Lecture 14:
Interest Rates and the Goods Market

Macroeconomics (Quantitative)

Economics 101B

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Keynes' Consumption Function

- Keynes (1936, p. 96):
  - "The fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* and from our knowledge of human nature and from detailed facts of experience, is that men are disposed, as a rule and on average, to increase their consumption as their income increases, but not by as much as the increase in their income."

Keynes' Consumption Function

- Keynes (1936, p. 93-94):
  - "The usual type of short-period fluctuation in the rate of interest is not likely, however, to have much *direct* influence on spending either way. There are not many people who will alter their way of living because the rate of interest has fallen from 5 to 4 per cent, if their aggregate income is the same as before."

Keynes' Consumption Function

- Consumption a function of after-tax income

$$C = \alpha + \gamma(Y - T)$$

- Marginal propensity to consume γ between zero and one
- Interest rate not important
- Future income not important

Introspection about Consumption

- Suppose you received a surprise one-time $1,000 scholarship
- How much would you spend within a year?
  (on goods and services, not paying down debt)

- How about a one-time $10,000 scholarship?
- How about a one-time $100,000 scholarship?

Introspection about Consumption

- Suppose interest rate rose by 1 percentage point
- How much more would you save over a year as a fraction of your annual consumption?

Keynesian Cross

- Planned expenditures (demand):

$$PE = C + I + G + NX$$

- Suppose I, G, and NX are "exogenous"
  (i.e., not affected by level of output or interest rates)
- Suppose C is given by Keynes' consumption function
- Suppose output is determined by demand

Keynesian Cross

- Output must equal planned expenditures:

$$Y = \alpha + \gamma(Y - T) + I + G + NX$$

- A little bit of algebra then gives:

$$Y = \frac{1}{1-\gamma}[\alpha - \gamma T + I + G + NX]$$

$$\text{Government purchases multiplier} = \frac{1}{1-\gamma}$$

$$\text{Tax cut muliplier} = \frac{\gamma}{1-\gamma}$$

Keynesian Cross

- If marginal propensity to consumer is 2/3
  - Government purchases multiplier is 3
  - Tax cut multiplier is 2
  - Multiplier for extra investment or consumption is 3
- Logic:
  - Government spends ΔG
    (extra income for households)
  - Households spend extra $\gamma \Delta G$ (more extra income)
  - Households spend extra $\gamma^2 \Delta G$
  - Etc.

