THE FOUR R-STARS: FROM INTEREST RATES TO INFLATION, AND BACK

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Where are interest rate going?

Important question to answer, even if very hard:

- for monetary policy in 2025: when will central bank stop easing?
- for fiscal policy: will $r < g$ keep sustaining high public debt?
- for macroeconomists: has the savings-investment balance changed?
- for intertemporal tradeoffs in economics: how is future being discounted?

Current approach and its difficulties

(1) Steady-state or long-run value component of realized returns.
Measured with time series models to separate trends from cycles.

(2) Counterfactual interest rate where investment equals savings
Measured using models of capital markets and investment

(3) Benchmark for policy rate, if above (below) it, the inflation will fall (rise)
Measured using expectations and financial conditions, models of inflation

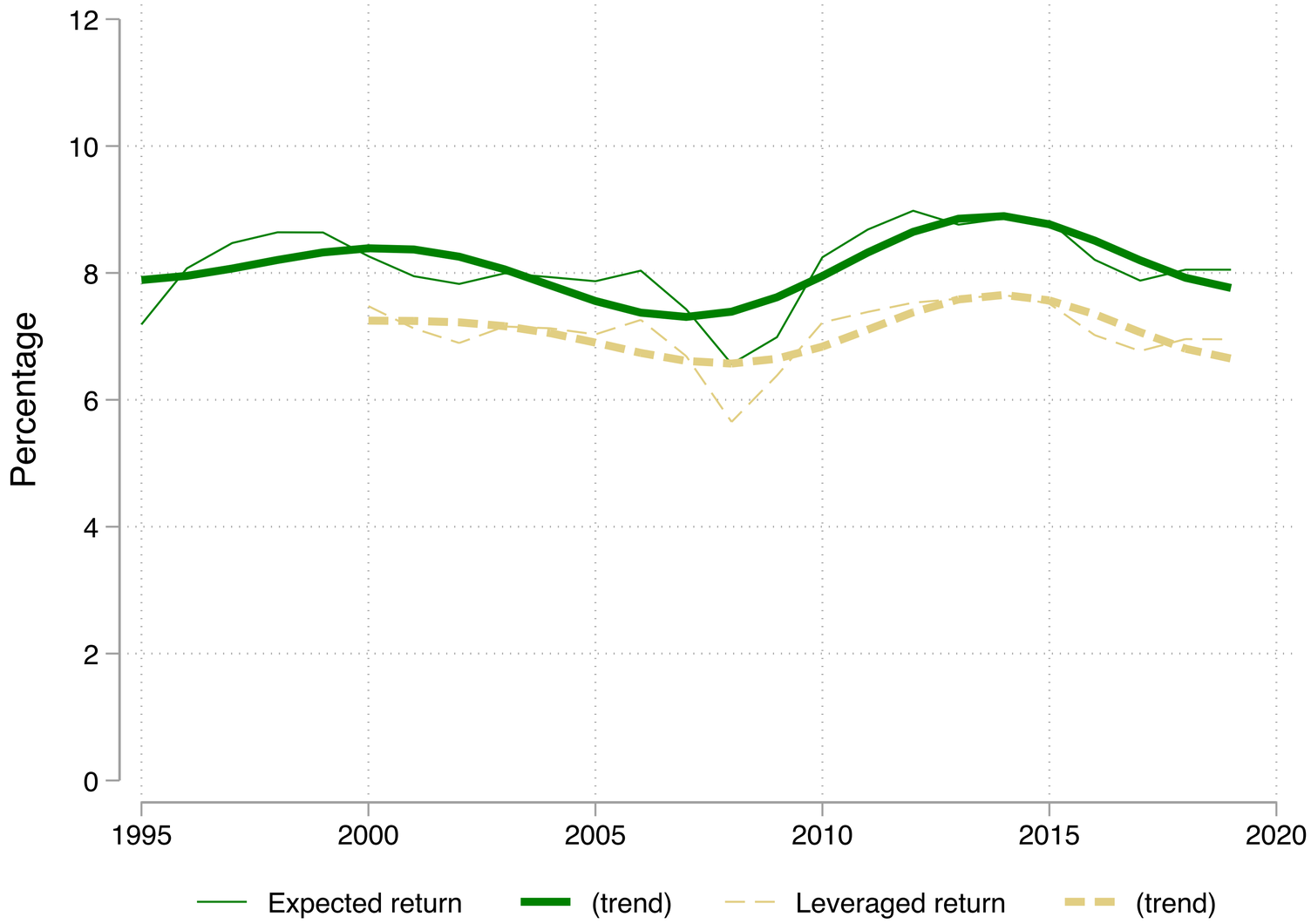
(4) Risk-free rate in $r_i = r^* + premium_i$,
Measures as return on safest, most liquid, short-term asset… policy rate!?

Four approaches because not really the same object, or the same use…

- The econometrician chasing four hares
- While thinking there is only one, and so missing
- **This talk**: Identify four separate R-stars, conceptually show they are different, look at data of the past, guess where they are going

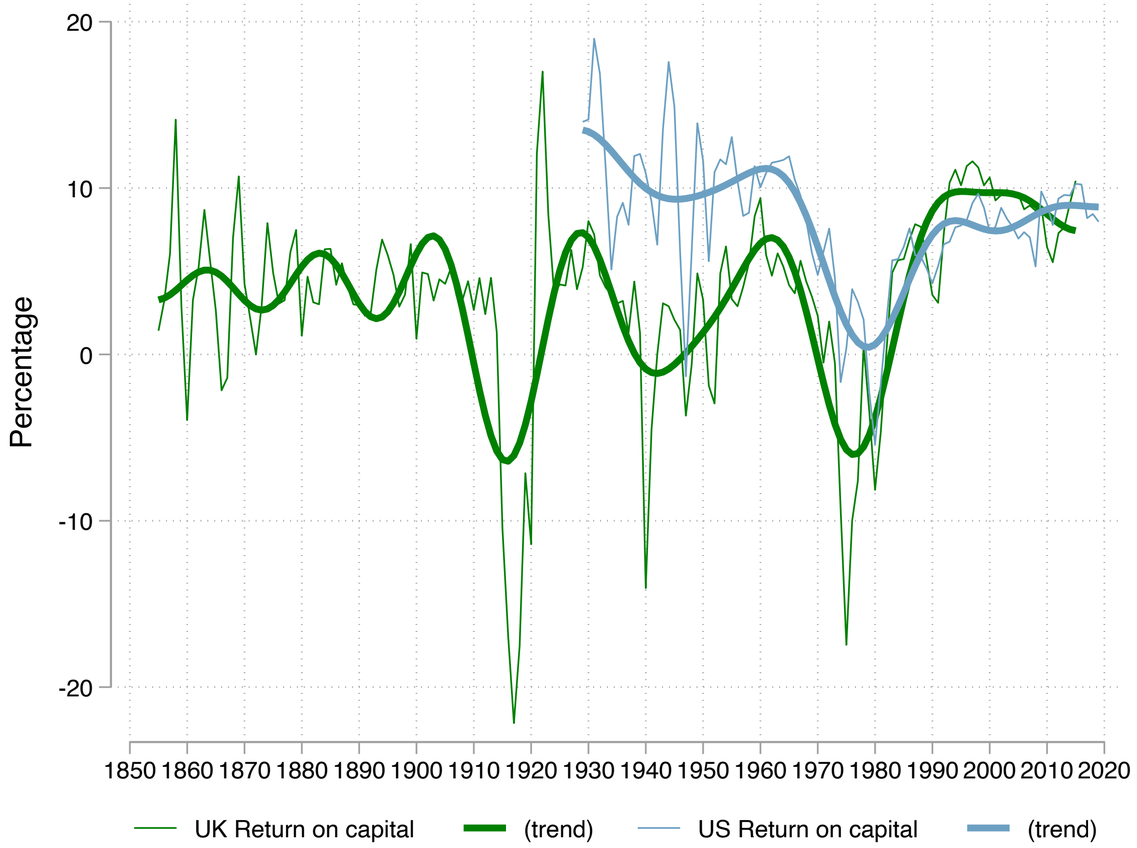
CONCEPTS AND TRENDS FROM 1995-2019

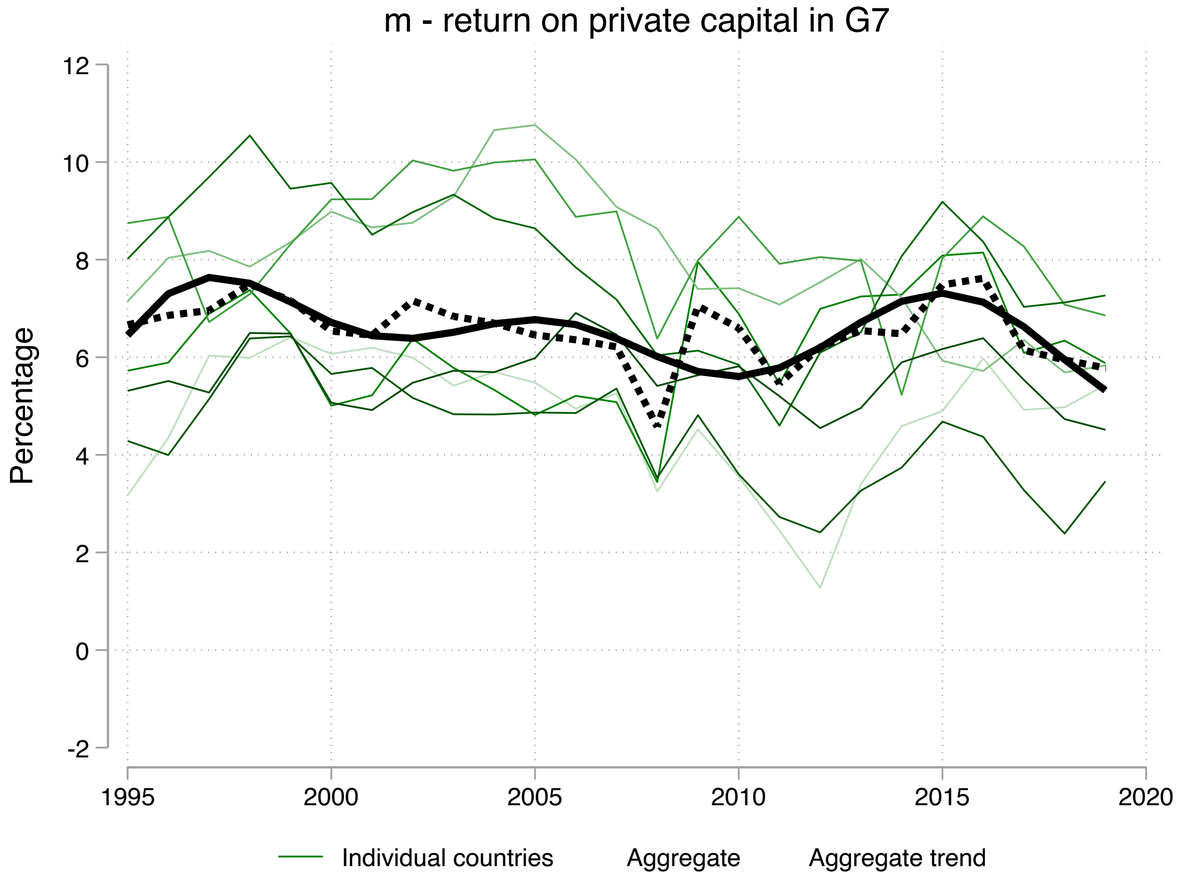
The four r-stars… (1) investment, *m*



- Expected return on productive investment
- Matches models of savings and investment
- Ramsey-Solow

