

Chapter 7. Savings, Investment and Interest

UMSL

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Savings, Investment and Interest: Facts

- Recession, bank sector during crisis period,
- savings by consumers & investment by firms falls.
- *Current period output* lower &
- ability falls to *accumulate capital* for increasing future output.
- Explaining crises: occupies both Neoclassical & Keynesian.
- Tend to view solution differently:
 - former on fixing the private bank sector, & priv. invest. resuming.
 - Latter focuses more on govt. doing investment in place of private.
- 2 approaches can be complimentary, eg.
- govt supplies efficient social insurance objective.

Historical View of Capital

- Capital accumulation generates wealth:
 - difference between "Western" & "Eastern" societies.
 - Through functioning capital markets:
 - market interest rates determine capital allocation.
- If ban interest on capital, capital accumulation is less.
 - Religion-led govt which ban interest, throughout history.
 - Christianity banned "*usury*", interest on capital : 1st -14th cent.
 - Muslim religion bans usury; "*Islamic banking*" all interest payments
 - on loans converted to equity dividend payments.
- Interest rate on debt & dividend yield rate on equity can be equal.
- Adam Smith's (1776) Wealth of Nations: interest & capital
 - necessary for industrial revolution in Great Britain; American Independence.
 - Market for capital became a staple of economics.
- Fisher (1896, 1907, 1930): optimization capital & interest theory.
 - Common graph, analysis, used to this day.

Wealth to Income Ratios

- As interest common usage, wealth accumulated more easily.
- OECD: Income & wealth vary across OECD countries.
- Wealth is greater than income in some & reverse also holds.
 - *Wealth to income ratios* led by US & Switzerland, at around 4.
 - Canada, Sweden, Italy & UK ratios around 2.
 - Germany, France, Austria, Luxembourg, Denmark, & Israel above 1.
 - Czech Republic, Spain & Ireland near 1; less developed economies.
- Turkey, Hungary & Greece at bottom of OECD *life satisfaction index*
 - wealth < income; Slovak Rep., Russia, Poland, Estonia, Slovenia.
 - Exceptions: Brazil & New Zealand high life satisfaction
 - & wealth < income; natural environmental resources
 - not captured in wealth estimates.
- Production Function approach: $\frac{y}{k} = \frac{f(h,k)}{k} = \frac{Ah^{0.3}k^{0.7}}{k} = A\left(\frac{h}{k}\right)^{0.3}$;
 - so income to wealth: has to do with Productivity factor A
 - & Society's Human/(Physical Capital) ratio; k is measurable Wealth

Savings & Investment: Accounting and Data Trends

- Post-WWII US Personal Saving Rate moves in opposite direction
- to Gross Private Domestic Investment as share of GDP.
- Share of investment from NIPA of Chapter 2.
- Personal Saving Rate in FRED, also from NIPA
 - ratio of personal saving to disposable personal income (DPI).
 - NIPA; Account 4: Personal Income & Outlay Acct definition:
 - "net acquisition of assets minus net acquisition of liabilities.
- Think of as NIPA ratios I/Y and $(Y-T-C)/Y$
- Question is not what is Happening to Savings rate,
- but what is Happening to Sav + Invest?

Investment Rate & Savings Rate: Mirror Image?

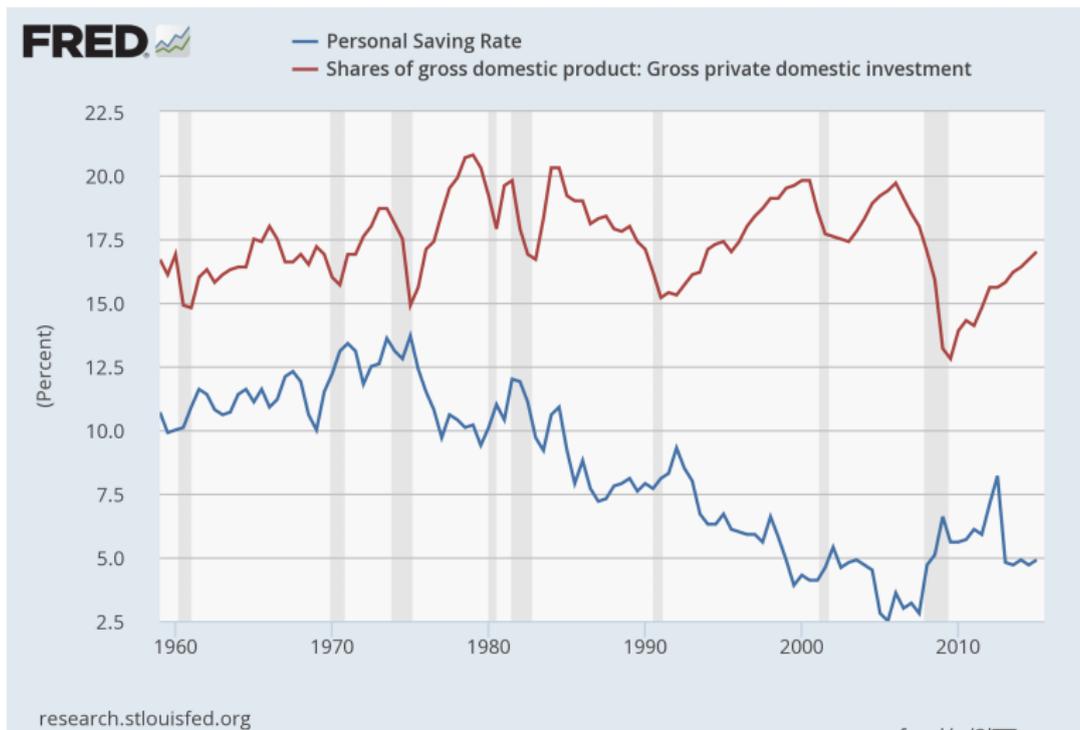


Figure: US Gross Domestic Private Investment Share of GDP and Personal Saving Rate, 1958-2015.

Why do they have high Negative Correlation?

- Negative correlation, up to -0.35 depending on subsample used.
- Tendency of net savings of household,
- as in NIPA definition of financial assets minus liabilities,
- falls when private investment goes up.
- Decrease in financial savings becomes increase in investment.
- Rep agent reduces its saved income when it invests it.
- Think of durables investment, housing investment, reducing savings
- & becoming firm investment in these goods.
- Sum of investment & saving constant over time?
- Could add these together & see if true.

Adding Saving, Investment Rates

- Savings rate + investment share, - (Net exports/GDP) - 27.
- $S+I$ amount around zero until 1991, then trends down.
- Net export share of GDP starts trending downwards.
- NIPA accounts: $C+I+G+NX=Y$.
- Solve for I ; $I=Y-C-G-NX$.
- Use that domestic investment equals domestic savings,
- or $I=S$, then $S'=I=Y-C-G-NX$.
- Personal savings rate is $Y-C-T$ which is $Y-C-G$, if $G=T$.
- So $I=S'=(Y-C-G-NX)$, and $I=S'$, so $I+S'$ constant over time.

Green Line is I+S Minus NX



Graphical Results Post 1958

- Vietnam war period: too much savings?
 - that was not turned into investment?
- Great Recession: too little investment, little savings?
- Only exceptions significantly from Vietnam War era (positively)
 - and Great Recession (negatively).
- Investment share is rather stable.
 - Marked downturns in investment share during every recession.
- Net exports: negative trend part of savings turned into
 - household investment in foreign goods?

Theory:

- Capital market theory starts with supply & demand for capital.
- Supply of capital is "*savings*", demand for capital "*investment*"
- Market theory describes equilibrium in capital market.
- Certain equilibrium interest rate at which
- quantity of capital supplied (Savings)
- equals quantity of capital demanded (Investment).

IS-LM Analysis

- First, Keynes (1930, 1936) idea of unused savings during crises
 - employed supply & demand theory of capital markets.
 - Simply assume price of capital became fixed, below-market rt.:
 - "price ceiling" causes excess supply of capital.
- Keynesian theory of aggregate demand management
 - originated from Keynes' (1930) Treatise on Money,
 - took form of "Keynesian Cross"; NIPA identity of GDI & GDP.
 - Adds consumption function, shows how more G increases Y .
- 2nd Keynesian analysis devised after Keynes (1936):
 - government spending & money supply increases boost GDP.
 - Uses savings of consumer rather than consumption function.
 - Widely known as *IS-LM analysis*.
- IS stand for Investment (I) & Savings (S):
 - IS curve shows equilibrium interest rate & output Y ,
 - corresponding to equilibrium in capital market of S&D.

