (like symmetric info case) + E tells I what X turned out to be

2) Debt (not share) & E always pays

3) Shares + I always pays c to see X

4) Debt + E pays unless E declares bankruptcy, in which case I pays c and gets all of realized X

Now

1) won't work. E will always lie.

2) won't work. If X turns out to be very low, E can't repay debt

3) Possible

4) Possible and better than 3, because in 4) I doesn't always have to pay c.

Imp. F. M.

Romer 10.2

Asymm. info (cont.)

Deal that will work, but won't happen: verify & share

E offers I share of output,

I pays c to observe realized X,

takes share · X.

I would get $sX - c$

s must be big enough to make

$$E[sX - c] = (1-w)(1+r)$$

$$sY - c = (1-w)(1+r)$$

$$s = \frac{(1-w)(1+r)+c}{Y} > \frac{(1-w)(1+r)}{Y}$$

Promised share under symm. info

E would get $(1-s)X$

$$= \left(1 - \frac{(1-w)(1+r)+c}{Y}\right) X$$

Expected return to E would be:

$$E[\quad] = \left(1 - \frac{(1-w)(1+r)+c}{Y}\right) Y =$$

$$= Y - (1+r)(1-w) - c < Y - (1+r)(1-w)$$

expected return to E under symm info

Imp. F M

Romer 10.2

Asymm info (cont.)

Why won't that deal happen?

There's a different deal that gives I expected return equal to $(1-w)(1+r)$ and gives E expected return greater than

$y-(1+r)(1-w)-c$ (verify & share

and gives E incentive to tell the truth about what he's required to report.

Debt contract

E takes $(1-w)$ from I & promises to pay fixed sum D if $X \geq D$.

If $X < D$, E reports "can't pay"

I pays cost c to verify value of X & can take all of X (E gets nothing, loses W)

E won't lie because:

- if $X < D$, E won't claim $X \geq D$: E can't pay D
- if $X \geq D$, E won't claim "can't pay" because if he did I would get to take all of X!

IMP. F. M.

Romer 10.2

Debt contract (cont.)

Uniform distn. for X $\qquad 0 \text{———————} 2\gamma$

If $X \geq D$, I gets D

$X < D$, I gets $X - c$

Range for D	Prob. $X < D$	$E[X/X \leq D]$
$2\gamma < D$	1	$\frac{1}{2}(2\gamma + 0) = \gamma$
$0 \leq D \leq 2\gamma$	$\frac{D-0}{2\gamma} = \frac{D}{2\gamma}$	$\frac{1}{2}(D+0) = \frac{D}{2}$

R(D) Expected value of return to I is (see 10.8)

Range for D	R(D)
$2\gamma < D$	$\gamma - c$
$0 \leq D \leq 2\gamma$	$\left(1 - \frac{D}{2\gamma}\right)D + \frac{D}{2\gamma}\left(\frac{D}{2} - c\right)$

$$= \underbrace{\frac{2\gamma - D}{2\gamma}D + \frac{D}{2\gamma}\frac{D}{2}}_{\text{expected value of what E pays I}} - \underbrace{\frac{D}{2\gamma}c}_{\text{"expected verification cost"}}$$

$$= \left(1 - \frac{c}{2\gamma}\right)D - \frac{1}{2\gamma}D^2$$

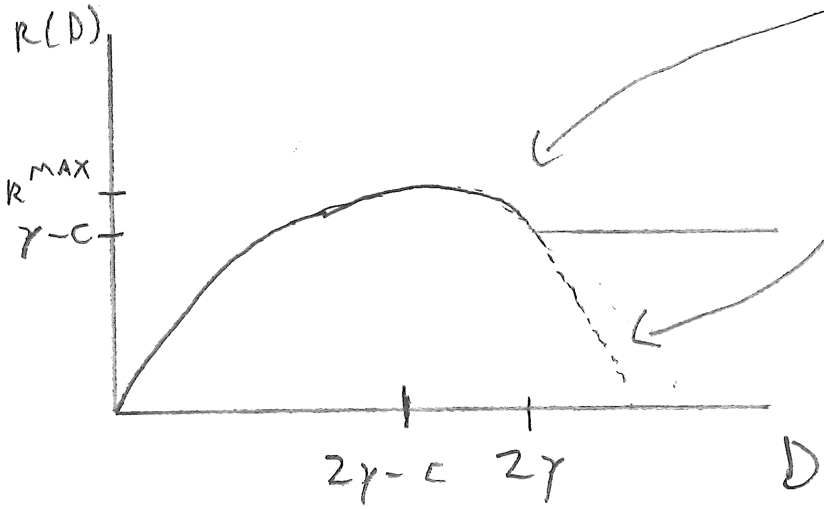
Note: $\frac{\partial R(D)}{\partial D} = 1 - \frac{c}{2\gamma} - \frac{D}{2\gamma}$. So $R(D)$ maximized at $D = 2\gamma - c$