The four r-stars… (1) investment, *m*

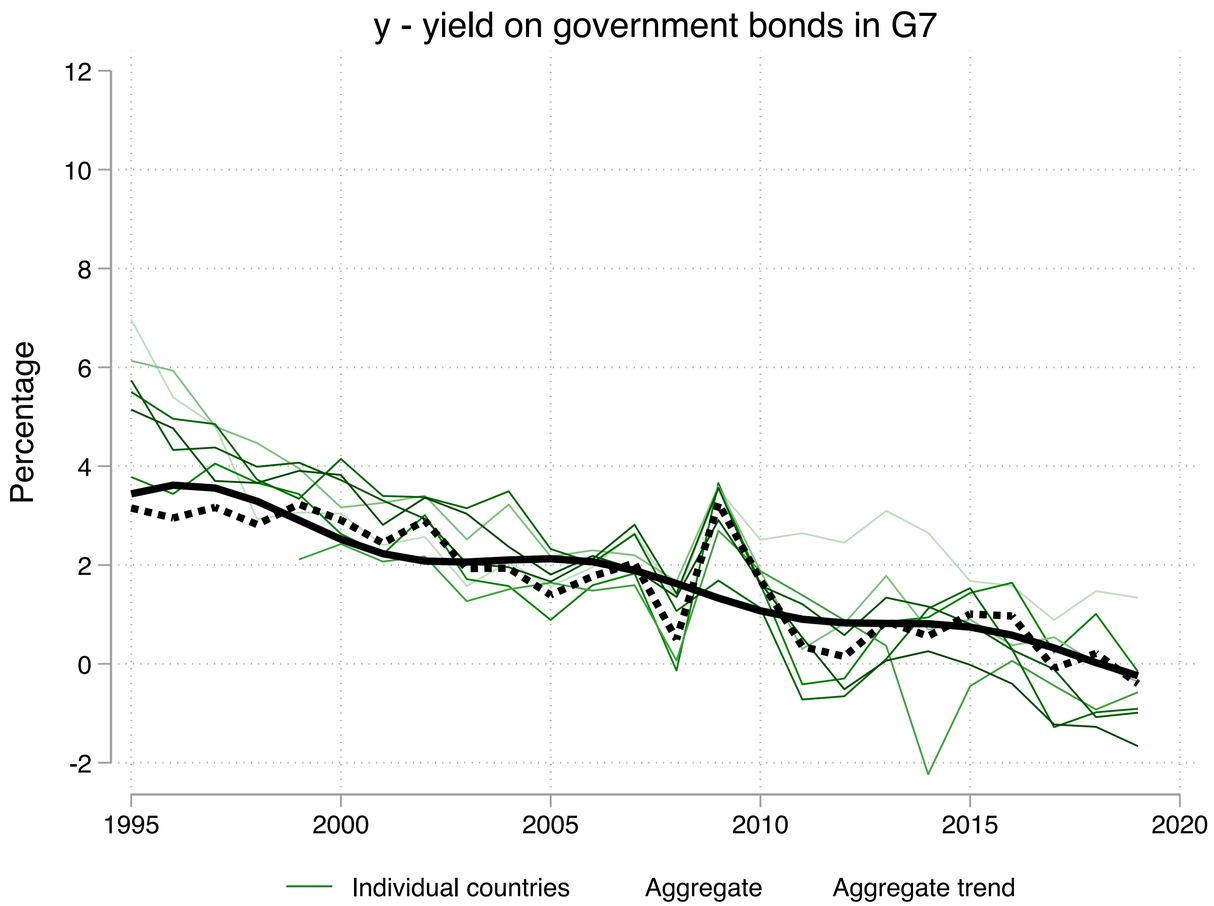


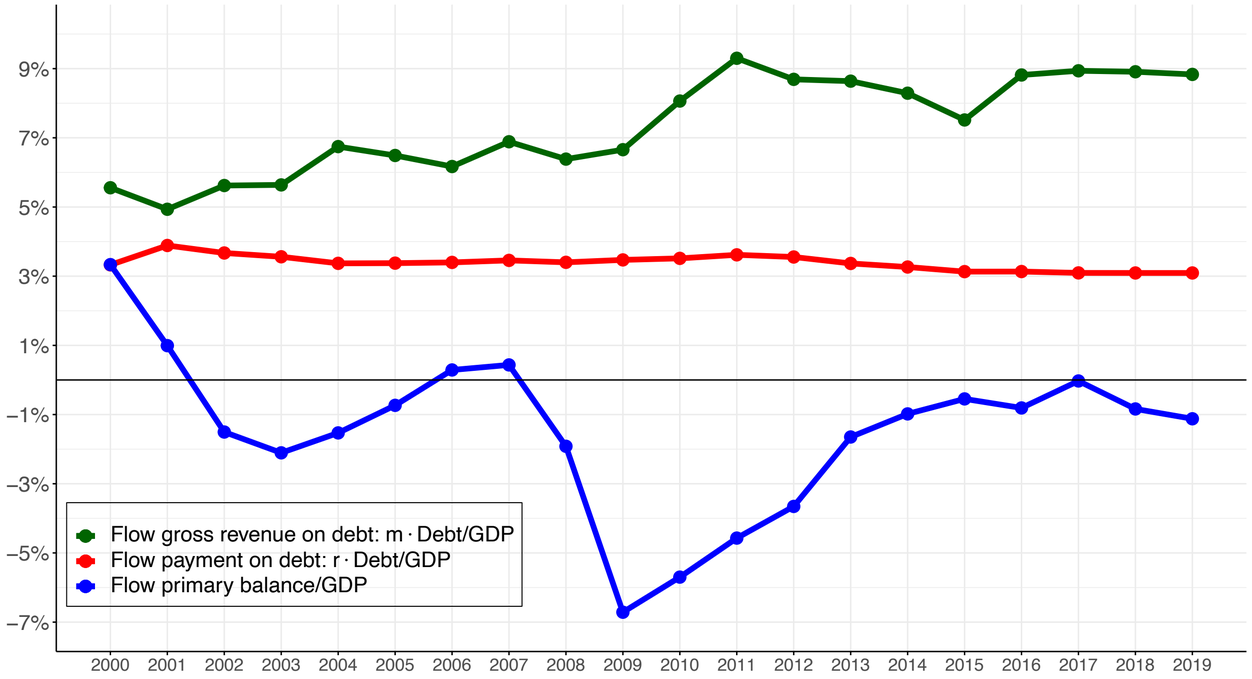


The four r-stars… (2) government bonds, *y*

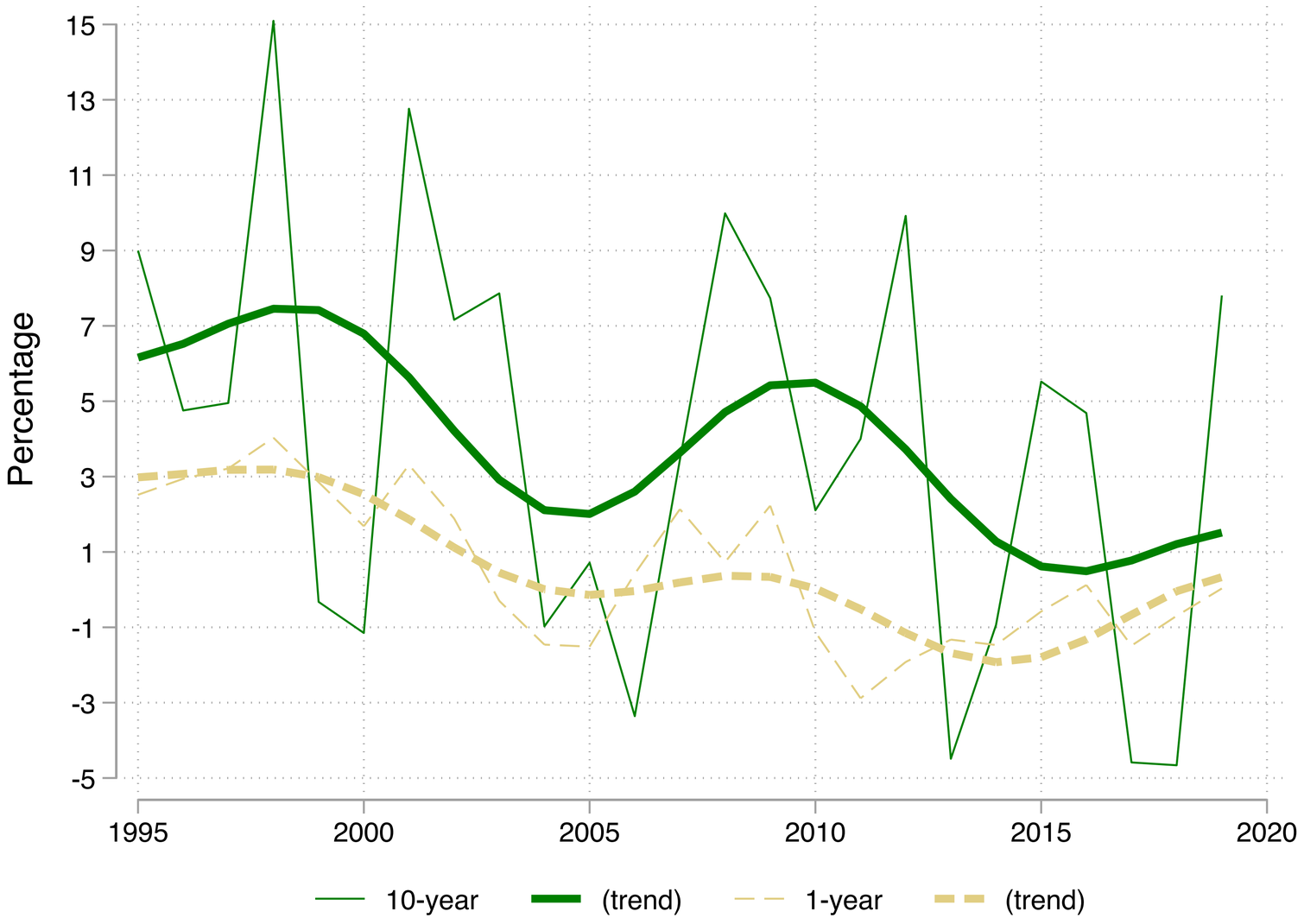
- Real yield on government bonds
- Matches finance models of safe returns
- Diamond's unproductive storage

The four r-stars… (2) government bonds, *y*



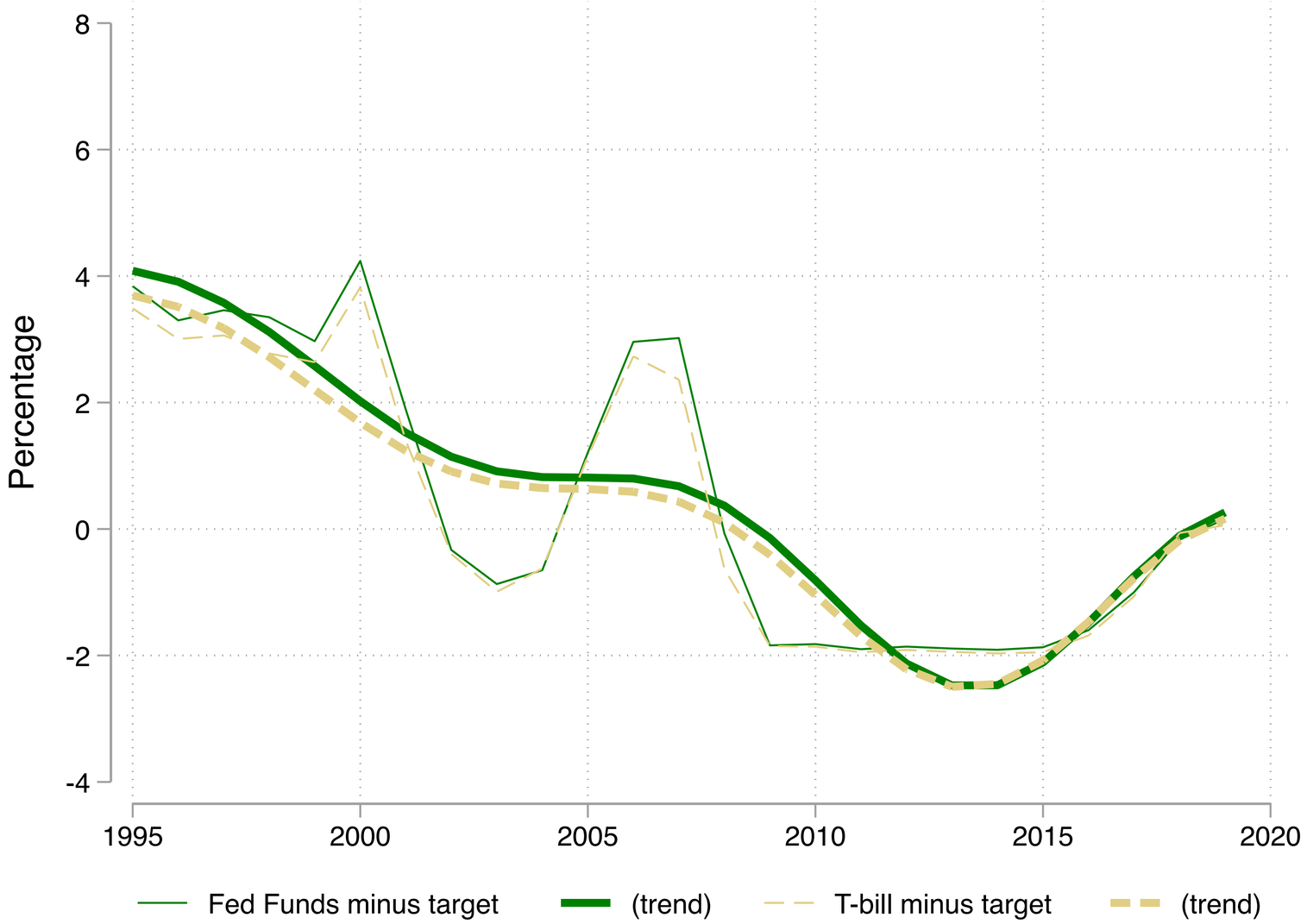


The four r-stars… (3) realized return ρ



- Realized return on government bonds
- Role of unexpected inflation in the business cycle
- Time series