IS-LM Assumptions

- Assumes Investment & Savings depend on given output Y .
- And when aggregate income increases, so Y goes up,
 - supply of capital shifts out by more
 - than demand for capital shifts out.
- If supply shifts out by more when Y rises,
 - as is **always** assumed,
 - then interest rate falls.
- Relating falling interest rate to rising income Y
 - provides negative relation between interest rates & income,
 - **which is graphed separately as IS curve.**
- Only one graph in Keynes' (1936) *General Theory*.
 - Shows this assumption of supply shifting out more than demand
 - when output Y rises.
 - So gives relation of Rising Y and Falling interest rate r .

Keynes's 1936 Only Graph

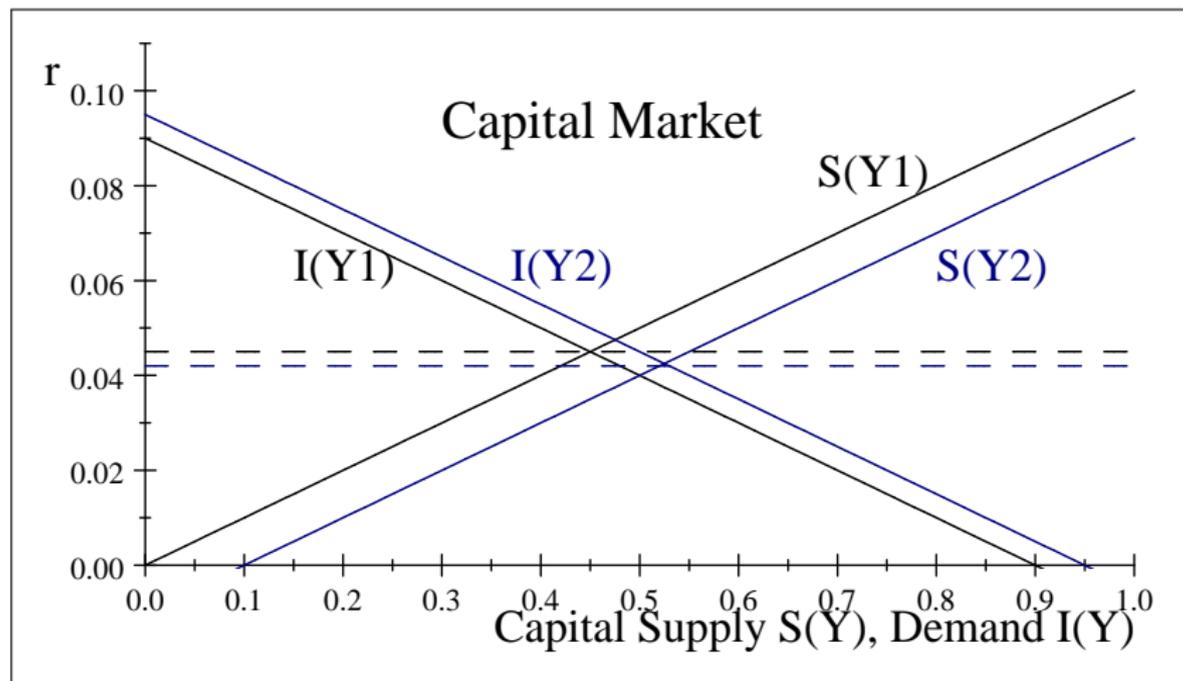


Figure: Keynes's (1936) Graph: Supply and Demand for Capital Shift Out When Income Y Rises (Black to Blue) ; Interest rate r falls as Y rises.

Downward Sloping IS Curve Requires Assumption

- If savings always shifts out by more than investment, when Y up,
- & if both *demand & supply for capital* depend upon level of Y ,
- then when output rises, interest rate falls.
- So various *equilibria* of I & S lines can be plotted
 - using these assumptions in space of Y and r .
- Resulting so-called "*IS curve*" slopes down,
 - when plotted in (r, Y) graphical dimensions.

IS Curve in Y, r Dimensions with Assumption

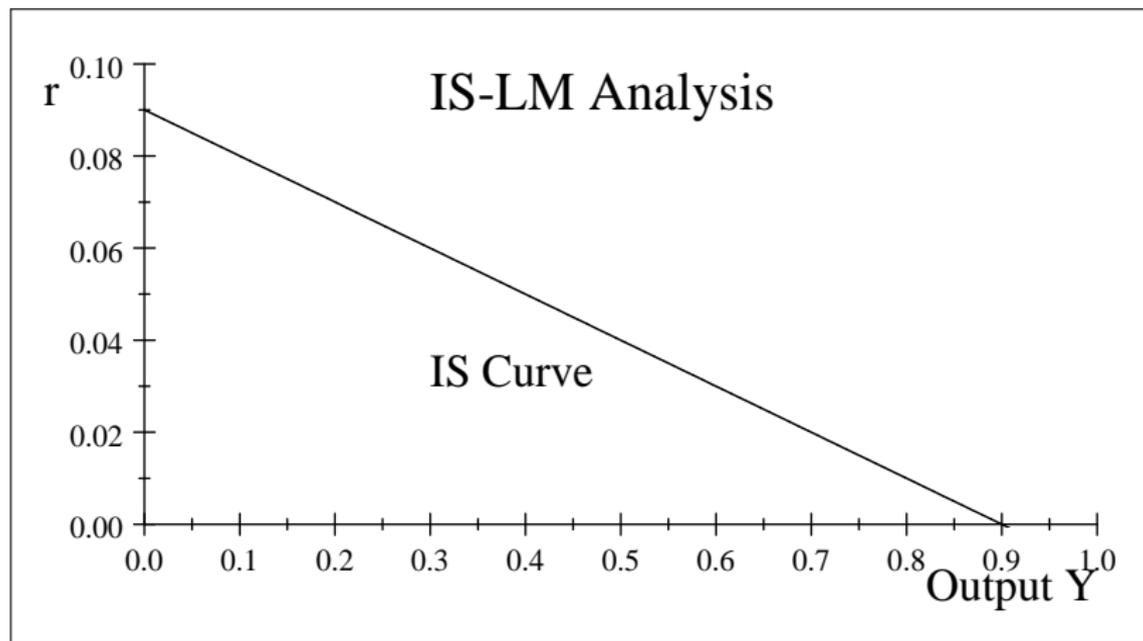


Figure: Downward Sloping IS Curve of Keynes, Hansen

Special Assumption Inconsistent with Growth Facts

- Shifting out of S by more I when income/output rises
 - very special assumption, generally does not hold.
 - Most normal would be that S & I shift out together with income,
 - by same amount & interest stays same, as *stylized growth facts*,
 - known as Solow growth facts: interest rate stays constant over time
 - as output grows at some trend rate.
- Keynes concerned with "excess savings" during Great Depression.
 - Downward sloping IS curve reformulation of idea of $I < S$,
 - more savings than investment, negative profits in Keynes (1930).
 - Special case may or may not have held during Depression.
- Surprising: today IS curves always assumed downwards sloping,
 - without regard to whether assumptions hold.
 - IS-LM used for all Macroeconomic policy analysis by some,
 - not just crisis periods; supports government intervention.
 - Remains attractive to economists; S&I step up from Cross.

Liquidity Preference for Money: LM Curve

- LM part of analysis, in full IS-LM constructed by Hicks (1937),
 - year after Keynes' (1936) *General Theory*.
 - IS-LM analysis in economics almost immediately after Keynes (1936).
- *LM curve* named for Keynes's (1936) *demand for real money*,
 - he called "*liquidity preference for money*",
 - since Keynes viewed money as most "liquid" of all assets.
- LM curve then derived from so-called money market.
 - as supply & demand for money,
 - with interest rate price of money.
 - Does not distinguish Real or Nominal Interest Rate:
 - Ok if assume zero inflation, so Real = Nominal Int. Rt.
- Zero inflation allows also real money same as nominal money,
 - just amount of dollars held.
- Why use money market, after using capital market?
 - Maybe consumer uses money only for current consumption.
 - While saving over time is Supply of Savings in capital mrkt.

LM Special Assumptions

- How supply & demand for money change when income changes.
 - Implies resulting interest rate, up or down.
- Greater shift out in demand than supply when income rises
 - is exactly what IS-LM analysis always assumes.
 - Implies in money market interest rate rises as income goes up.
- So relation of interest rates & income in money market is
 - that higher interest rate coincides with higher income Y .
 - Gives what is called an "upward sloping" LM curve.
- Get result by assuming money supply is **only**
 - *fixed government supply of money.*
 - *Ignores private bank supply of money,*
 - *which if added would make supply of money curve*
 - *normal upward sloping function depending upon income.* 4.

More Generally for Money Market

- Money supply & money demand shift out equally
 - with income along growth path of economy.
- Interest rate remains unchanged.
- LM curve is flat, horizontal line;
- just as IS curve is flat line along growth path of economy.
- So *upward sloping LM curve* again
 - from very special assumptions,
 - especially complete ignoring of private bank money supply
 - which is largest component of so-called M1
 - monetary aggregate (sum of currency plus deposits at banks).