Imp. F. M.

Romer 10.2

Graph of R(D)

$$\left(1-\frac{c}{2\gamma}\right)D-\frac{1}{2\gamma}D^2$$



$$R^{MAX} = R(2\gamma - c) = [(2\gamma - c)/(2\gamma)]^2 \gamma$$

I won't lend unless $R(D) \geq (1+r)\underbrace{(1-W)}_{\text{amount of loan}}$

so if $R^{MAX} < (1+r)(1-W)$, no loan. "Credit rationing."

For $R^{MAX} \geq (1+r)(1-W)$, find D^* by solving:

$$(1+r)(1-W) = \left(1-\frac{c}{2\gamma}\right)D - \frac{1}{2\gamma}D^2$$

(using quadratic formula) and take <u>smaller</u> value for D^* (competition among lenders...)

$$D^* = 2\gamma - c - \sqrt{(2\gamma - c)^2 - 4\gamma(1+r)(1-W)} \qquad (10.9)$$

IMP. K. M.

Romer 10.2

Debt contract

See this beats "verify & share" contract

because it's better for E. (I always gets $(1+r)(1-W)$.)

Recall: under verify & share, expected value of return to E was $\gamma - (1+r)(1-W) - c$.

Here, it's $\gamma - (1+r)(1-W) - \frac{D}{2\gamma} c$ Bigger!

how do you know?

Expected return to E $= \gamma - E[\text{payment to I}]$

$$(1+r)(1-W) = E[\text{payment to I}] - \frac{D}{2\gamma} c$$

so $E[\text{payment to I}] = (1+r)(1-W) + \frac{D}{2\gamma} c$

so ......

IMP. F. M.

Romer 10.2

Will investment happen?

Recall $E\left[E\text{'s payment to } I\right] = (1+r)(1-W) + \underbrace{\frac{D}{2\gamma} c}$

expected value of verification cost paid by I, E must compensate I for it. Call it "A"

$$A = \frac{D^*}{2\gamma} c$$

$$= \left[\frac{2\gamma - c}{2\gamma} - \sqrt{\left(\frac{2\gamma - c}{2\gamma}\right)^2 - \frac{(1+r)(1-W)}{\gamma}}\right] c \qquad (10.10)$$

See: $A\left(\overset{+}{c}, \overset{+}{r}, \overset{(-)}{W}, \overset{(-)}{\gamma}\right) \qquad (10.11)$

Investment happens if

$$\gamma - (1+r)(1-W) - A\left(\overset{+}{c}, \overset{+}{r}, \overset{-}{W}, \overset{-}{\gamma}\right) > (1+r)W \qquad (10.12)$$

$$\gamma > (1+r)W + (1+r)(1-W) + A = (1+r) + A$$

So anything that raises A reduces probability that investment happens. Holding r fixed, this includes

$\gamma \downarrow$, $W \downarrow$, $c \uparrow$.