The four r-stars… (4) policy rate, *i*



- Policy rates
- Captures role of monetary policy
- Connection to inflation

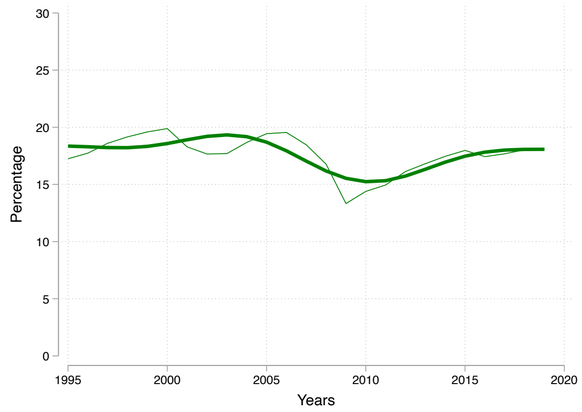
Conclusions for 1995-2019

The four r*

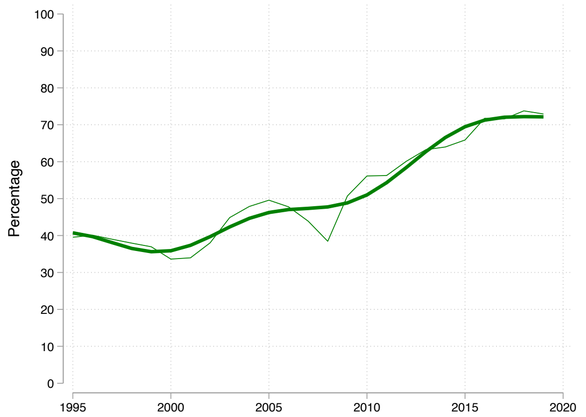
- **m:** Expected return on productive investment was **roughly stable throughout**.
  The r that matches long-run macro models of savings and investment*
- **y:** Real yield on government bonds **declined throughout**
  The r that matches finance models of safe returns*
- ρ: Realized return on government bonds **mirror yields until 2010-15, then up**
  The r that captures time-series role of unexpected inflation in business cycle*
- **i:** Policy rates **fell even faster until 2010-15, but then rose**
  The r that captures role of monetary policy in inflation*

Other indicators

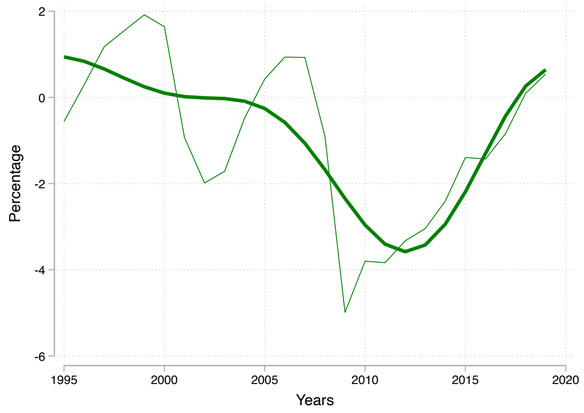
(a) k: investment over output



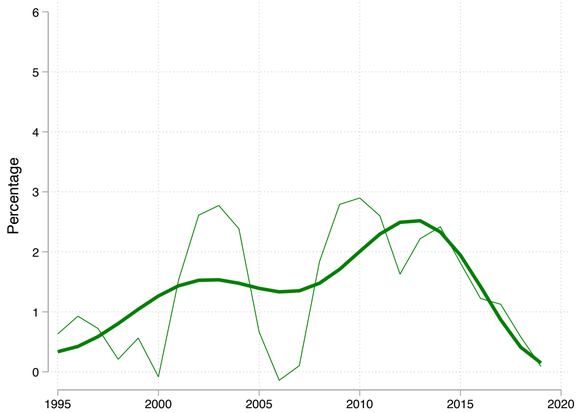
(b) b/k: ratio of unproductive to productive assets



(c) x/x^p: output relative to potential



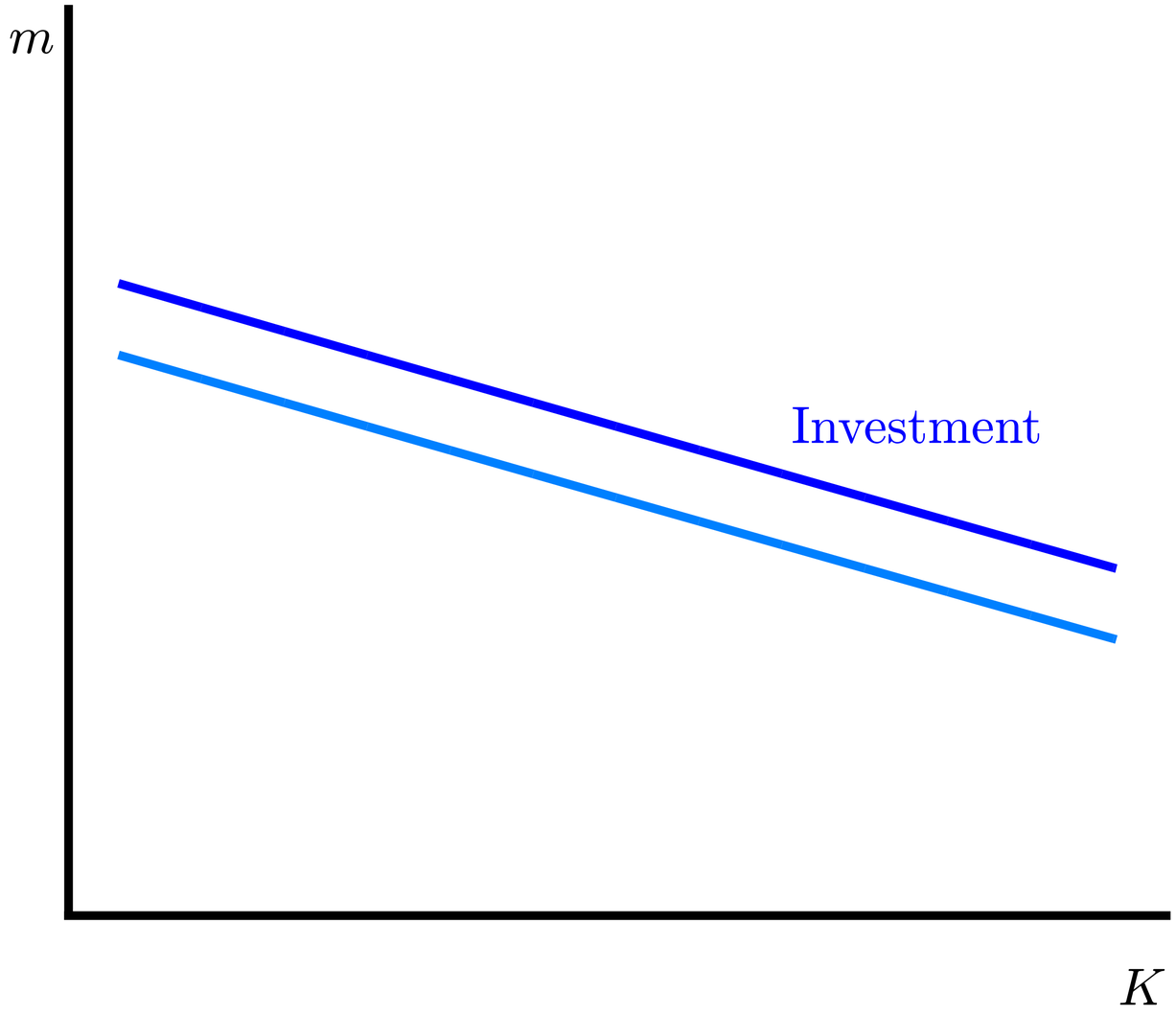
(d) t: term premium



Notes: Panel (a): ratio of private investment to GDP. Panel (b): ratio of government debt plus the capital stock on dwellings to the private capital stock excluding dwellings. Panel (c): GDP relative to potential GDP according to the Congressional Budget Office. Panel (d): Difference between the yield on 10-year and 1-year government securities. Trends calculated using a Mueller-Watson filter with a 10-year window.