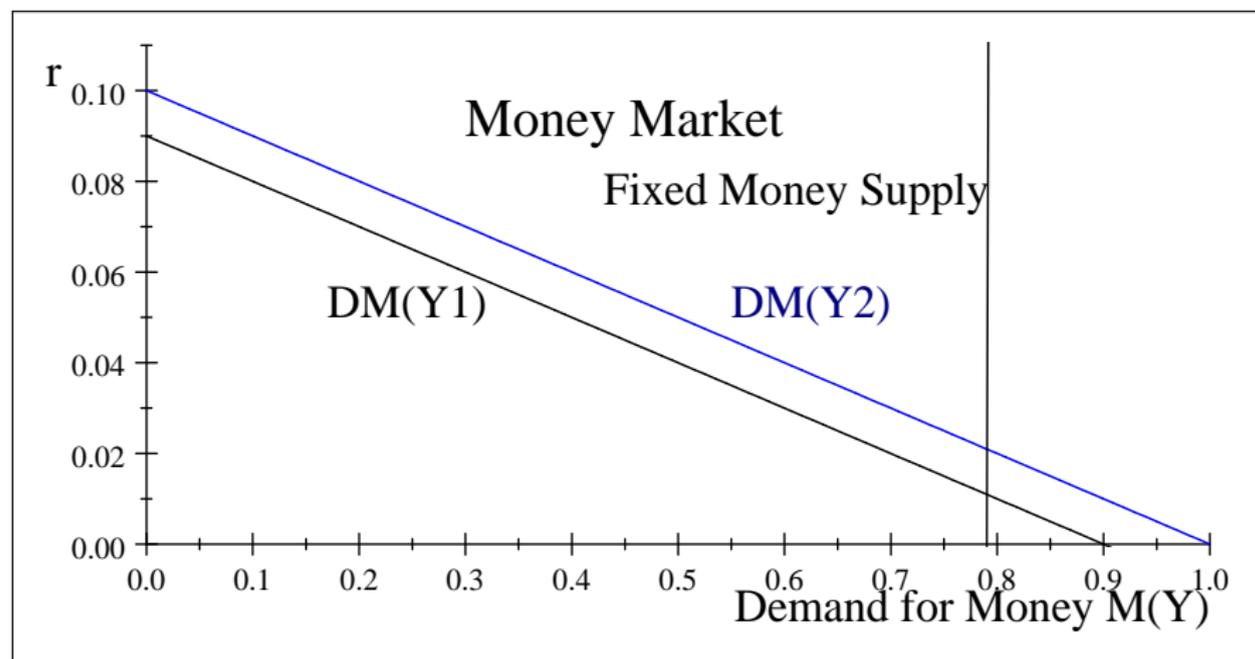


Figure: Downward Sloping Demand for Money that Depends on Y (DMY1-Black) and Shifts Out When Y Increases (DMY2-Blue).

Putting Together IS and LM in Y & r Graph

- Graphing all possible interest rates in money market
 - with Assumption, results in an LM curve upward sloping.
- LM upward sloping; previously "*derived*" IS curve downward sloping.
- Idea is a unique equilibrium level of interest and output Y
- where IS & LM curves intersect.

IS and LM Graphed Together, Unique "Equilibrium"

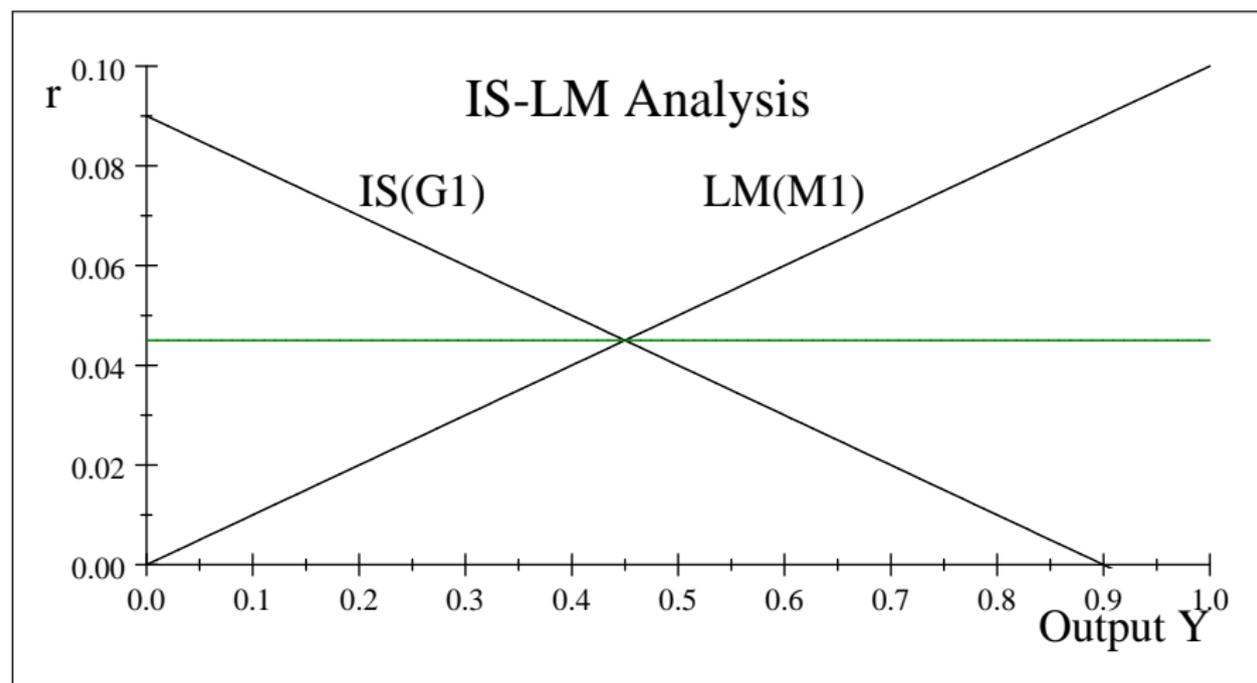


Figure: Downward Sloping *IS* Curve and *LM* Curve from Money Market, Giving "Equilibrium" Y and r .

IS-LM Policy: Government Spending & Money Supply Increases

- Special cases set up to get Govt Intervention results.
 - 1) increase in government spending increases output
 - and raises interest rate.
 - Assumes government spending not paid for by taxes,
 - & govt spending is exogenous increase in investment demand.
- Increase in govt spending then causes IS curve to shift out,
 - reach new equilibrium interest rate & output level,
 - as move up along LM curve; both Y & r higher.
 - IS curve written as $IS(G_1)$, indicating dependence
 - on level of govt spending. Govt spending rises from G_1 to G_2 ,
 - then *IS curve shifts out*.
- 2) Increase in money supply shifts out LM curve, down along IS
 - & causes lower interest rate & higher level of output.
 - Say LM curve depends on current money supply, M_1 .
 - If M_1 rises to M_2 , then in money market interest rate falls.

Overall Policy Results

- Combining LM curve with IS curve, an increase in
- government money supply causes LM curve to shift out & down.
- Increase govt spending causes IS to shift out and up.
- Both govt actions increases output.
 - Govt spending increase also raises interest rate.
 - Money supply increase also lowers interest rate.
- So government comes out quite nicely: can increase output
- by either of two changes, called Stabilization Policy sometimes.

Critique of IS-LM Policy Analysis

- Government spending requires taxes: excluded from IS-LM;
 - Taxes to pay for expenditure would offset increase in Invest Demand
 - and Inflation Tax results if continuous Money printing
 - (inflation assumed to be zero in IS-LM analysis).
- IS-LM policy internal contradiction in practice:
 - almost never only one-time increase in spending
 - and one-time increase in money supply.
- Rather new spending programs continually increase deficit,
 - and if instead money is printed,
 - then money supply continually augmented each period,
 - and growth rate of money supply increases; causes inflation.
- Other Criticisms: IS & LM curves normally flat over time;
 - & private bank money creates upward sloping money supply.

Appendix: Government Policy in the IS-LM Framework

- Gov spending G or more Govt Money causes higher output.
- Qualified: govt spending has larger impact than money supply increase.
- Shift out in capital demand occurs from Govt Spending increase.
 - Interest rate r rises while output Y is same;
 - so shifts out Invest Dem curve.
- In (r, Y) dimensions of IS line, increase in Investment shifts out IS line:
 - IS has higher interest rate at every Y .
 - So is shift out in IS curve, from higher G .
- If money supply \bar{M} increased,
 - then money market interest rate r falls.
 - Output level Y unchanged; shifts out fixed money supply,
 - decreases in real interest rate.
- Increase in fixed money supply causes interest rate to fall
 - with output constant; means LM curve shifts out & to right.