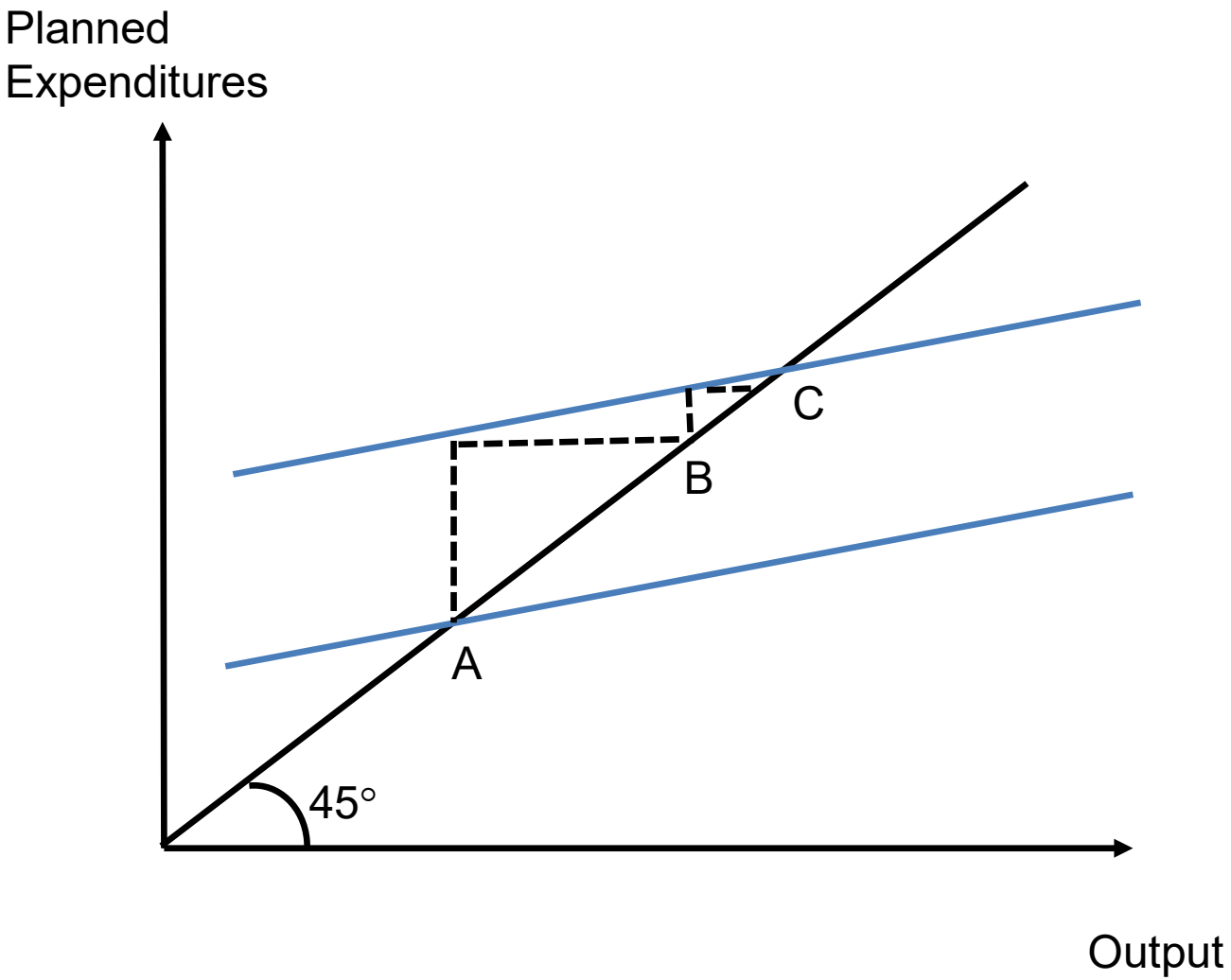
Keynesian Cross

- Planned expenditure:

$$PE = \alpha + \gamma(Y - T) + I + G + NX$$

- Equilibrium dictates

$$Y = PE$$



Keynesian Cross

- Keynesian economics in its simplest form
- Very strong assumptions:
  - Consumption and investment not affected by interest rates (or future income)
  - Prices not affected by changes in output
- We next consider a slightly more sophisticated version, where demand depends on the interest rate

The IS Curve

- Same starting point:

$$PE = C + I + G + NX$$

- But consumption and investment affected by interest rate:

$$PE = C(Y, r) + I(r) + G + NX(r)$$

- Goods market equilibrium:

$$Y = PE$$

$$Y = C(Y, r) + I(r) + G + NX(r)$$

Consumption

$$C_t = a_c \bar{Y}_t - b_c \bar{Y}_t (R_t - \bar{r})$$

- Let's try to captures basic idea of the permanent income hypothesis:
  - Consumption not a function of current income, rather potential income since it helps forecast future (lifetime) income
  - Negative relationship between consumption and real interest rate (relative to "natural rate" $\bar{r}$)
- Slightly more sophisticated than in Jones

Investment

$$I_t = \bar{a}_i \bar{Y}_t - \bar{b}_i \bar{Y}_t (R_t - \bar{r})$$

- Same as consumption:
  - Investment a function of permanent income since it helps forecast future demand and profitability
  - Investment negatively affected by real interest rate (relative to "natural rate" $\bar{r}$)
- Higher interest rate, lower investment

Imports

- Most of imports are consumption and investment
- So, consistency dictates that

$$IM_t = a_{im}\bar{Y}_t - b_{im}\bar{Y}_t(R_t - \bar{r})$$

- This is again slightly more sophisticated than in Jones

Government Spending and Exports

- Government spending:
  - Assumed to be exogenous

$$G_t = \bar{a}_g \bar{Y}_t$$

- Exports:
  - Assumed to be exogenous

$$EX_t = \bar{a}_{ex} \bar{Y}_t$$

Planned Expenditure

$$PE_t = C_t + I_t + G_t + EX_t - IM_t$$

- Consumption:

$$C_t = a_c \bar{Y}_t - b_c \bar{Y}_t (R_t - \bar{r})$$

- Investment:

$$I_t = \bar{a}_i \bar{Y}_t - \bar{b}_i \bar{Y}_t (R_t - \bar{r})$$

- Imports:

$$IM_t = a_{im} \bar{Y}_t - b_{im} \bar{Y}_t (R_t - \bar{r})$$

- Government spending and exports:

$$G_t = \bar{a}_g \bar{Y}_t \qquad EX_t = \bar{a}_{ex} \bar{Y}_t$$

IS Curve

- In equilibrium output equals planned expenditures:

$$Y_t = C_t + I_t + G_t + EX_t - IM_t$$

- Plugging in for $C_t, I_t, G_t, EX_t, IM_t$:

$$Y_t = \bar{a}_{PE}\bar{Y}_t - \bar{b}_{PE}\bar{Y}_t(R_t - \bar{r})$$

where

$$\bar{a}_{PE} = \bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im}$$

$$\bar{b}_{PE} = \bar{b}_c + \bar{b}_i - \bar{b}_{im}$$

IS Curve

$$Y_t = \bar{a}_{PE}\bar{Y}_t - \bar{b}_{PE}\bar{Y}_t(R_t - \bar{r})$$

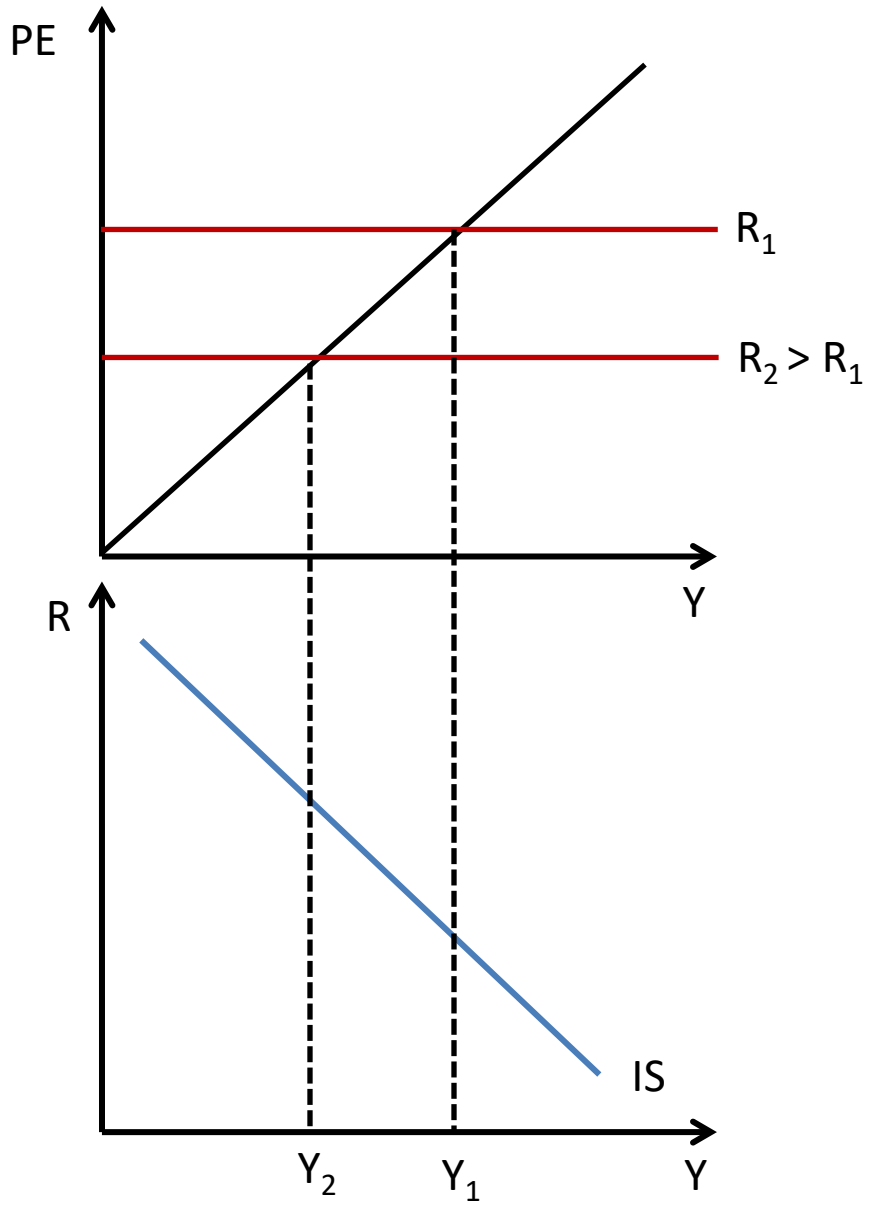
- Let's now divide through by $\bar{Y}_t$ and subtract 1 from each side:

$$\frac{Y_t}{\bar{Y}_t} - 1 = (\bar{a}_{PE} - 1) - \bar{b}_{PE}(R_t - \bar{r})$$

$$\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$$

IS Curve

- IS curve gives demand as a function of the interest rate
- Higher interest rate lowers demand
- Planned expenditure lines are flat because demand a function of $\bar{Y}_t$ not Y_t



“One-Line” Intuition

- How changes in interest rates affect the demand for goods, and thus output

- Negative relationship between R and Y

$$R \downarrow \Rightarrow C^d \uparrow \text{ and } I^d \uparrow \Rightarrow Y \uparrow$$

IS Curve

- Where did the name come from?
- Investment:

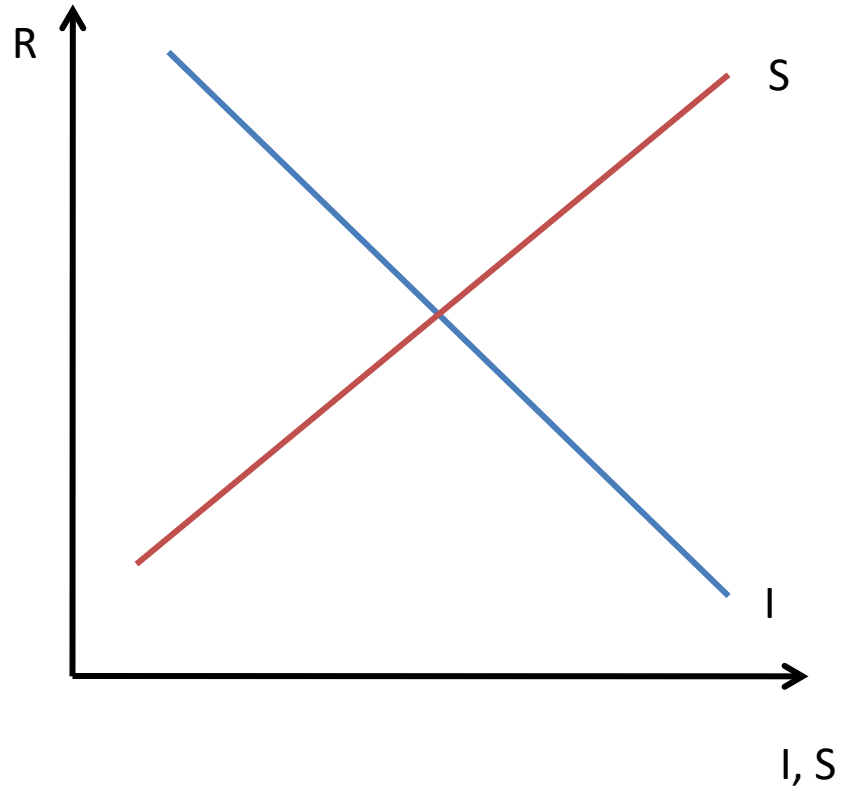
$$I_t = \bar{a}_i \bar{Y}_t - \bar{b}_i \bar{Y}_t (R_t - \bar{r})$$

- Savings:

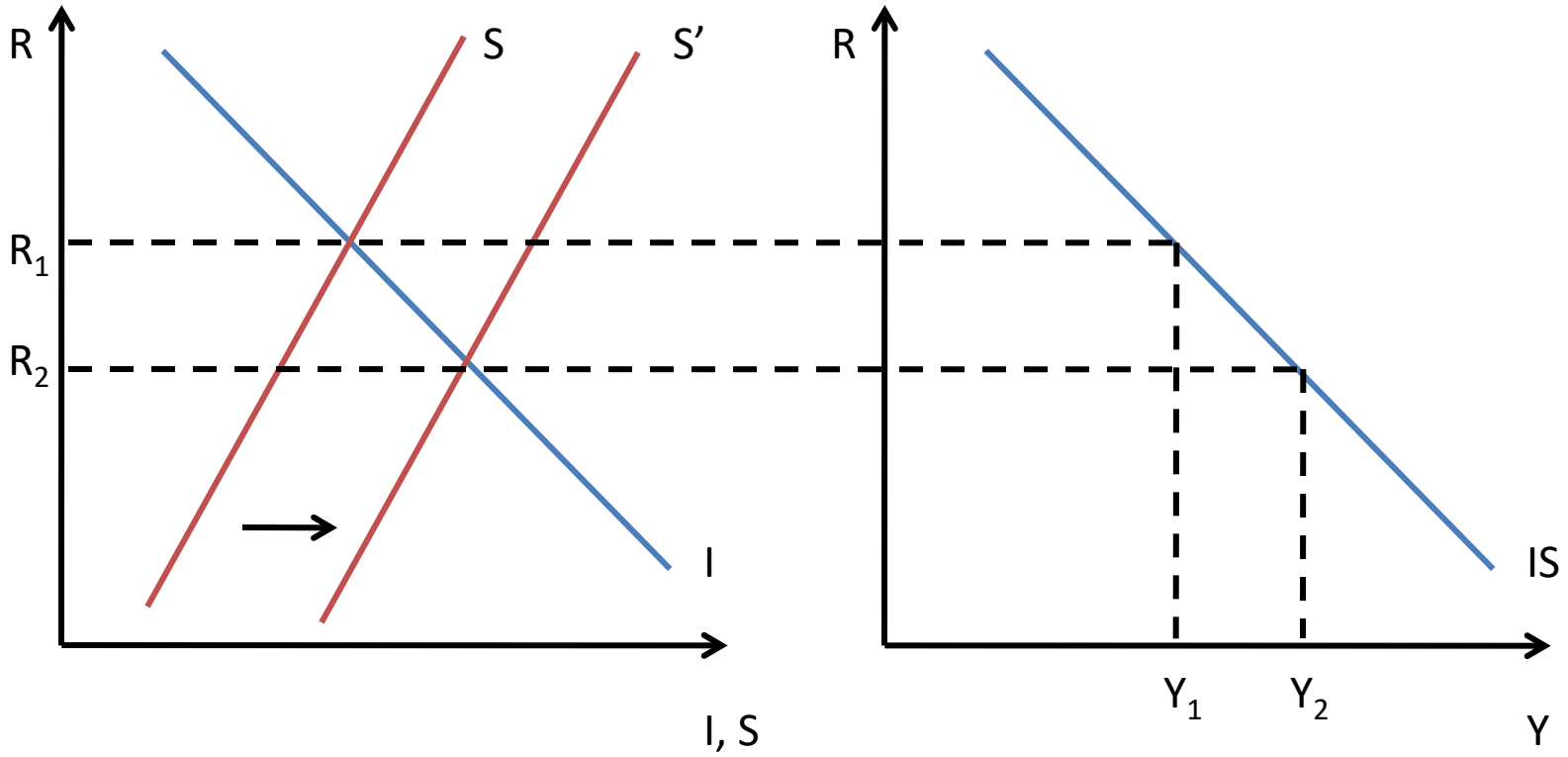
$$S_t = Y_t - \bar{a}_s \bar{Y}_t + \bar{b}_s \bar{Y}_t (R_t - \bar{r})$$

- Equilibrium:

$$I_t = S_t$$



IS Curve



Increase in output from Y_1 to $Y_2 > Y_1$

IS Curve Shocks

- What shifts the IS curve?