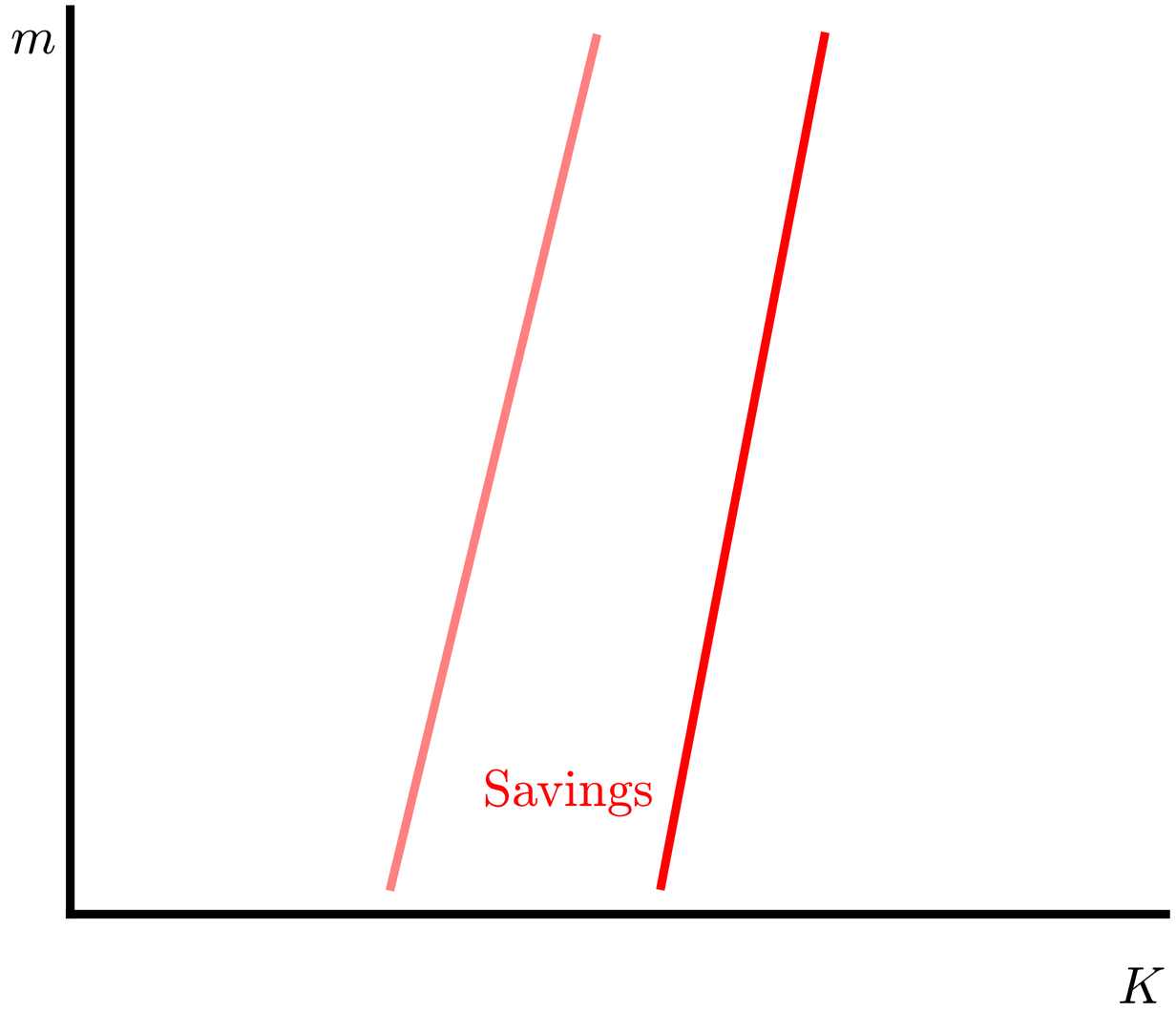
AN EXTENDED I-S FRAMEWORK

1. Productive savings and investment



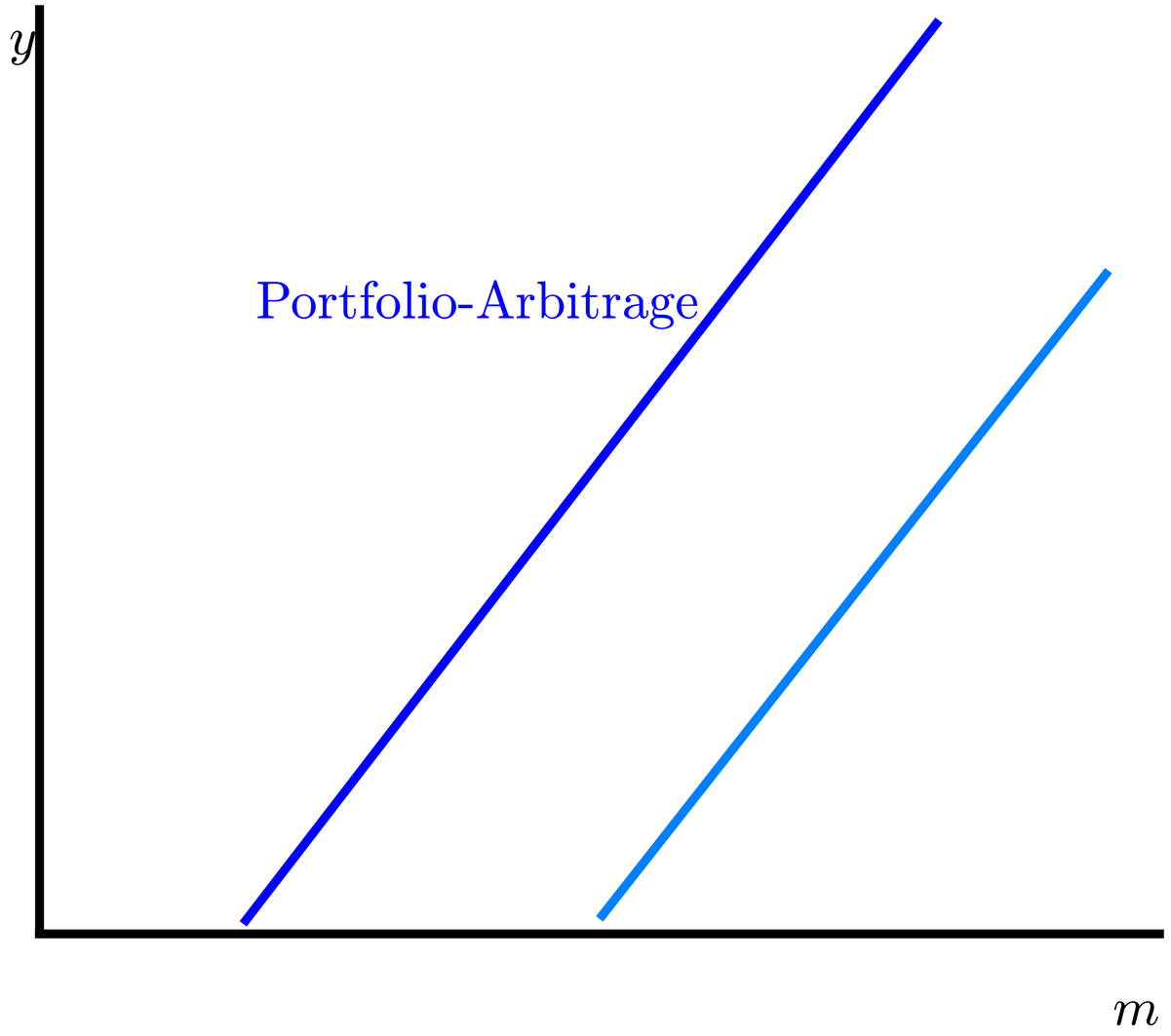
- ***m*** marginal product of capital
- Productive investment is lower the higher is the return it gives, diminishing returns
- Shifts left-down when:
  - TFP or deprecation falls
  - Price of capital goods falls
  - Less competition, more regulation, higher income taxes
  - Public investment falls

1. Productive savings and investment



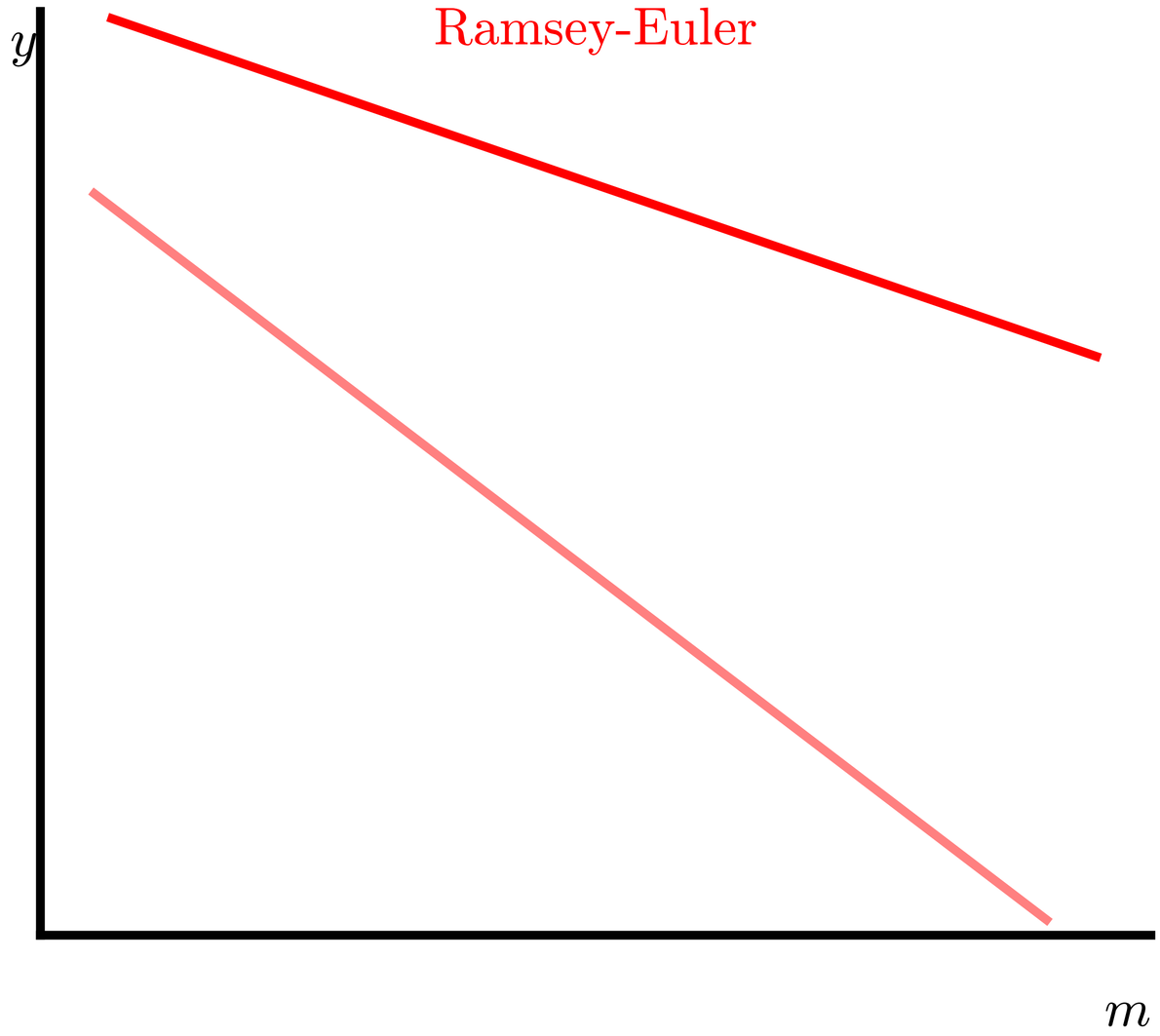
- In Ramsey model, supply of savings it horizontal at the discount rate.
- Upward sloping with incomplete markets.
- Unpack it…

2. Productive versus storage savings



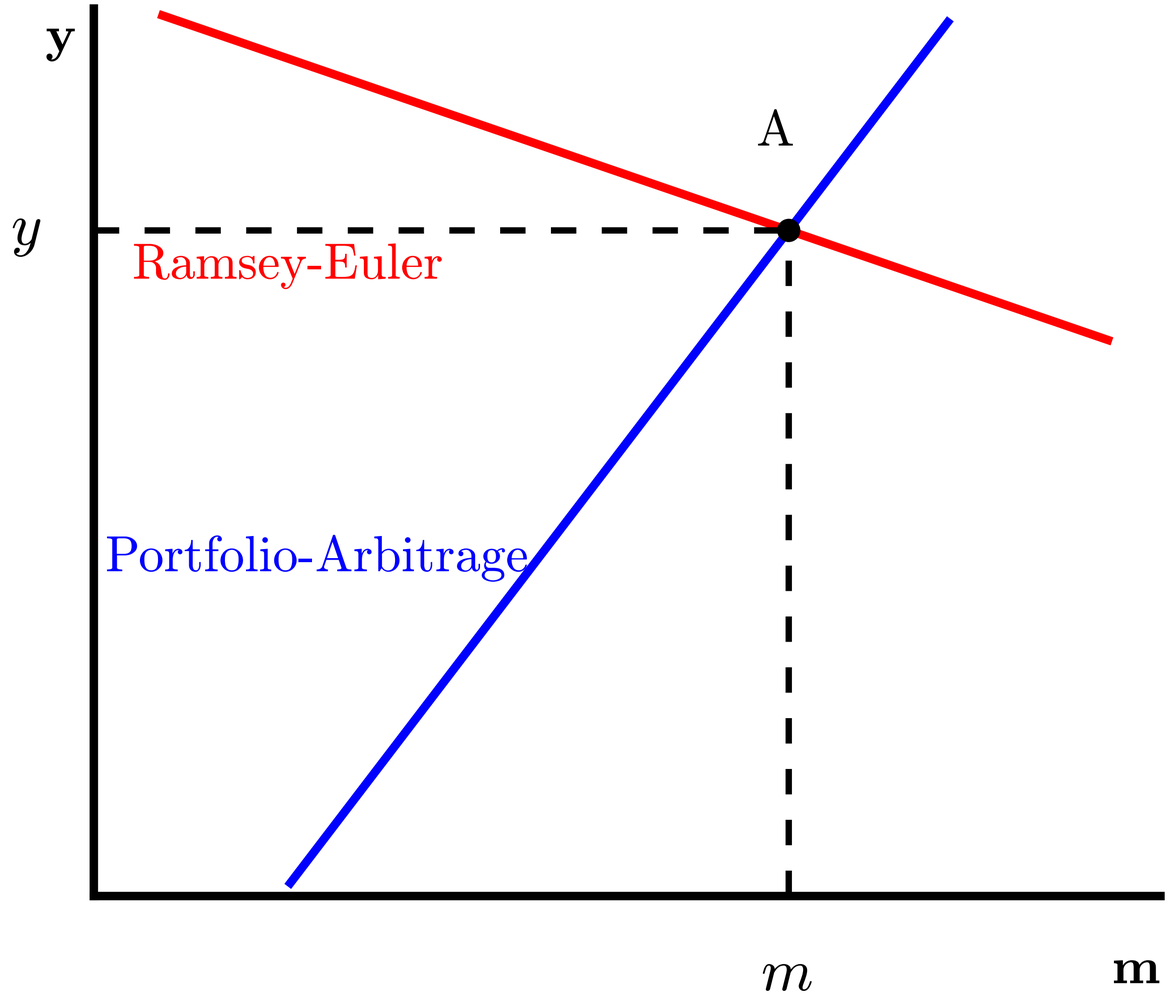
- Productive capital stock vs storage (gov debt + housing + rents)
- Not 45 degree line because differ in their non-return features
- Shifts right-down when:
  - Productive investments are perceived as riskier or less liquid
  - Financial frictions preventing productive investment