Increase in Investment Demand from Govt Spending

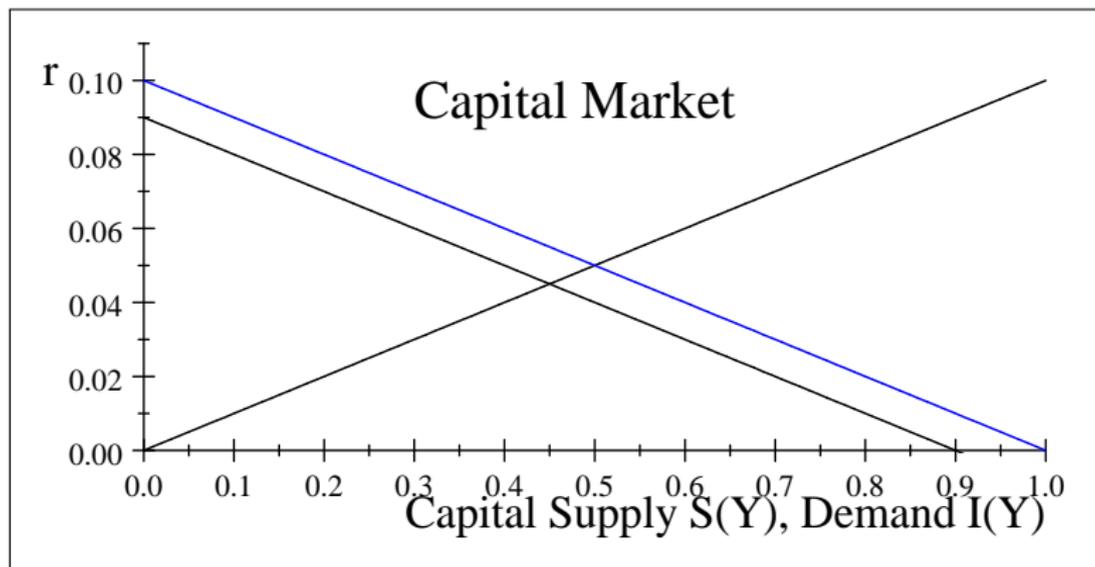


Figure: Increase in G Shifts out Demand for Capital Shifts Out while Supply of Capital is the Same: Gives Higher r and Y equilibrium set of points.

Shift in IS Curve from Increase in Govt Spending

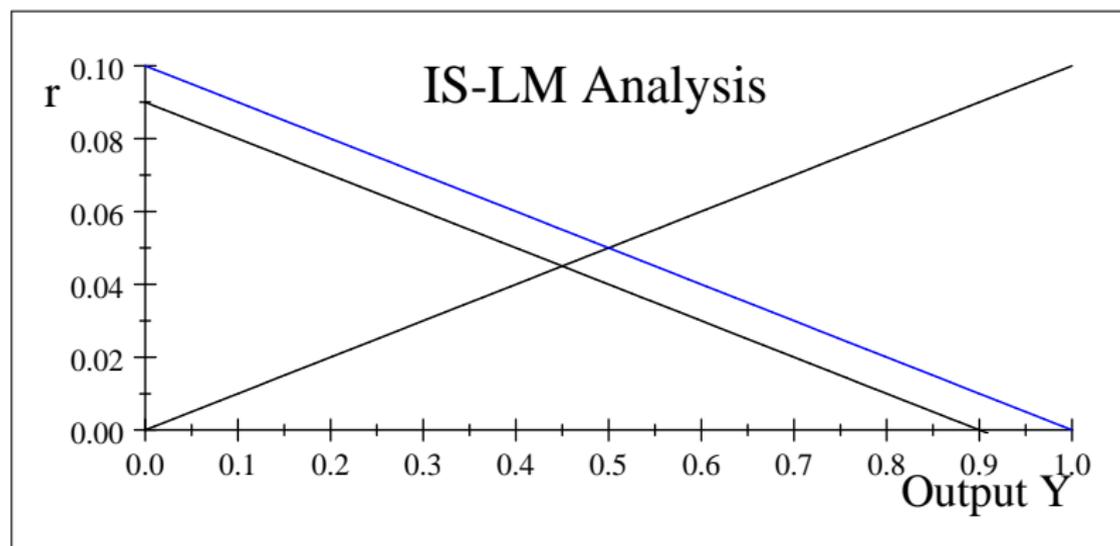


Figure: Increase in G Shifts out Downward Sloping IS Line as Increase in G Shifts out Investment Demand in Capital Market.

Shift in Money Supply from Increase in Govt Money

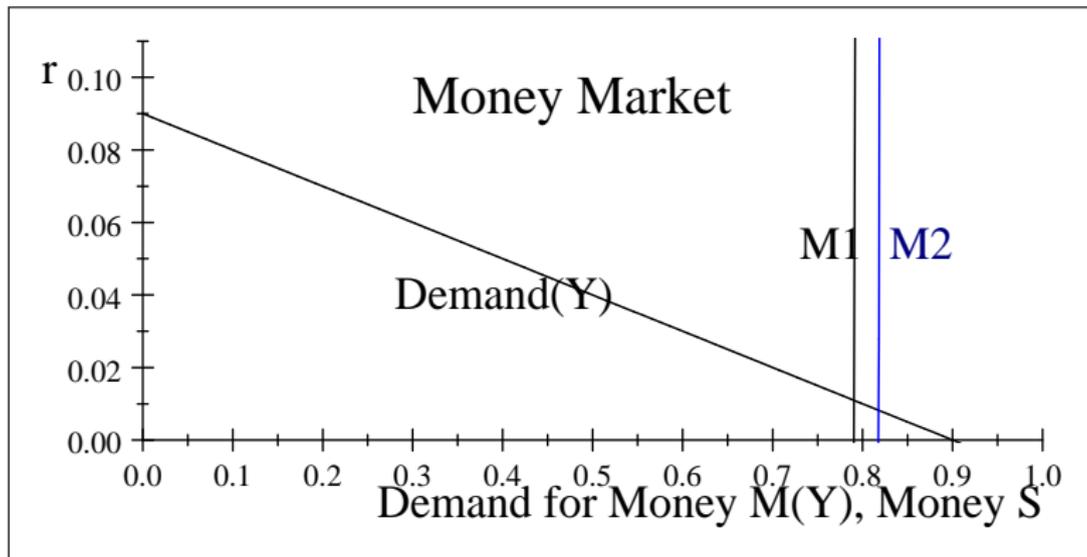


Figure: Downward Sloping Demand for Money and Fixed Supply of Money, with Fixed Supply of Money Shifting to the Right.

Shift in LM Curve from Increase in Govt Money Supply

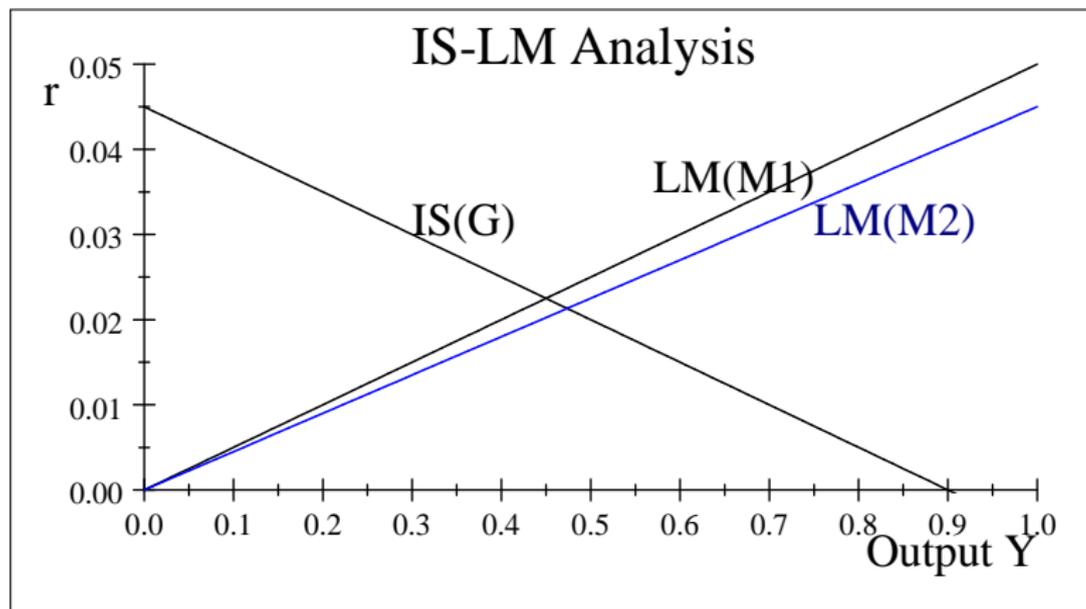


Figure: LM line shifts out when Fixed Money Supply Increases Causing Output Y to Rise.