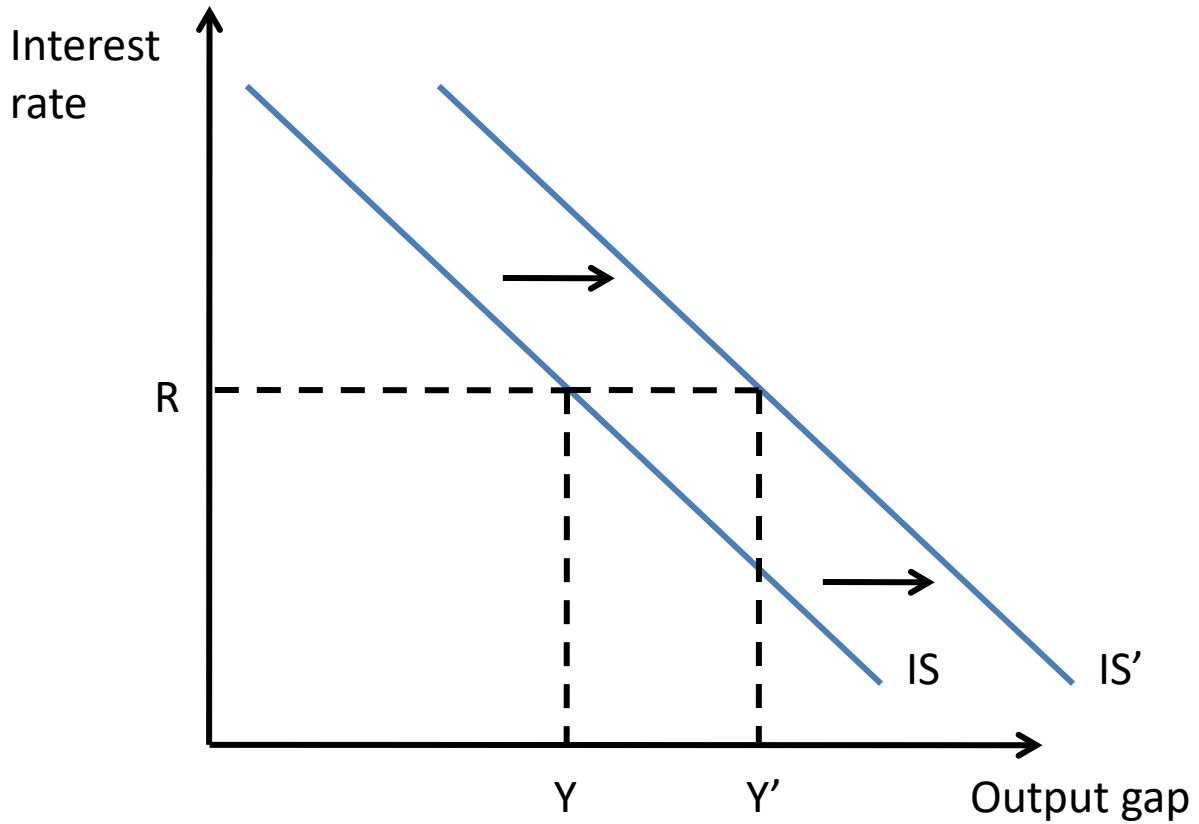
$$\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$$

- Quintessential IS curve "shifter":
  - Government spending shock
- In normal times:

$$G_t = \bar{a}_g \bar{Y}_t$$

- Suppose government decides to spend more:

$$G_t = \bar{a}'_g \bar{Y}_t \text{ where } \bar{a}'_g > \bar{a}_g$$



IS Curve Shocks

- Expectations shock (Optimism):
  - Positive revision of expectations about the future
  - Expect more growth/higher income in the future
  - What happens today?
    - Consumption and investment increase

$$C_t = \bar{a}'_c \bar{Y}_t - \bar{b}_c \bar{Y}_t (R_t - \bar{r}), \text{where } \bar{a}'_c > \bar{a}_c$$

$$I_t = \bar{a}'_i \bar{Y}_t - \bar{b}_i \bar{Y}_t (R_t - \bar{r}), \text{where } \bar{a}'_i > \bar{a}_i$$

$$\tilde{Y}_t = \bar{a}' - \bar{b}\,(R_t - \bar{r})$$

What Shifts the IS Curve?