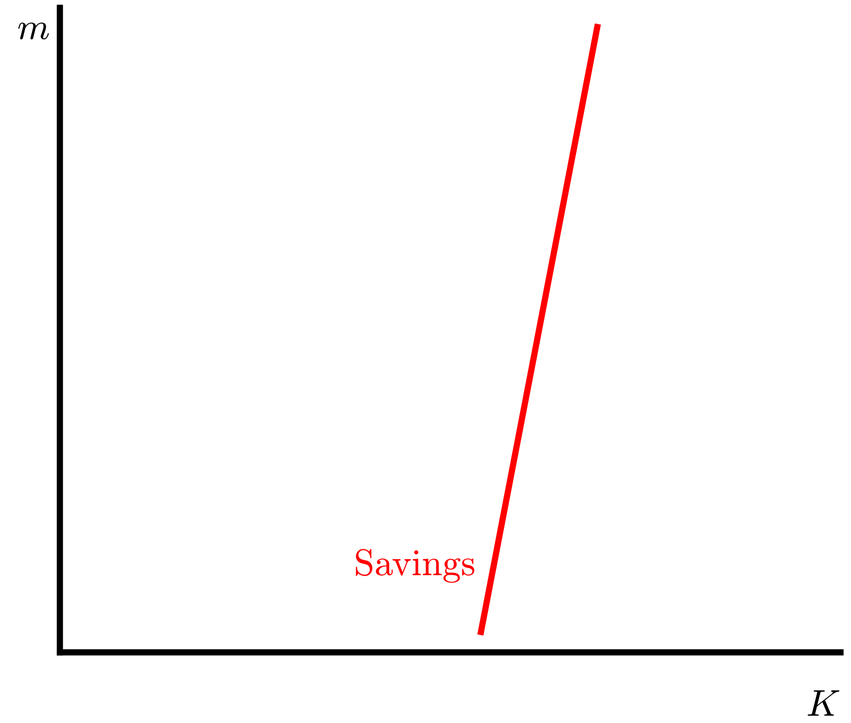
2. Productive versus storage savings



- Average return on savings equals discount rate plus growth (times inverse IES).
- Weighted average of returns on the two forms of savings, so it is downward sloping between the two returns.
- Shifts left-down:
  - Growth falls, or inequality
  - Demography so discount less

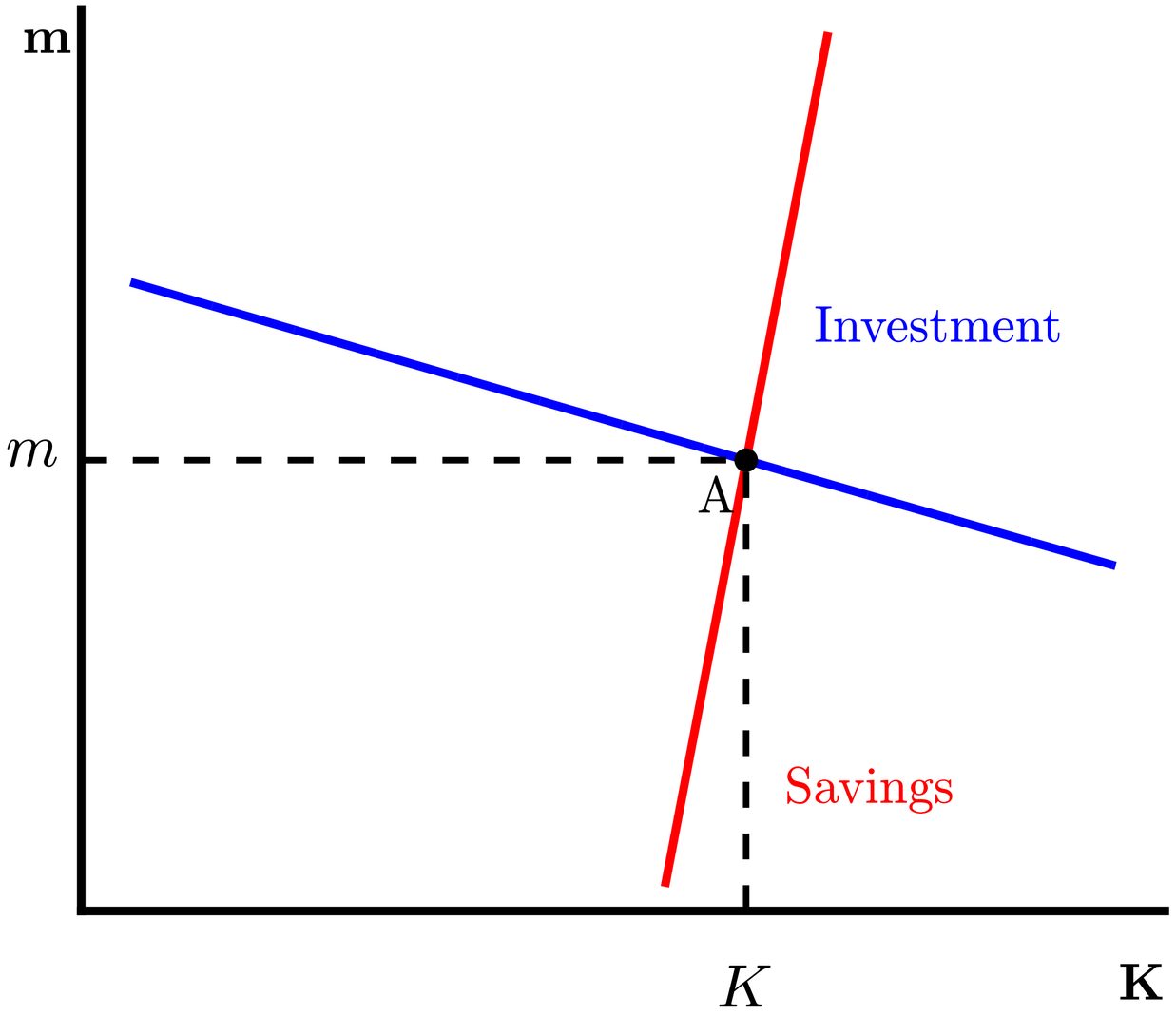
2. Equilibrium



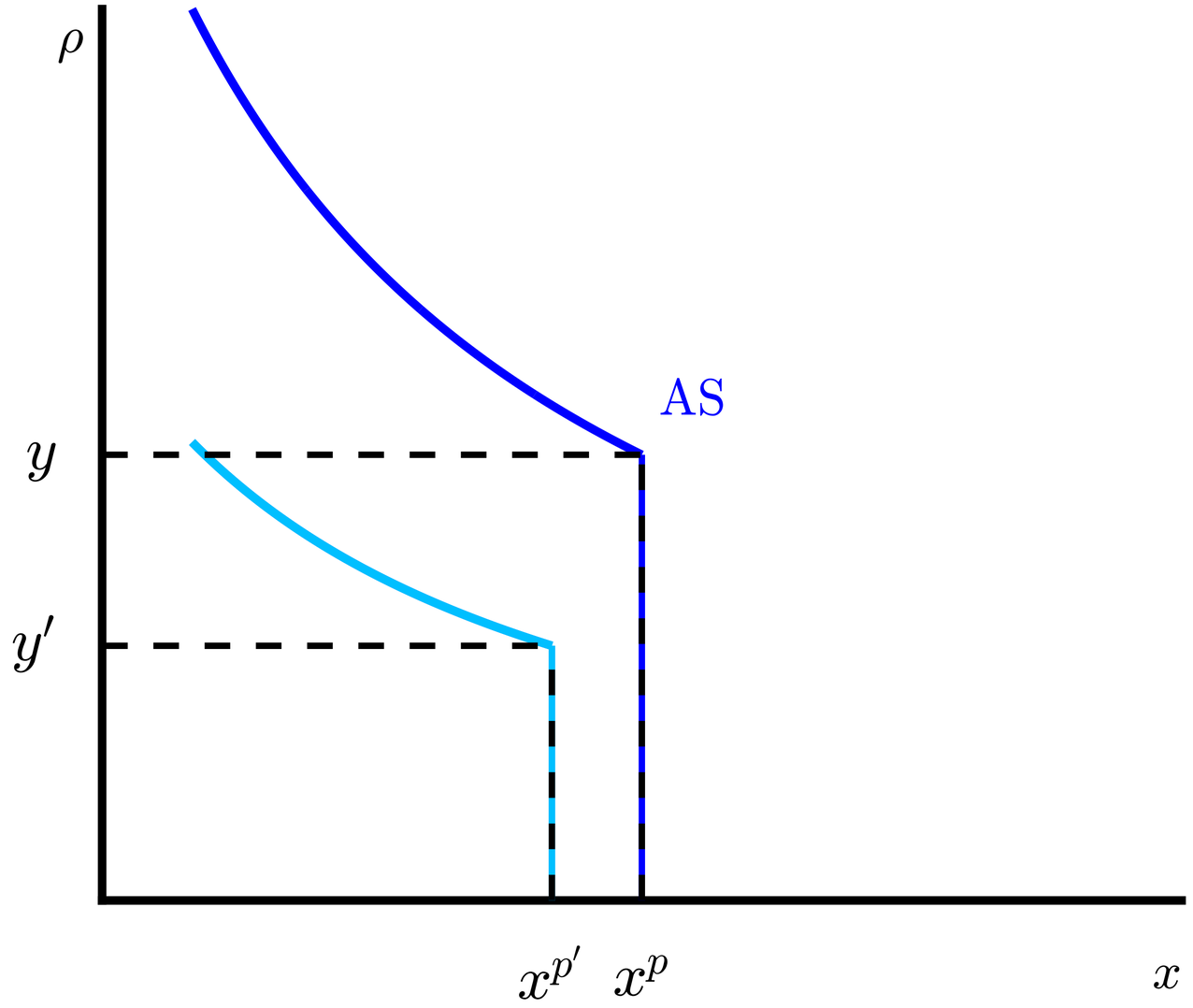


- More investment in productive assets (***k***) shifts P-A right-down, raises ***m,*** Savings upward slope
- Savings shifts left-down if: (i) lower growth, (ii) aging, (iii) more financial frictions