Shift in Money Supply when "Liquidity Trap": No Interest Rate Effect

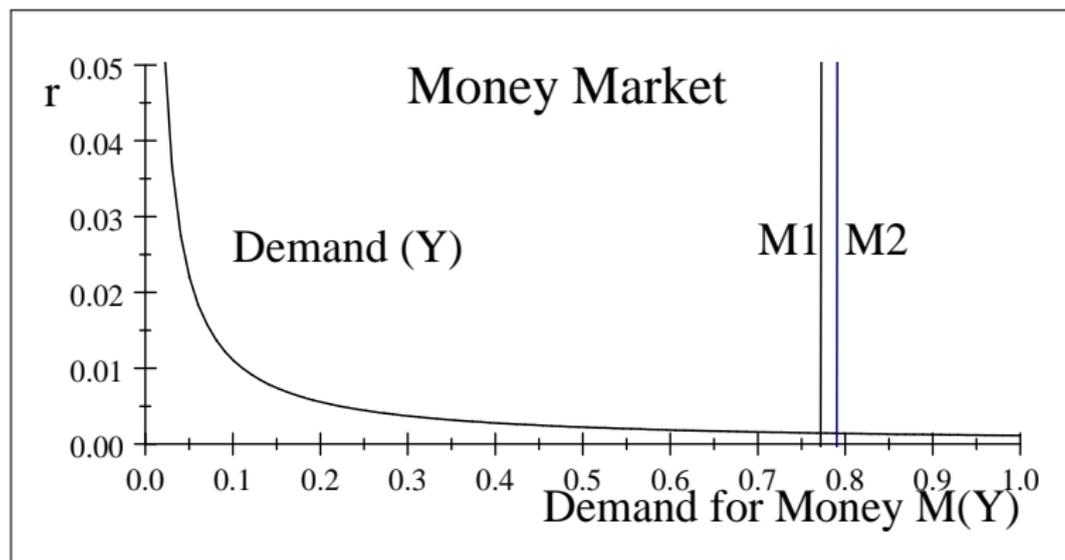


Figure: Liquidity Trap: Downward Sloping Demand for Money is flat at intersection with Fixed Money Supply \bar{M}^1 , so an Increase in Money to \bar{M}^2 Does not Decrease r .

Shift in LM Curve when "Liquidity Trap": No Interest Effect

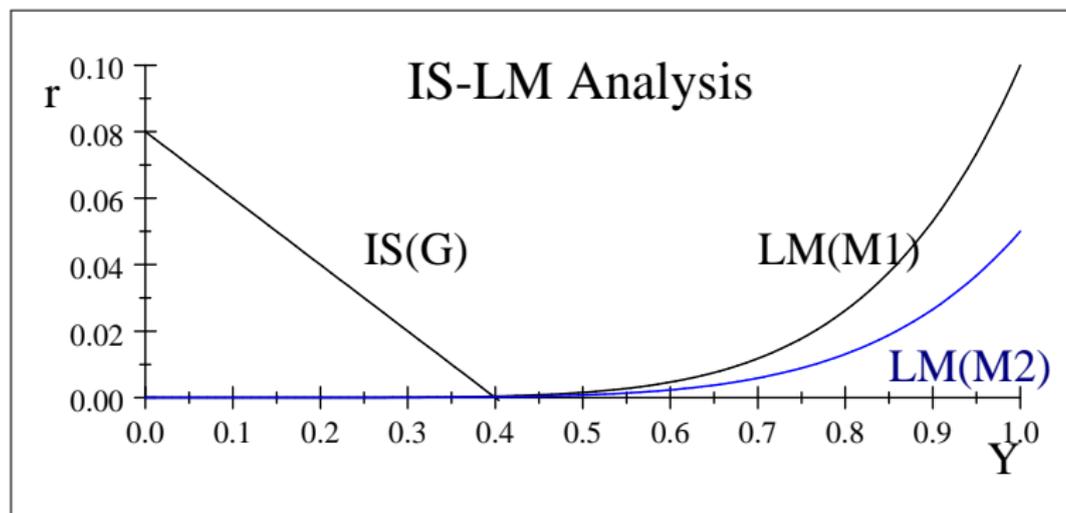


Figure: IS and LM curves intersect at flat Portion of LM. When LM shifts out From Money Supply Increase, Y output does not change.

Liquidity Trap Ever Exist?

- Keynes (1936) writes: no Liquidity trap in Great Depression,
- an probably never existed.
- Although he emphasizes the idea.
- It lives on in IS-LM analysis.
- Today being called "*zero lower bound*" of interest rates.
- In times of a "zero interest rate",
 - IS-LM advice is only government spending can raise output.
 - Monetary policy will not work.
 - Reforming private bank sector not mentioned.

Fisher's Neoclassical Model of Savings & Investment

- Fisher's (1907) *The Rate of Interest*, 1930 *The Theory of Interest*,
 - first now-standard diagram of economy with capital accumulation.
 - Fisher focuses on "intertemporal" choice with just two periods,
 - the current period and next period.
- Rep. agent maximizes *utility of consumption in current & next period*
 - with production turning current period output into next period output.
 - Equilibrium at tangency of indifference curve & production poss. curve,
 - giving equilibrium amount of consumption in each of two periods.
- Production possibilities curve (PPC) (blue): decrease in C_0
 - enables more *future period consumption* C_1 .
- Indifference curve (red) shows constant utility level
 - for different combinations of C_0 and C_1 .
- Turn PPC around, is *production function for C_1 consumption*.
 - Vertical dashed line shows income level in period 0: of 100.
- Difference between income & savings is C_0 consumption.
 - which also equals firm's investment.

Current and Future Consumption Smoothing

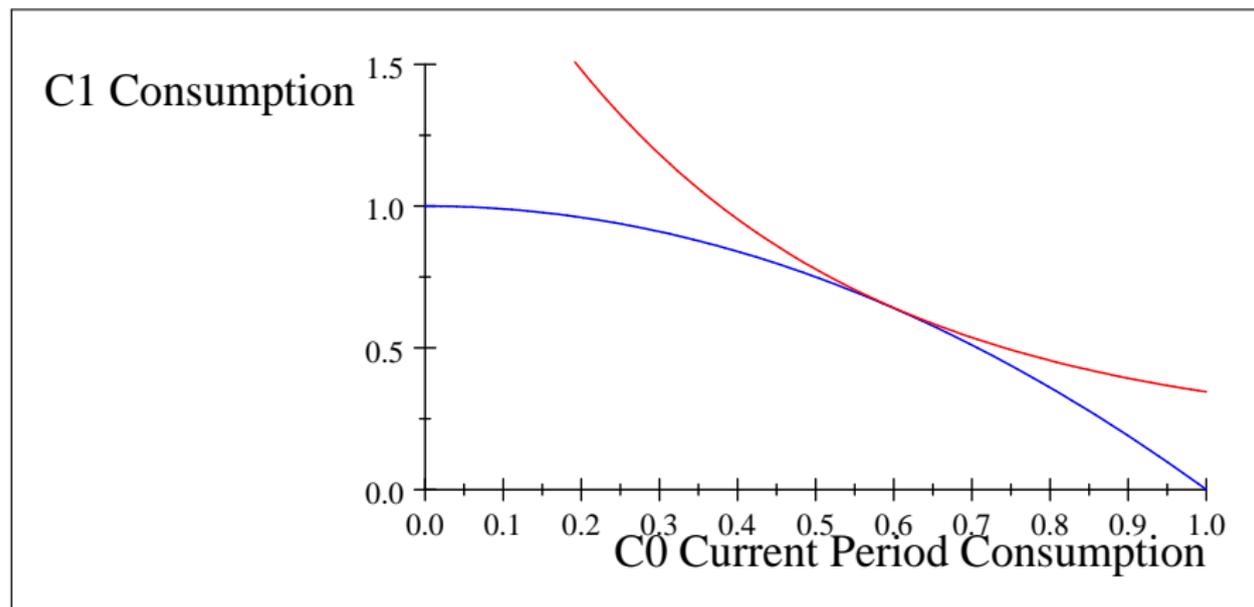


Figure: Production Possibility Curve Between Current and Next Period Consumption (Blue) and Equilibrium Utility Level Indifference Curve (Red).