- Δ government spending (G)
- Δ lump sum taxes (T)
- Δ expected future income or output
- Δ wealth
- Δ investment for reasons other than change in R
  (i.e. autonomous shock to I)
- Δ consumption for reasons other than change in R
  (i.e. , "autonomous" shock to C)

IS Curve and Credit Constraints

- In above derivation:
  - Consumption, investment, etc. functions of potential output, not actual output
  - Theoretical justification: Permanent income hypothesis
- Liquidity constraints:
  - Some consumers can't borrow against future income
  - Are credit constrained

IS Curve and Credit Constraints

- What will credit constrained households do if they get extra income?
  - Spend it!
  - They would like to borrow and consume more
  - If their income rises temporarily, they spend the extra income
- These households are said to live "hand-to-mouth"

Credit Constraints and the MPC

- Marginal propensity to consume (MPC):
  - If you get an extra dollar, how much do you spend (over say a 3 month period)
- In permanent income hypothesis model, the MPC is very low (close to zero)
- Credit constrained agents have a very high MPC

Measuring the MPC

- Parker, Souleles, Johnson, McClelland (2012):
  - Look at 2008 Economic Stimulus Payments
  - People got checks from the government
  - Timing was random (based on last digits of SS#)
  - Compare those that got a check at time t with those that didn't (treatment vs. control)
  - How much more did treated people spend over a 3 month period

TABLE 3—THE RESPONSE TO ESP RECEIPT AMONG HOUSEHOLDS RECEIVING PAYMENTS

	Dollar change in		Percent change in		Dollar change in	
	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending 2SLS	All CE goods and services 2SLS
Panel A. Sample of all households ($N = 17{,}478$)						
ESP	0.117	0.507			0.123	0.509
	(0.060)	(0.196)			(0.081)	(0.253)
$I(ESP)$			2.63	3.97		
			(1.07)	(1.34)		
$I(ESP_{it} > 0 \text{ for any } t)_i$	9.58	21.21	−0.88	−1.17	8.23	20.77
	(36.07)	(104.00)	(0.50)	(0.63)	(38.79)	(112.18)
Panel B. Sample of households receiving ESPs ($N = 11{,}239$)						
ESP	0.185	0.683			0.252	0.866
	(0.066)	(0.219)			(0.103)	(0.329)
$I(ESP)$			3.91	5.63		
			(1.33)	(1.69)		
Panel C. Sample of households receiving only on-time ESPs ($N = 10{,}488$)						
ESP	0.214	0.590			0.308	0.911
	(0.070)	(0.217)			(0.112)	(0.342)
$I(ESP)$			4.52	6.05		
			(1.50)	(1.89)		

Source: Parker, Souleles, Johnson, McClelland (2012)

Hand-to-Mouth Consumers

- **Assumption**: A fraction of households are credit constrained and spend temporary increases in income. Aggregate consumption is then:

$$C_t = \bar{a}_c' \bar{Y}_t + \bar{x} Y_t - \bar{b}_c \bar{Y}_t (R_t - \bar{r})$$

where $0 < \bar{x} < 1$

- Reasonable value for $\bar{x}$?
  - Perhaps 0.25 based on Parker et al. (2012)

Hand-to-Mouth Consumers

$$C_t = \bar{a}_c' \bar{Y}_t + \bar{x} Y_t - \bar{b}_c \bar{Y}_t (R_t - \bar{r})$$

- Extra term reflects hand-to-mouth consumers
- Since their spending rises and falls one for one with actual output (as opposed to potential output), aggregate consumption will vary with the output
- This turns out to have important consequences

IS Curve with Hand-to-Mouth Consumers

- Same steps as before yield:

$$\tilde{Y}_t = \bar{a} + \bar{x}\tilde{Y}_t - \bar{b}(R_t - \bar{r})$$

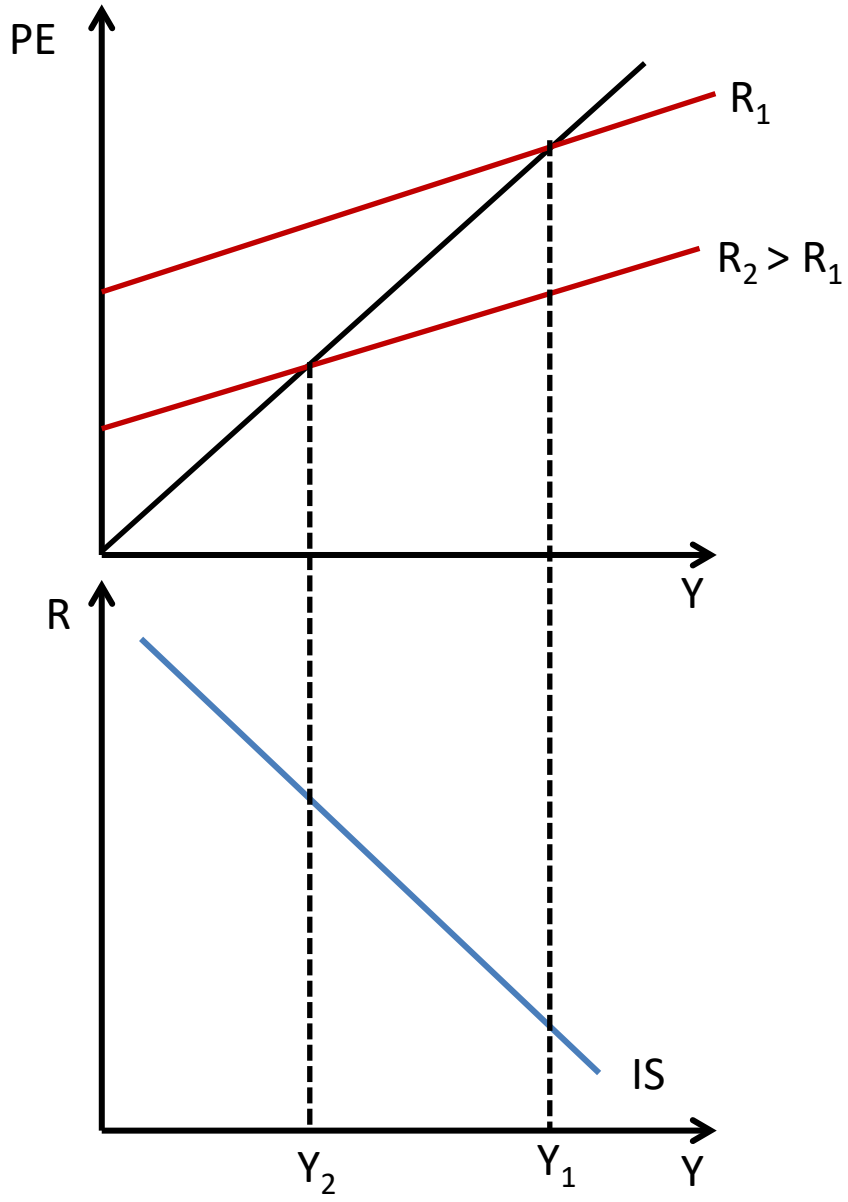
$$(1 - \bar{x})\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$$

$$\tilde{Y}_t = \frac{1}{1 - \bar{x}}\left[\bar{a} - \bar{b}(R_t - \bar{r})\right]$$

- Multiplier effect: Any change in $\bar{a}$ or R_t have a larger effect on the output gap than before

IS Curve with Hand-to-Mouth Consumers

- Planned expenditure lines are now upward sloping because consumption a function of Y_t
- Implies that shift in R_t has a bigger effect on Y_t



Multiplier Effect

- What is the intuition for the multiplier effect?
- Say foreign demand falls by 1%
- Without multiplier: Output falls by 1%
- With multiplier:
  - Fall in output implies a fall in the income of hand-to-mouth consumers
  - They reduce their consumption.
  - This further reduces output, and on and on

Multiplier Effect

- Initial fall in foreign demand: 1%
- 1st round fall in consumption: $\bar{x}\%$
- 2nd round fall in consumption: $\bar{x}^2\%$
- 3rd round fall in consumption: $\bar{x}^3\%$
- Etc., Etc.
- Total effect:

$$1 + \bar{x} + \bar{x}^2 + \bar{x}^3 + \cdots = \frac{1}{1 - \bar{x}}$$

Where Do We Stand?

- Money Market (LM Curve):

$$\log M_t - \log P_t = -\phi i_t + \log Y_t + v_t$$

- Fisher Equation: $R_t = i_t - E_t \pi_{t+1}$
- Price Setting Equation: $\pi_t = \theta \tilde{Y}_{t-1}$
- Goods Market (IS Curve): $\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$
- Okun's Law: $u_t - u^n = -\frac{1}{2}\tilde{Y}_t$

IS-LM Model

- Short-run model
- Determines output gap and real interest rate
- Inflation predetermined (unaffected by output)
- Money market shocks shift the LM curve
- Goods market shocks shift the IS curve