1 and 2. Equilibrium

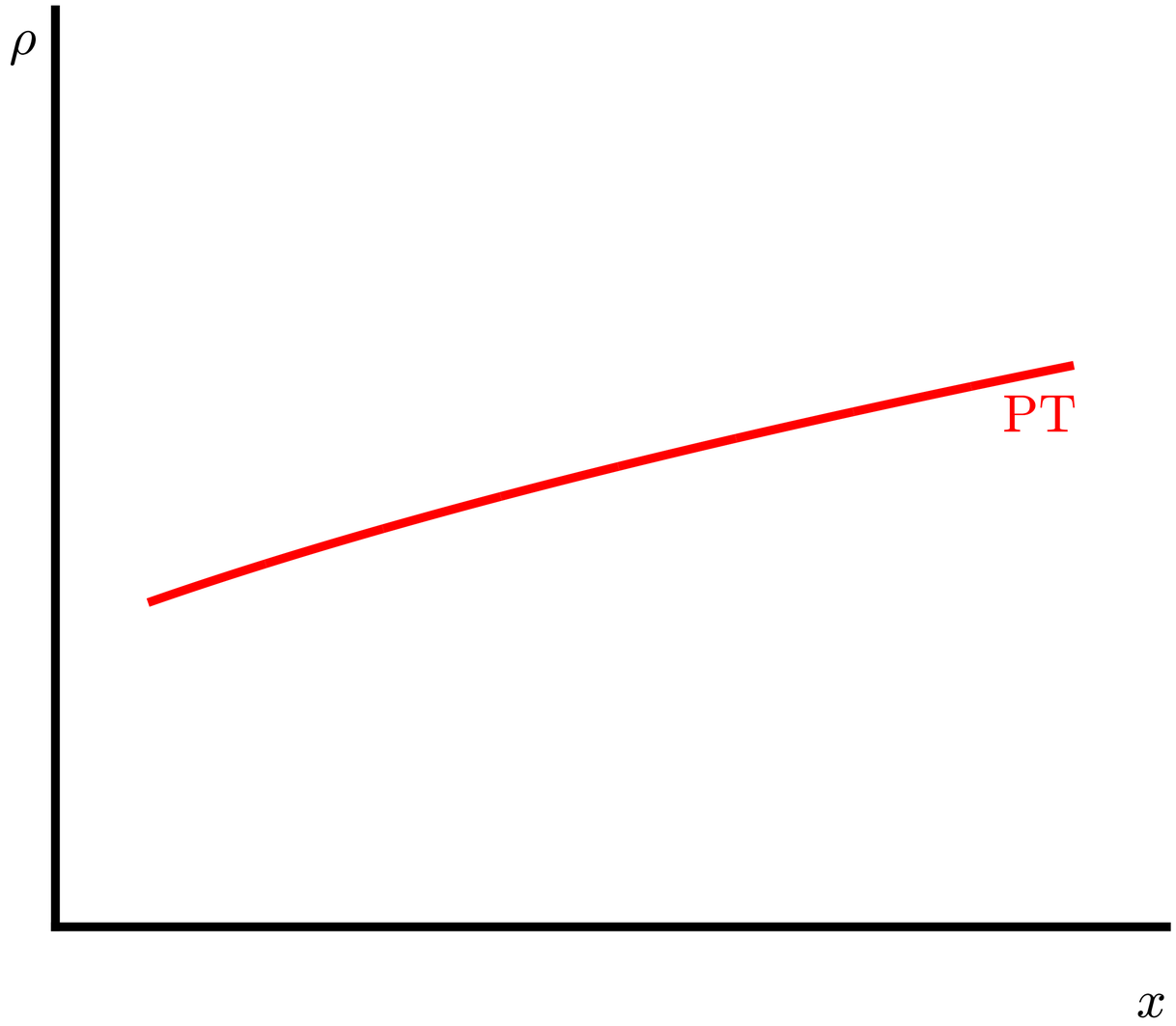


3. Realized returns, potential and actual output



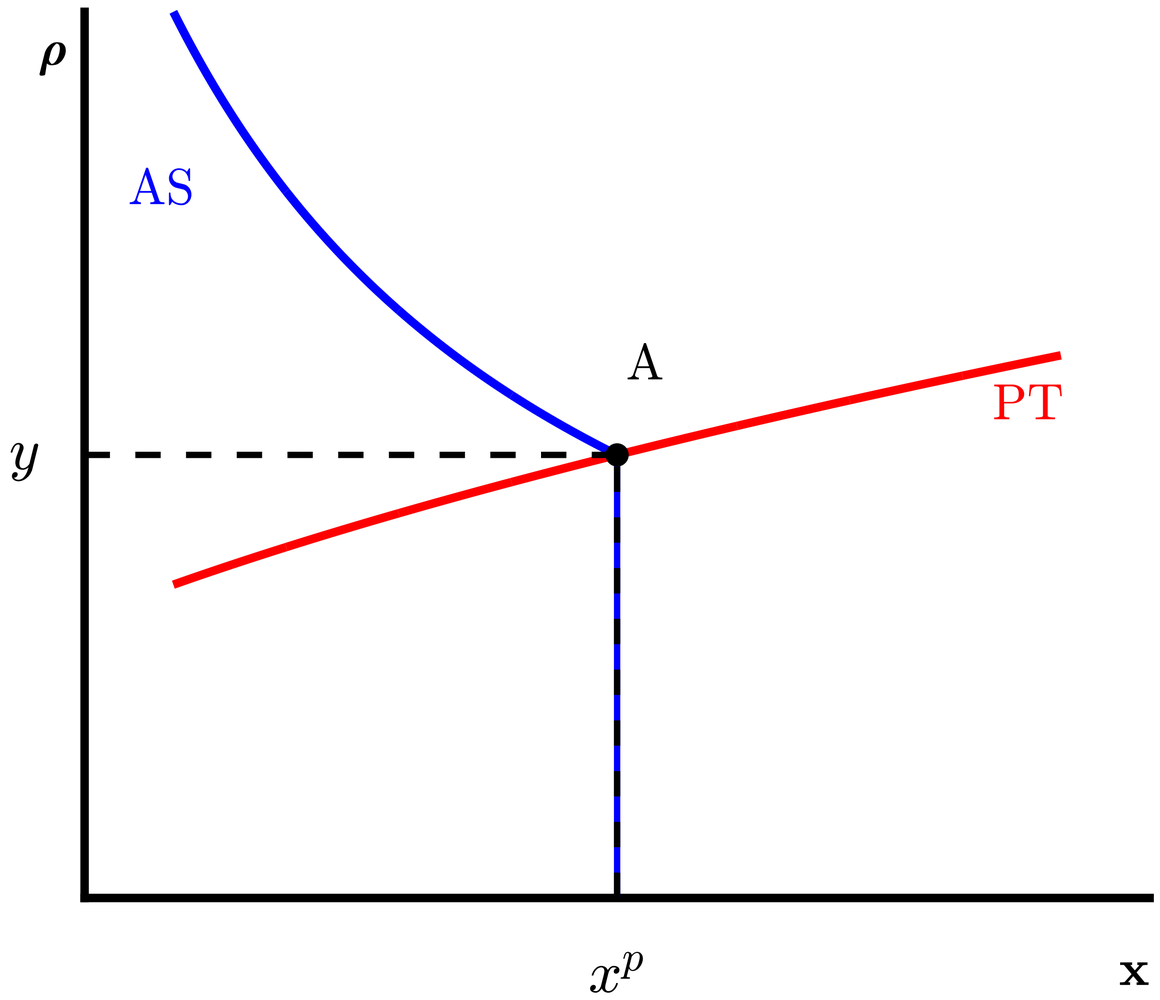
- Given productive capital, output ***x*** equals potential x^p
- Variable inputs require ex post return through anorm. Inflation below norm, then ρ is high, inputs are less used, output is below potential x^p
- Kink where $\rho = y$
- Shifts left-down if less capital

4. Policy target: fiscal and monetary policy



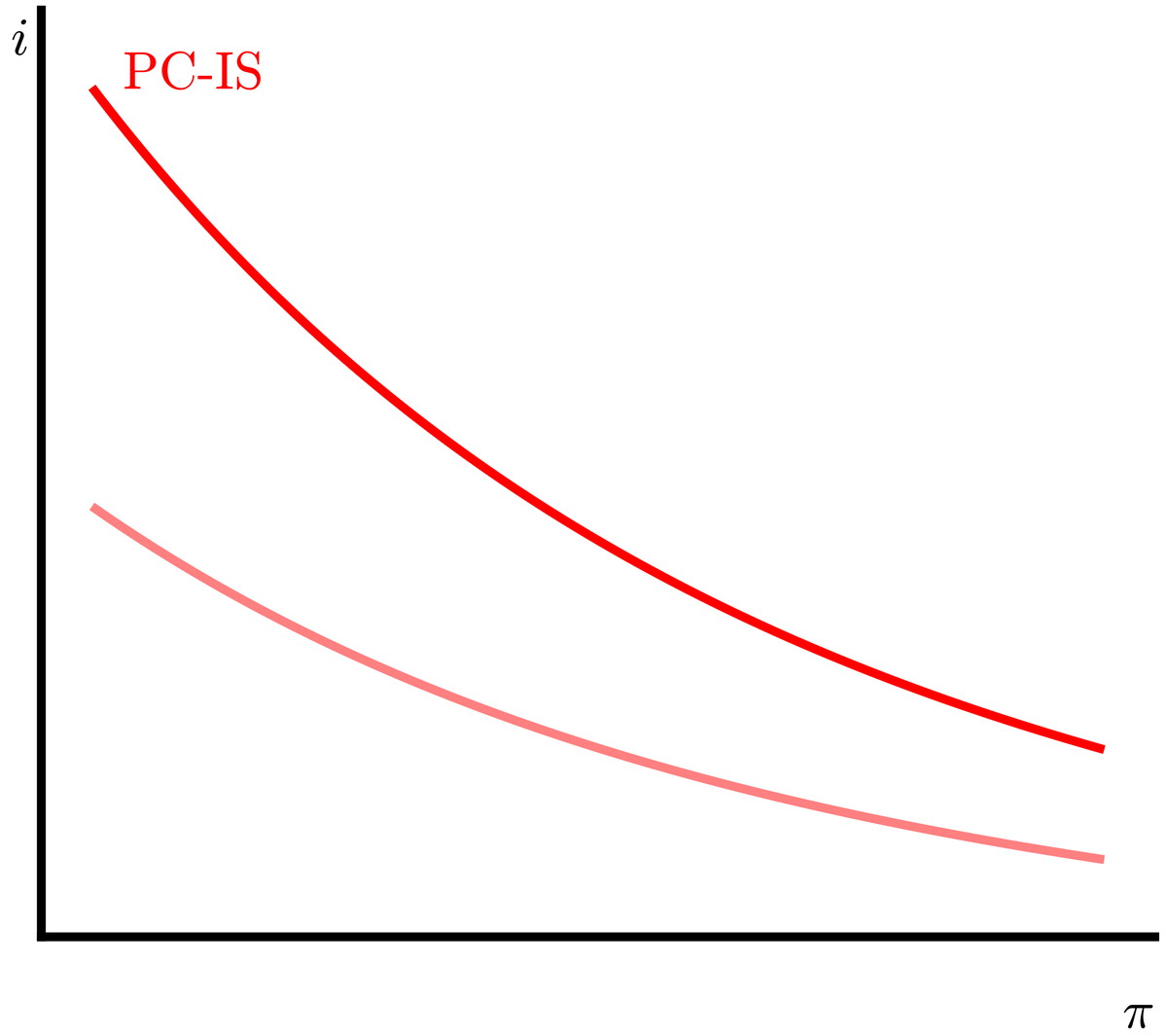
- Aggregate demand management by fiscal and monetary policy
- Policy targets: trade-off costs of inflation versus costs of underemployment.
- Shift right-down when
  - ***y*** falls
  - over-estimate potential, and target inflation above the norm

4. Equilibrium realized returns and output



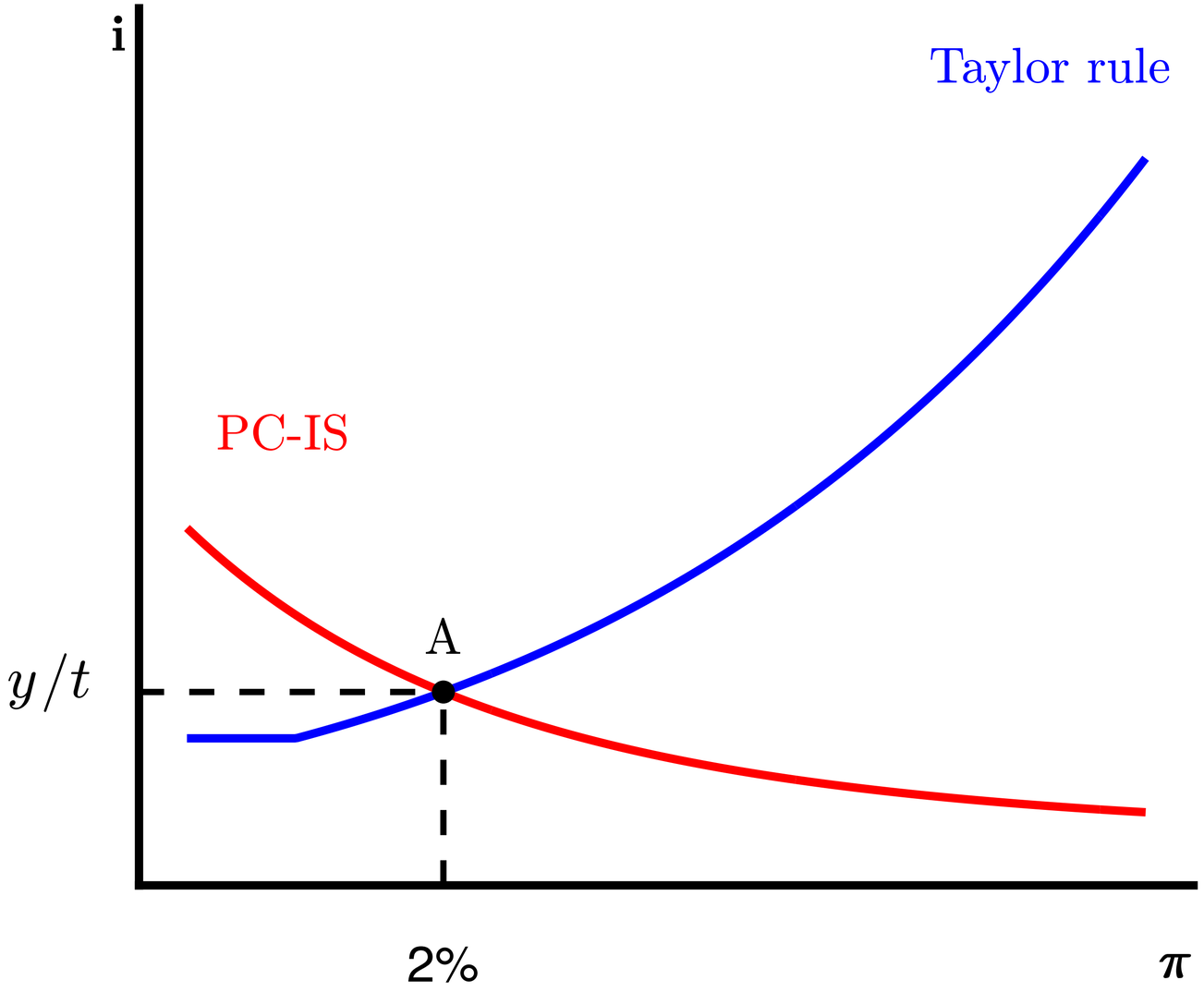
- Goal: intersect at the kink
- Policy: target inflation equals inflation norm and target output equals potential output.
- If overdo it, intersect below kink, high inflation, realized returns lower.
- By RE, inflation norm rises, shift ***PT*** left-up towards kink