"Turning Around" Production Possibility Curve

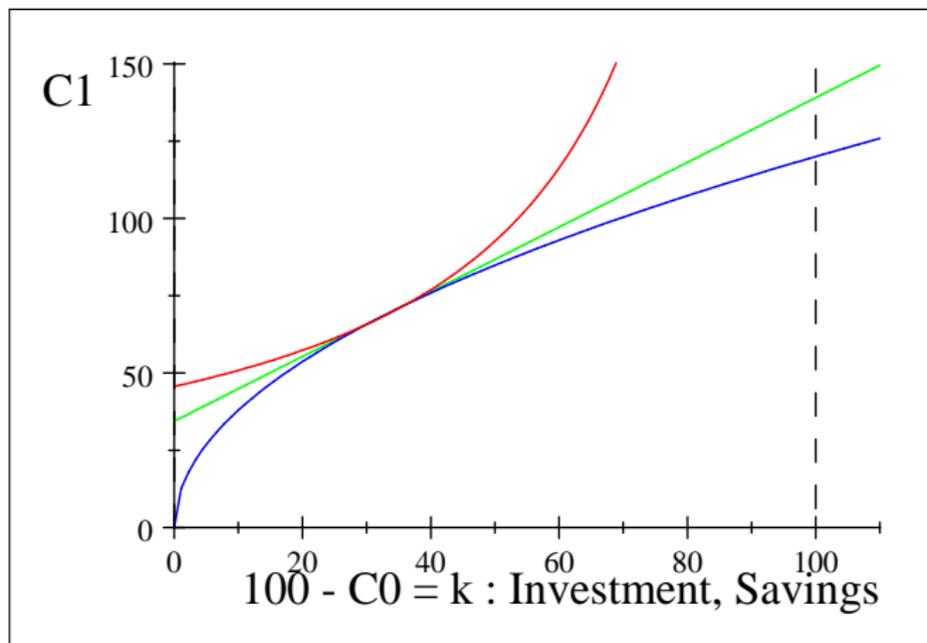


Figure: Production Function for Next Period Consumption (Blue), Equilibrium Utility Indifference Curve (Red), and Budget Line (Green).

Supply and Demand for Capital

- Fisher 2-period diagram implies supply & demand for capital.
- Supply & demand curves together give "market" in capital.
- Relative price of saving one dollar is 1 plus interest received
 - at end of period.
 - You get back $1+r$ for 1 dollar saved.
- So relative to value of dollar today, which is 1,
- relative price of capital is opportunity cost of consumption today,
- which is $(1+r)$, divided by price of dollar today of 1.
- $(1+r)/1$ is relative price of consumption today vs. consumption next period.

2-period Market for Capital

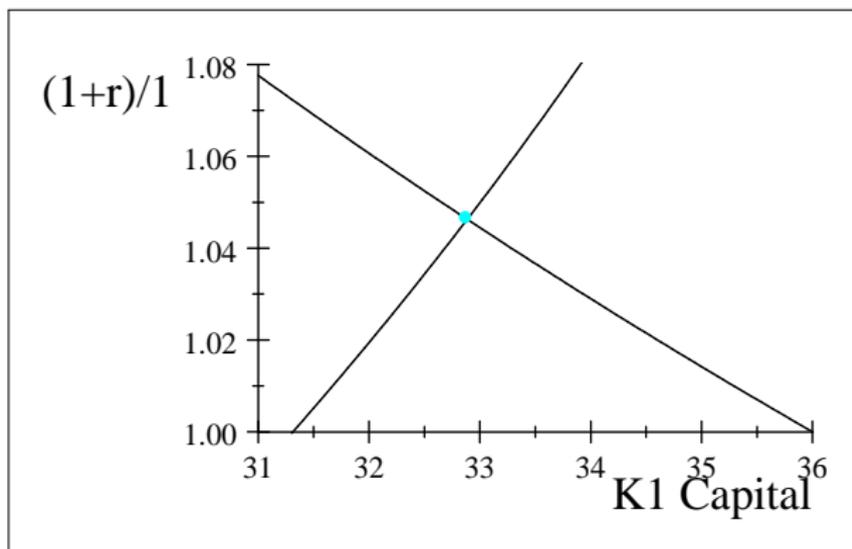


Figure: Savings and Investment: Aggregate Supply and Demand for Capital k in Example Economy.

Relative price of capital

- Relative price of capital can be price of future consumption relative to today,
- which is $(1+r) / 1$.
- Or can be price of current consumption relative to future consumption,
- which is $1 / (1+r)$.
- Can write down supply & demand for future consumption
- that is implied from savings & investment decisions today.
- Opportunity Cost of one dollar of future consumption
- in economic terms is $1/(1+r)$.
- Supply & demand for future consumption C_1 graphed with $1/(1+r)$.

Market for Future Consumption

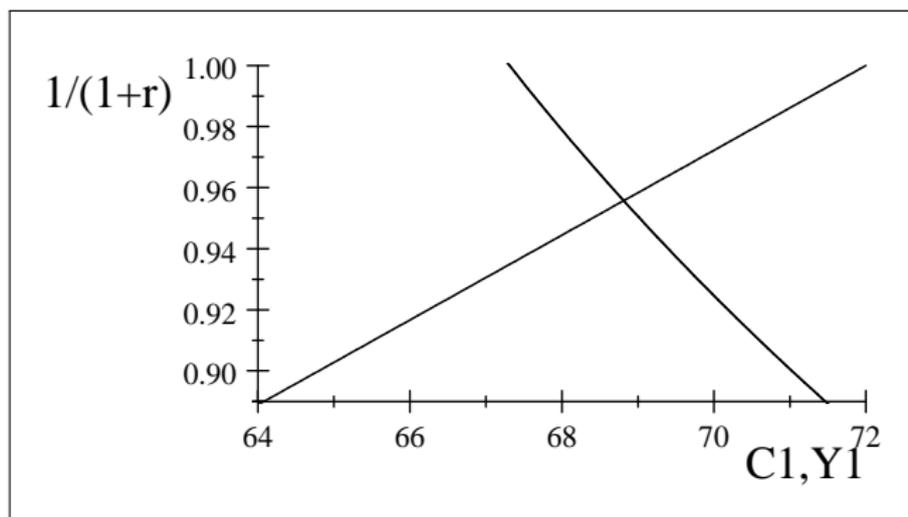


Figure: Market for Future Period Consumption.

Two Period Capital Model

- Two-period model, consumer cannot save & firm invest again,
- since no third period, only two with C_0 and C_1 consumption.
- Implies: Period 1 consumption, C_1 , equals period 1 output Y_1 .
- With infinite future horizon, not just two periods,
- consumer keeps saving & firm invests, every period.
- Capital market derived explicitly unlike Keynes 1936 graph.
- This is a Special Case we can derive
- using similar comparative static exercises.

Comparative Static Increase in Productivity of Capital

- Productivity increases, as in (RBC) upswing of business cycle
 - & over time with steady growth in output:
 - demand & supply curves for both capital
 - & next period consumption are affected.
- Here productivity increase means again the parameter
 - factoring production function (A) increases,
 - while we holding labor constant, & letting capital k vary.
- Result is demand for capital shifts out
- & supply of capital curve shifts back.
- With No Change in Investment, Savings k ,
- but higher interest rate r .

Productivity Shifts out Demand, Shift Back Supply

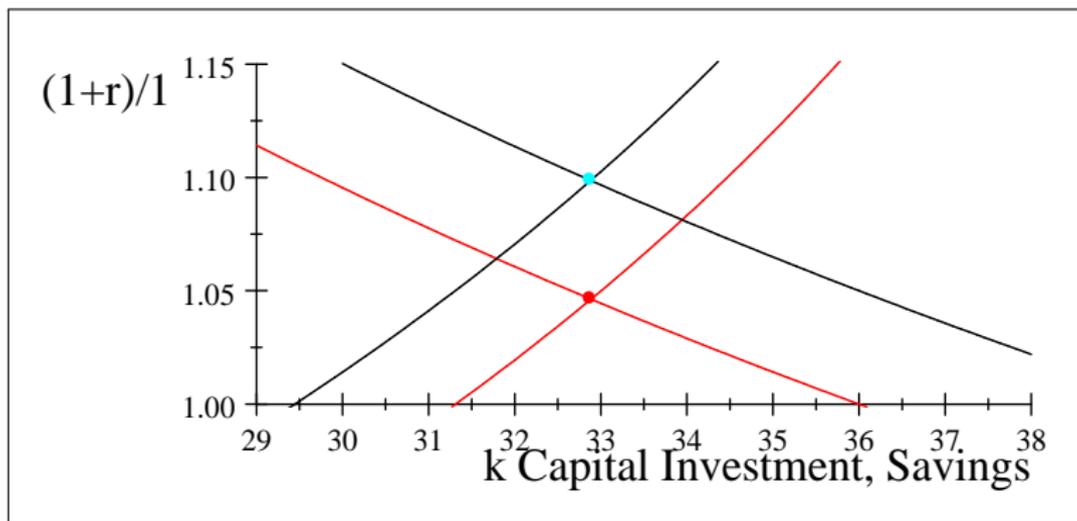


Figure: Shift Back in Supply and Upwards in Demand for Capital (Black), from a Productivity Increase Relative to Baseline (Red): Capital Investment (and Savings) Unchanged, but Interest Rate Higher.