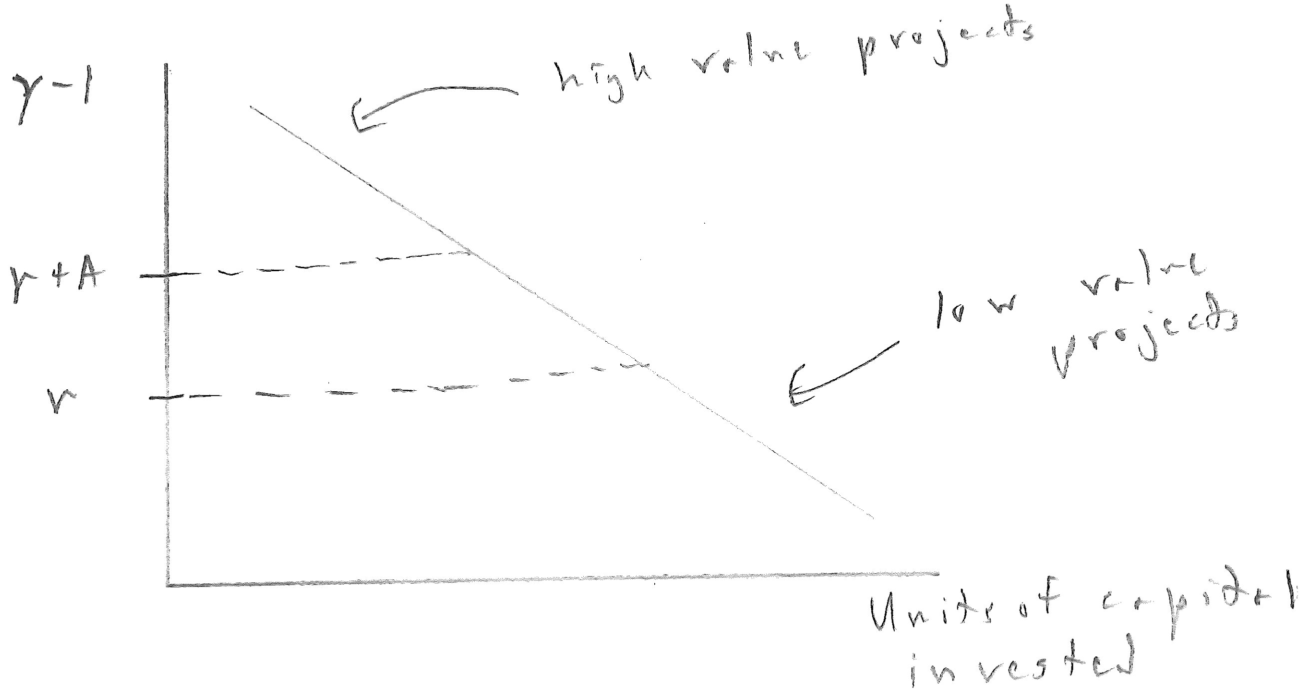
Imp. F. M.

Romer 10.2

Compare with symmetric info

Investment happens if:

Asymm info, debt	Symm. info, shares
$\gamma > (1+r) + A(\overset{+}{c}, \overset{+}{r}, \overset{(-)}{W}, \overset{(-)}{\gamma})$	$\gamma > 1+r$



1) Less investment

2) If W ↓, further reduces investment

3) If r ↑, reduces investment more than under symm. info, shares because $\partial A/\partial r > 0$

IMP. FM

Romer 10.2

Asymm info

Results of (cont.)

What would happen if we embed this story into a macro model?

1) New source of exogenous shocks

Exogenous shocks to c or W affect volume of investment resulting from a given interest rate r, hence current Y, future K, etc.

2) Endogenous W,

W is real value of entrepreneur's assets minus real value of pre-existing debts.

Thus, many ways that variables in a macro model could affect W.

W then affects Y, etc.

Some possible stories here: ...

Imp. FM

Romer 10.2

Asymm info

Results

2) Endogenous W (cont.)

Debt deflation

Debts denominated in \$

If price level turns out to be lower than expected when debts incurred (surprise disinflation or deflation),

then existing debtors have less real wealth,

" creditors have more,

Transfer of wealth from debtors to creditors.

Can this have macro effects, even though total wealth unchanged?

Yes. Say E's among set of existing debtors.

Then $(\pi < \pi^e) \rightarrow W\downarrow \rightarrow A(\quad)\uparrow \rightarrow$ investment $\downarrow$ etc.

IMP. FM

2) Endogenous W (cont.)

Financial accelerator

$r\uparrow$, $Y\downarrow$ could decrease value of assets

(shares in a business, MPK, PDV of expected future MPK...)

thus $\longrightarrow W\downarrow \rightarrow AC(\ )\uparrow \rightarrow$ investment $\downarrow \rightarrow Y\downarrow \rightarrow$ etc.

could make $Y\downarrow$ bigger & more persistent.