Result of Productivity Increase: No Rise in Capital

- Relative price rises as interest rate goes up.
- Is Typical of business cycle expansion.
 - Real interest rate rises in expansion & falls in contractions,
 - as productivity rises & falls.
- But capital investment remains unchanged:
- inconsistent with business cycle expansion.
- Capital Investment Rises strongly.
- One Comparative Static Change only does not explain both
- higher investment in expansion, & higher interest rate.

Comparative Static 2: Increase in Current Period Income Endowment

- Increase in capital productivity leaves equilibrium S_{av} , Invest same.
- Current income also rises in business expansion
 - as more labor hired.
 - Labor abstracted from in 2-period savings-investment analysis.
- So now look at effect of increase in current Income.
- This shifts out supply in capital, but not demand.
- Causes interest rate to fall &
- equilibrium quantity of capital saved & demanded to rise.
- Results from movement down Demand Curve when Supply Shifts out.
- A bit of problem in that During business cycle expansion
- interest rate usually rises, rather than falls.

Supply of Capital Shifts Out Only, Interest Rate Falls

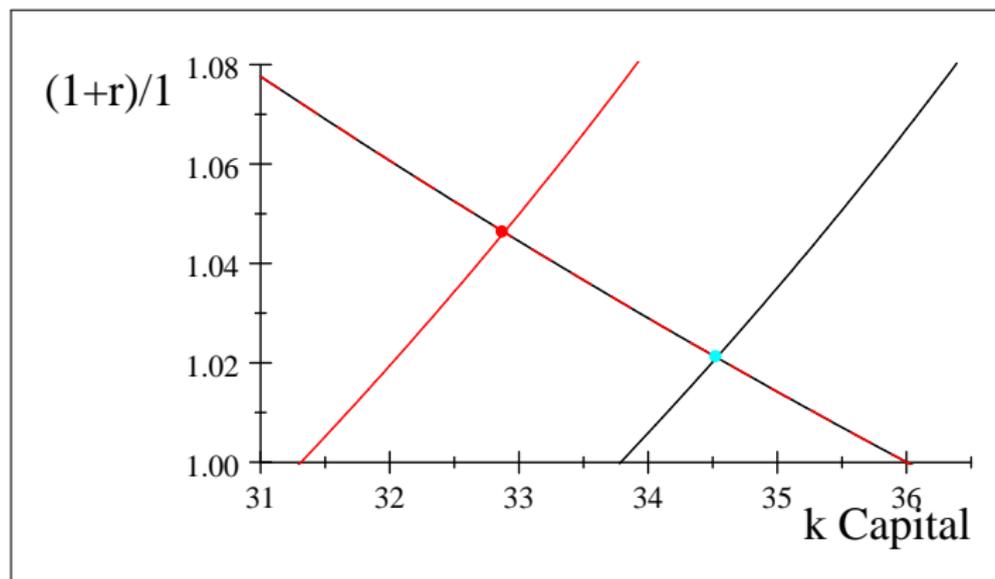


Figure: An Increase in Current Income Endowment Shifts out the Supply of Capital (Black Curve) and Lowers the Real Interest Rate.

Great Depression: Fisher 2-period vs Keynes's IS-LM

- Comparative Static of reducing only current income
 - does resemble Keynes' (1936) version
 - of capital market when income goes down.
 - In both, Fisher 2-period & IS-LM: Interest rate goes up,
 - as savings shifts back by more than does Investment demand.
- Low current income could help explain rising real interest r_t ,
 - in Great Depression, so Fisher, Keynes analysis could agree.
- Can also add Fisher Productivity Decrease,
 - and get even Less Equilibrium Investment & Savings,
 - but this Comparative Static causes lower real interest rate.
- So combination of Fisher Productivity decrease
 - & Current income decrease would need larger percent
 - decrease in current income than in Productivity to get
 - Equilibrium Interest rate to rise as in Great Depression.
 - When was a positive 10%.

Business Cycle Explanation Using the Two-Period Model

- Typical business cycle: both interest rates &
 - equilibrium quantity of capital savings & investment rise.
- Achieve: Combine increase in productivity & in current income.
- Here: *equi-proportional increase in both productivity & current income*
 - up by 5% each
 - supply & demand for capital shift OUT
 - from combined effect of both comparative static changes.
- Demand shifts out by more than supply,
 - so interest rate & investment rise,
 - reproducing basic features of business cycle expansion.
- Contraction: Reverse of lower productivity & current income
 - by an equal percent reduction.
 - Demand shifts back by more than supply shifts back.
 - Interest rate & equilibrium capital supplied & demanded falls.

Expansion

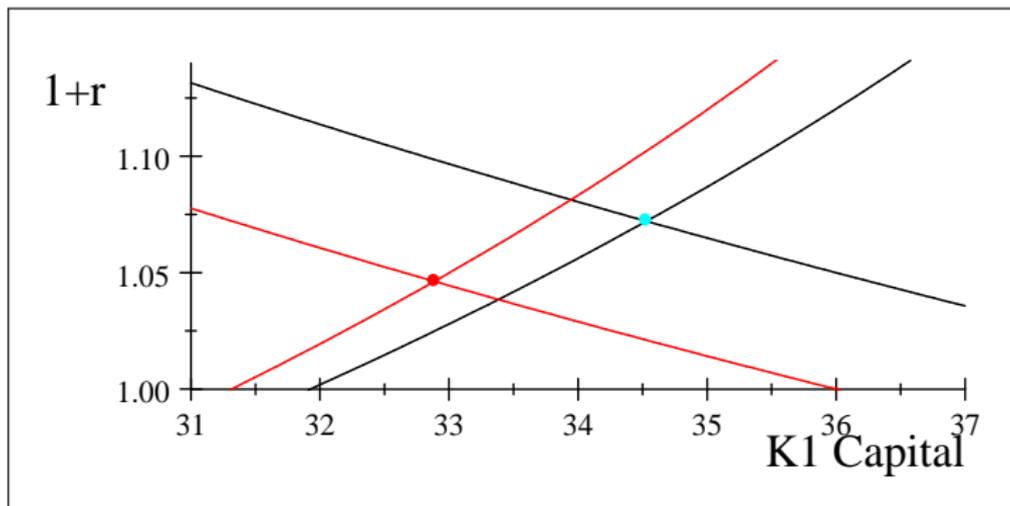


Figure: Capital Market with 5% Increase in Goods Productivity and Income Endowment (Black) versus Baseline (Red).

Contraction

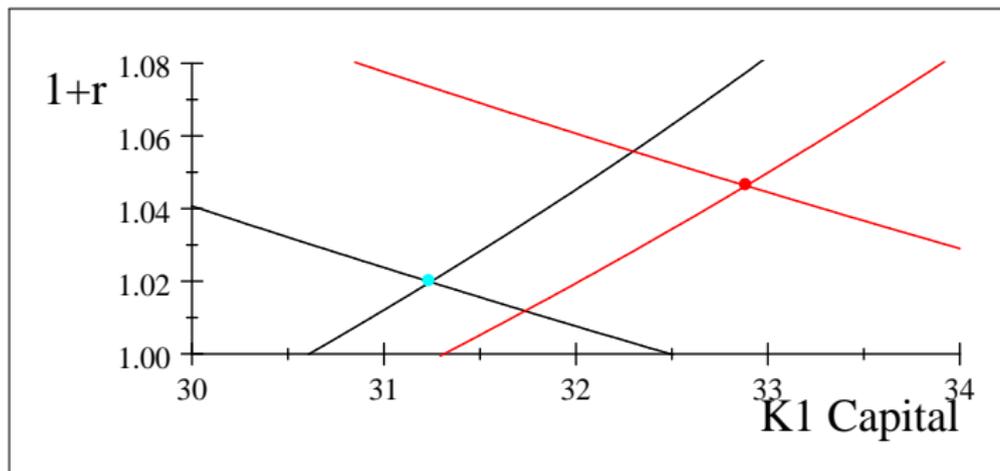


Figure: Capital Market with 5% Decrease in Goods Productivity and Income Endowment (Black) in versus the Baseline (Red).

Fixed Interest Rates and Excess Supply of Capital

- Recession with interest rate fixed: no adjustment downwards.
- Normal recession becomes severe recession;
- equilibrium amount of capital demanded is much lower.
- So there is much less investment.
- Fixed interest rate captures Keynes' idea of how an *excess supply of capital* might result. Here, at the fixed, above natural market rate of interest (which would have fallen if it was not fixed), there is an excess supply of capital. This type of excess supply always occurs when a price is fixed above its equilibrium level, as discussed in Chapter 1.2.6.

Graph with Excess Supply of Capital

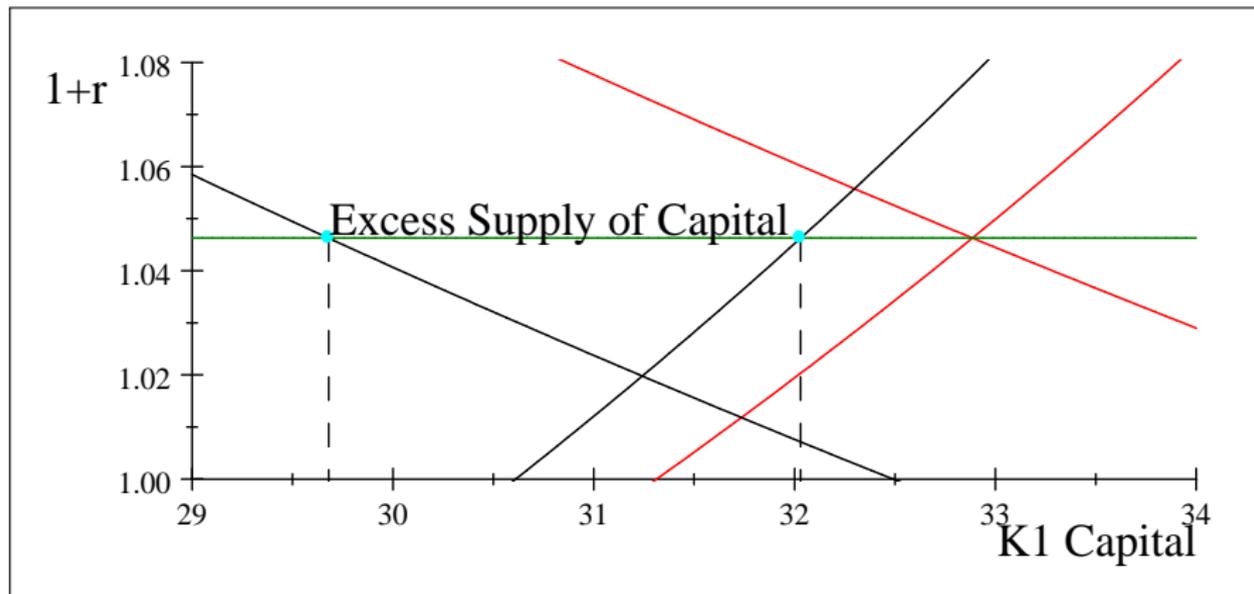


Figure: Excess Capital Supply Indicated by Horizontal Distance between Vertical Dotted Lines.

Alternative Theory with Banking

- Fixed interest rate theory: real interest rate cannot be held fixed,
- even if nominal interest fixed by government (Fed).
- If Low investment during crisis from *collapse in private bank sector*.
- Fix problem in banking sector, & revive private savings & investment.
- Focus on banking seen in Great Recession & 2008-2010.
- Real interest rate matters for capital markets, not Nominal Rate.

- Fisher (1896) definition and clarification (p. 19):

“The ordinary definition of the “present value” of a given sum due at a future date is “that sum which put at interest today will ‘amount’ to the given sum at that future date”...The literal meaning of “present value” implies that it is the actual market price today of a future sum due.” (“ quotes in original).

Basic example

- Next period value of 1 dollar is $1+r$ dollars in the next period
 - if r is real interest rate.
- Future value of one dollar held today, is $1+r$.
 - The $1+r$ exactly is "economic" future value of 1 dollar today.
- Present discounted value: if will have $1+r$ dollars next period,
 - need 1 dollar to generate $1+r$ dollars next period.
 - So value of $1+r$ dollars next period is 1 dollar today.
- $1+r$ dollars tomorrow is worth 1 dollar today,
 - "*present discounted value*" of $1+r$ dollars held next period
 - is 1 dollar today.
 - Implies method of discounting using interest in discounting process.
- To have 1 dollar tomorrow, need $1/(1+r)$ today, or $\frac{1}{1+r}$;
 - Invest this & get $1/(1+r)$ back tomorrow plus interest of $r/(1+r)$,
 - or $(1+r)/(1+r) = 1$.

Example with 5% Interest Rate

- 100 dollars next period is worth $\frac{1}{1+r}(100)$.
- Assume interest rate of 5%.
- Present discounted value of 100 dollars next period,
 - when $r = 0.05$, is $\frac{100}{1+0.05} = \frac{100}{1.05} = 95.24$.
- Reason 100 dollars next period is worth less today (95)
- is we save & invest 95 dollars today & earn interest
- so we get back 100 dollars tomorrow.
- *Computing present value* by dividing next period income by $1 + r$.
- Next period future value of current income found by multiplying current income by $1 + r$.

Two Future Periods

- Using present discounted value enables calculation
- of value of ongoing, or "infinite" stream of future dividends,
- as well as calculation of just one period forward of dividends.
- If income, say d , received & invested for two periods,
 - after one period, income $= d(1+r)$;
 - that income $d(1+r)$ would again be invested at rate r , for another period.
 - Interest would be earned on $d(1+r)$, equal to $rd(1+r)$
 - plus principal $d(1+r)$ would be returned at end of 2nd period.
 - $d(1+r) + rd(1+r) = d(1+r)(1+r)$, or $d(1+r)^2$.
- Interest "*compounded*": interest earned in 2nd period
 - on interest earned from first period.
- If income d received two periods in future,
 - present discounted value (PDV) is $\frac{d}{(1+r)(1+r)}$, or $\frac{d}{(1+r)^2}$.
 - True: eg. if $\frac{d}{(1+r)^2}$ invested now & earned interest for 2 periods,
 - future value of $\frac{d}{(1+r)^2}$ would be $\frac{d}{(1+r)^2} (1+r)(1+r) = d$.

PDV (Present Discounted Value) of Infinite Divide Stream

- Doing same type of calculation for every future period of income,
- Value of constant stream of dividend dollar payments d computed.
- Assumptions 1) dividend starts being paid in next period,
- 2) dividend is constant & 3) interest rate is constant;
- formula for PDV of *infinite dividend stream*:

$$\frac{d}{1+r} + \frac{d}{(1+r)^2} + \frac{d}{(1+r)^3} + \dots = \frac{d}{r}.$$

- Say price p for stock with $p = d/r$.
- Company's price-earnings ratio from formula $p = d/r$
 - (Hint: $(p/d) = 1/r$) : & $d = e$, where e is "earnings" or "dividends".
 - $p/e=1/r$. So if P/E is 20, implies
 - "internal" discount rate of 0.05, or 5%.
- Riskier companies may have higher "internal" discount rates, lower P/E.

Questions

- 1 Describe what is usury, Islamic banking, and explain how did the recognition of the role of interest change market economy's ability to create wealth.
- 2 What is the relation between wealth and income levels that is found internationally, how does this relate to life satisfaction, and how can a flow of income be generated by a certain stock of wealth?
- 3 Explain how Keynes (1936) used a capital market to lay the foundation for the construction of an IS curve, and indicate the assumptions required to make the IS curve slope downwards.
- 4 How is the LM curve constructed from the money market?; and what assumptions are necessary to ensure that the LM curve is upward sloping?
- 5 What is the IS-LM analysis used for in terms of ways to increase aggregate output?
- 6 How does a critique of the IS-LM analysis involve the role of inflation?

Rest of Questions: part 2

- 1 How does the Fisher two-period analysis use optimization theory to determine the equilibrium quantity of the savings and investment of capital?
- 2 The Fisher two-period analysis uses a production function to transform invested capital into output next period; what choices by the consumer and firm are involved in this production process, and how does the production determine the consumption in the second period?
- 3 Describe the market for capital in Fisher's two-period model.
- 4 Describe the market for future period consumption in Fisher's two-period model.
- 5 What happens in the markets for capital and future period output when the productivity of capital is exogenously increased?
- 6 What happens in the markets for capital and future period output when the current income endowment is exogenously increased?

Rest of Questions part 3

- 1 What happens in the markets for capital and future period output when both the productivity of capital and the current income endowment are exogenously increased by the same percent, and in what sense is this consistent with a business cycle expansion?
- 2 How can an excess supply of capital result when the interest rate is fixed?
- 3 How can an explanation based in the banking sector explain a depression in aggregate activity?
- 4 What is the future value of 100 dollars received two periods from today, when the full capital is saved and it earns an interest rate of 10 percent each of the two periods?