5. Policy rate and unexpected inflation



- Lower policy interest rate (i) raises aggregate demand by consumers, pushes inflation high from sticky prices by firms
- Neutral/Wickselian rate: ***y/t***
- Shifts left-down if:
  - Yield y falls
  - Term premia (t) rises
  - Expected inflation (π^e) falls

5. Policy rate and unexpected inflation

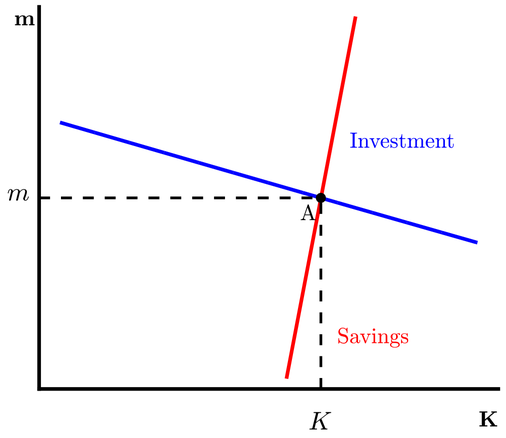


- Taylor rule for policy rate: higher inflation leads to higher policy rate, as usual.
- Shifts right /down when higher target inflation rate
- Policymaker targets the neutral rate, and if gets it right, then inflation is equal to target, as intersects the PC-IS at this level

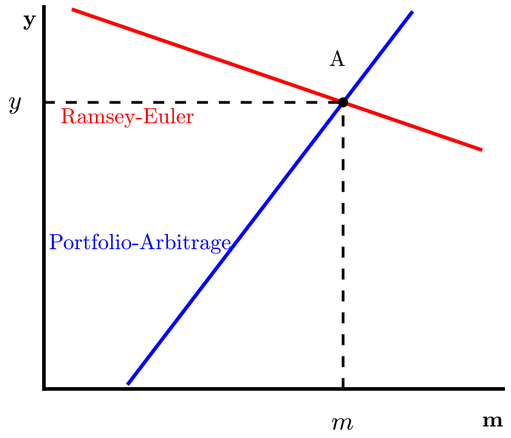
All together: four r*'s

Figure 3: A model of four returns

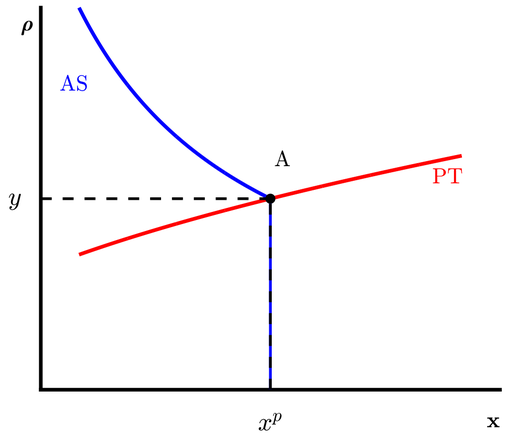
(a) Productive investment and savings



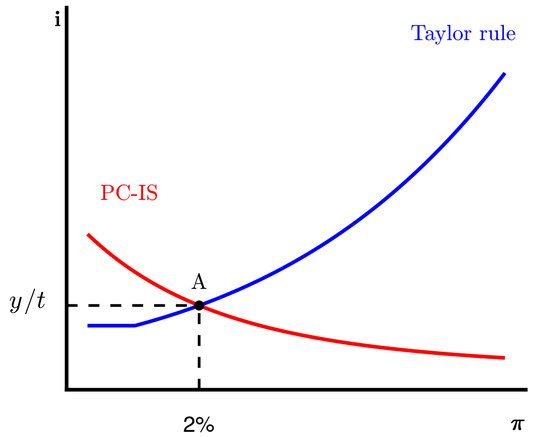
(b) Unproductive or productive savings



(c) Realized returns and policy choices



(d) Monetary policy

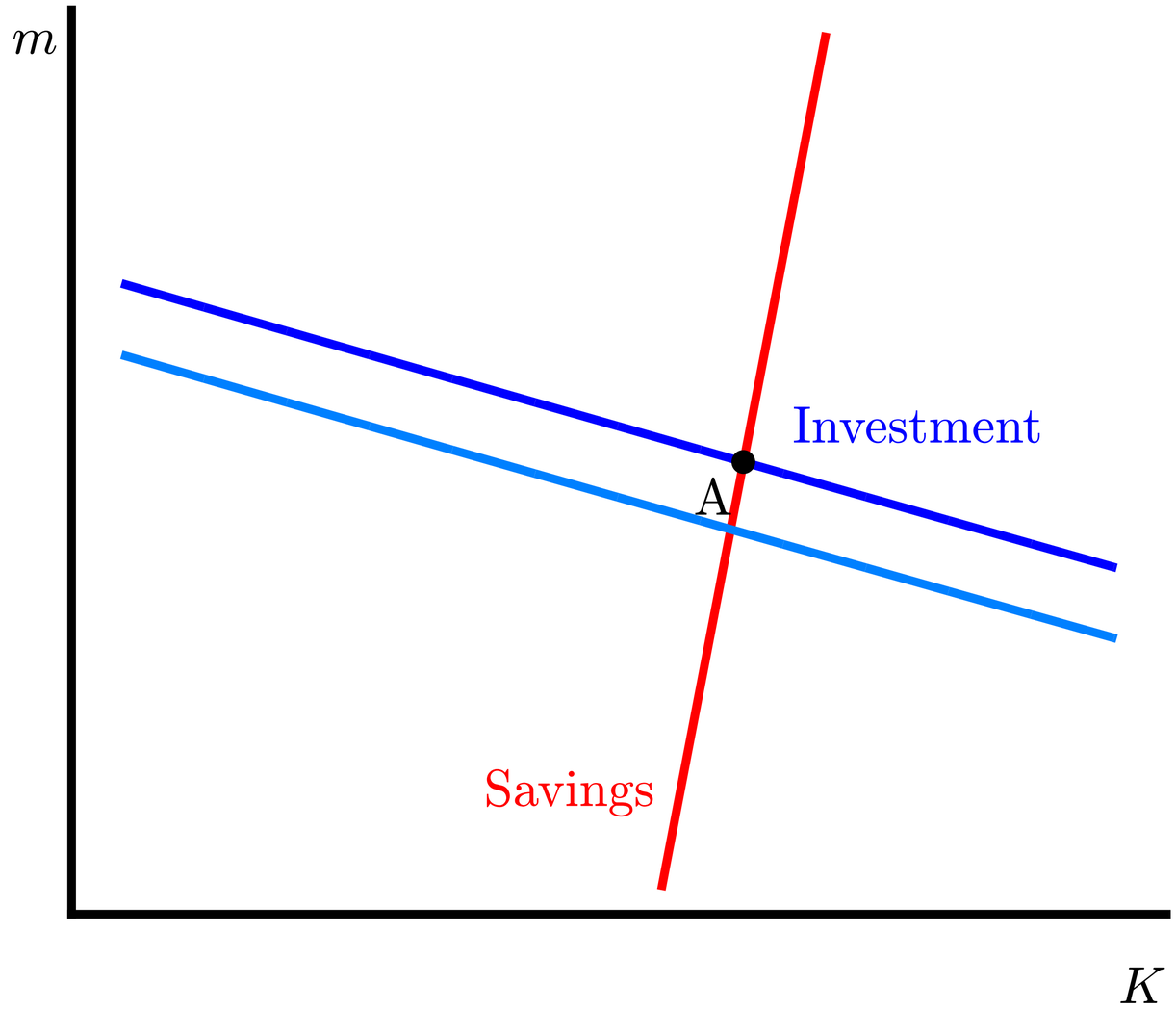


Four R-stars and three macro outcomes

- **Structural determinants:** growth, demographics, productivity, competition, financial frictions
- **Norms, expectations:** compensation, expected inflation, term premium
- **Policy goals / targets**: potential output, inflation target, neutral rate pursued

USING THE FRAMEWORK TO ACCOUNT FOR THE 1995-2019 TRENDS

Fundamentals from literature on investment



Investment curve left-down

- Rachel Smith (17), Rachel (23).

(1) Fall in relative price of capital

(2) Lower economy and population growth rate.

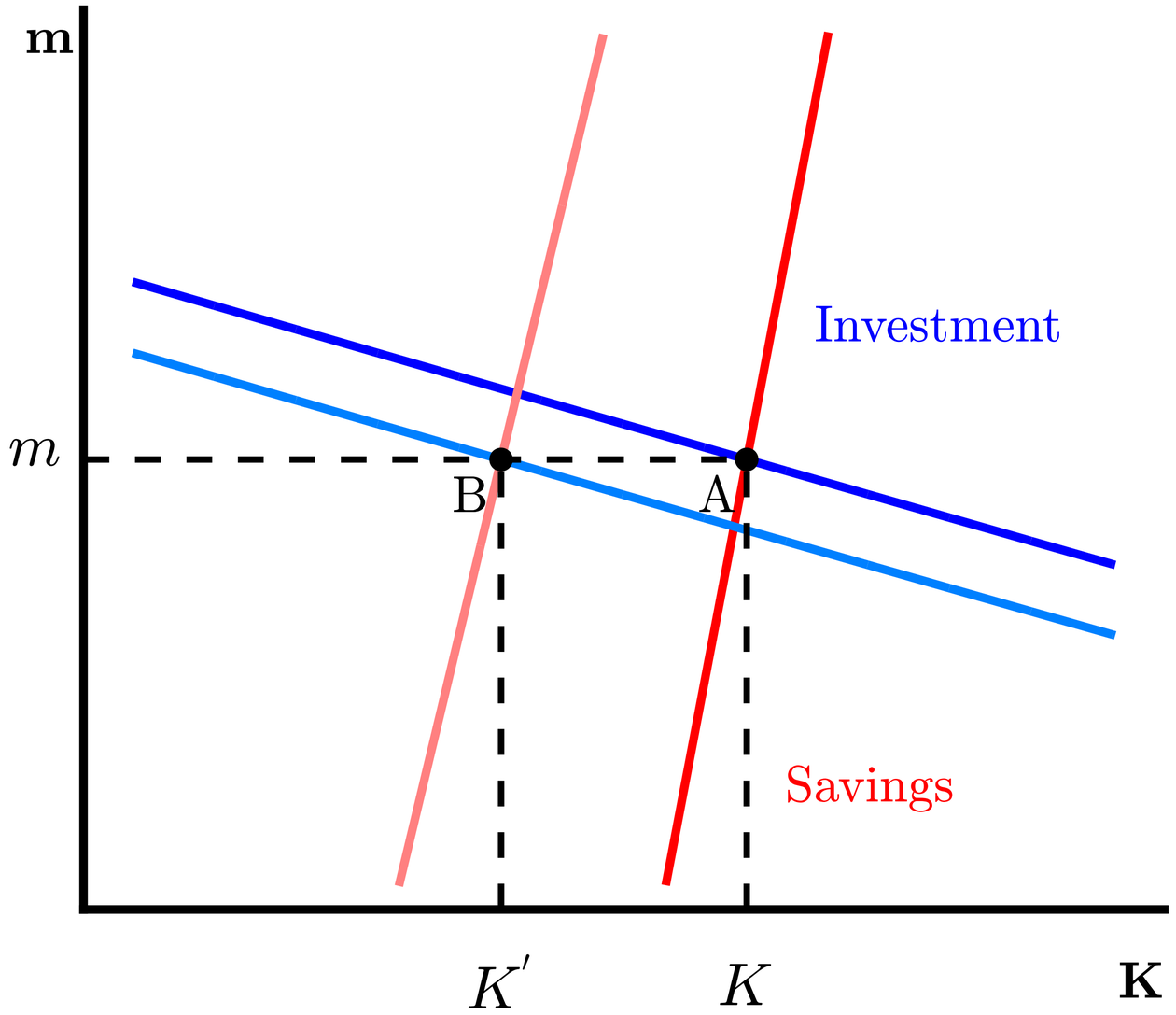
(3) Decline in public investment

- I would add:

(4) Higher depreciation

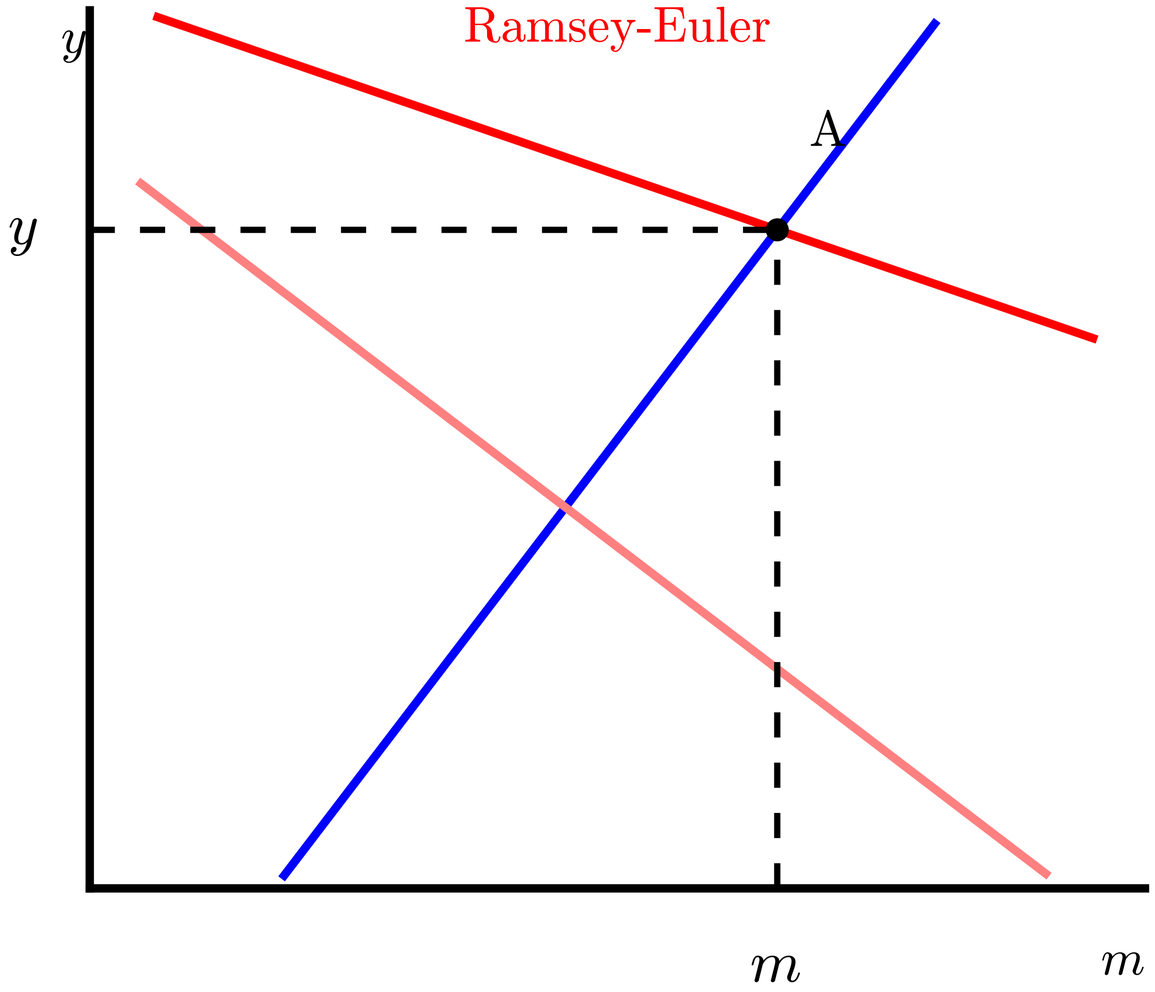
(5) Higher markups

But data says m constant or barely fell



- Therefore ***S***avings curve must have shifted left-up
- Consistent with data on depressed investment
- To see why ***S*** may have shifted left and what about ***y*** turn to the next plot…

Fundamentals from the literature on savings



- Rachel Smith (17), Rachel (23).

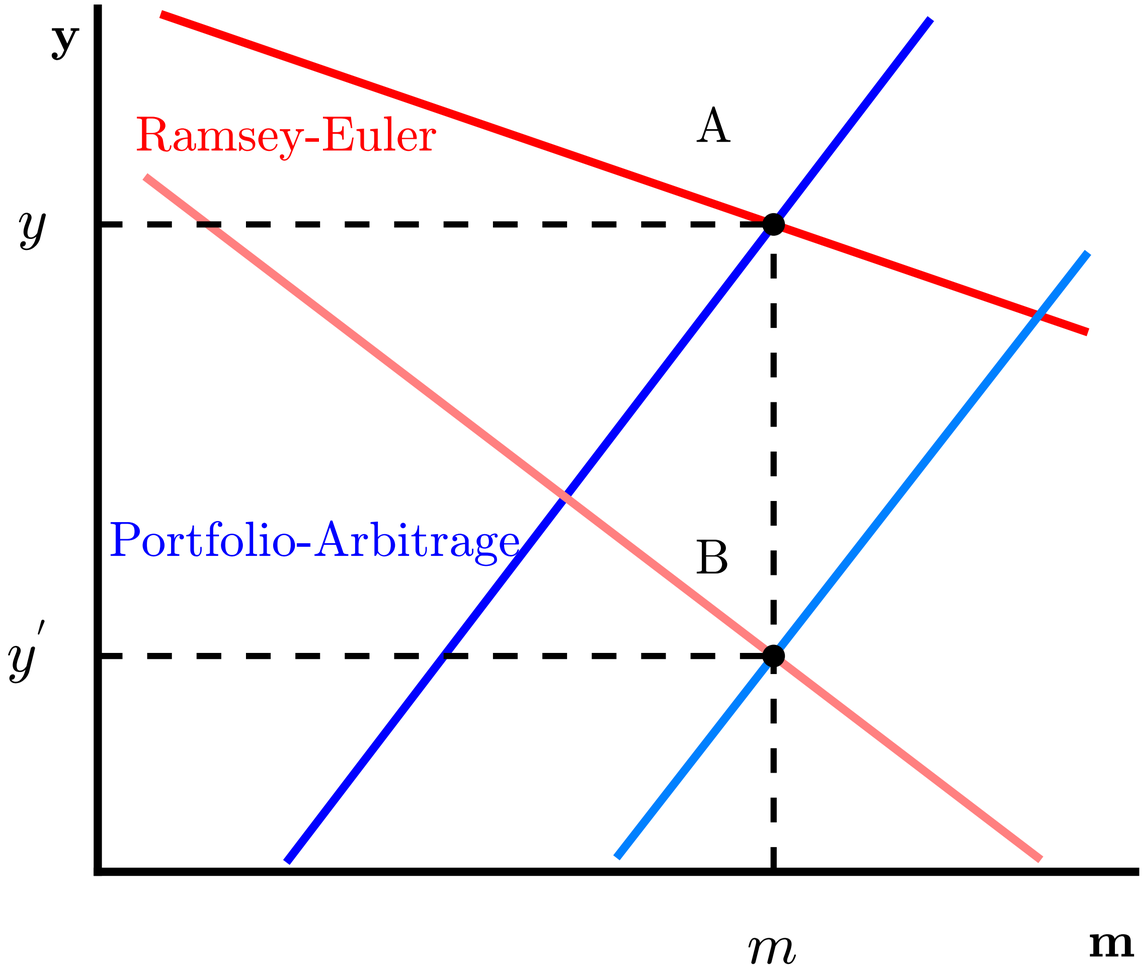
(1) Demographics: ageing
RE left-down

(2) Productivity and population
RE left-down

(3) Rising inequality
RE left-down

- But would lead to ***m*** falling as much (or more) than ***y***.

P-A to the right-down is consistent with m-y



(1) Global imbalances

State-controlled foreign investors prefer storage, since more exposed to information asymmetry, and desire liquidity.

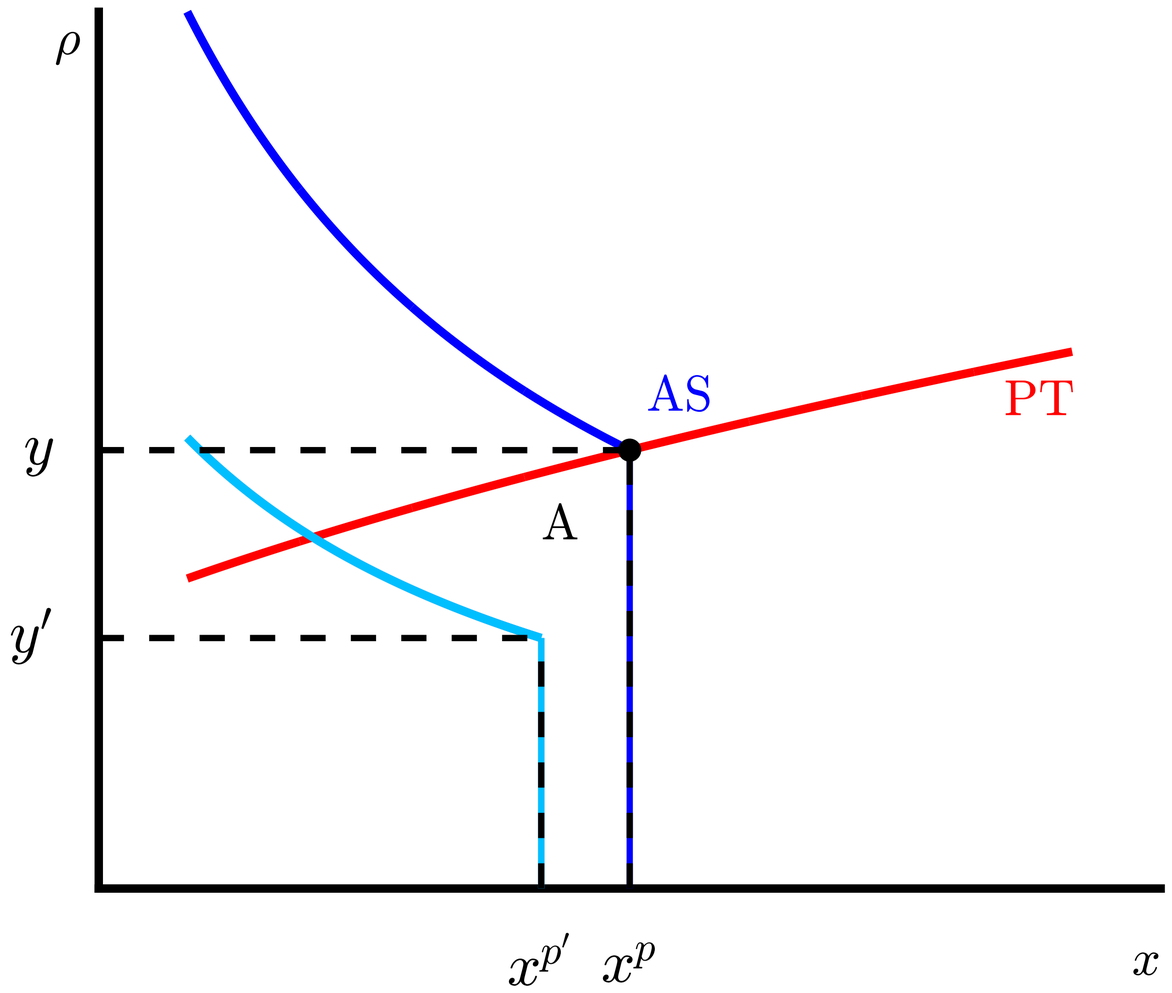
(2) Global financial crisis

Risk aversion and regulation rise

(3) Increase in supply of storage

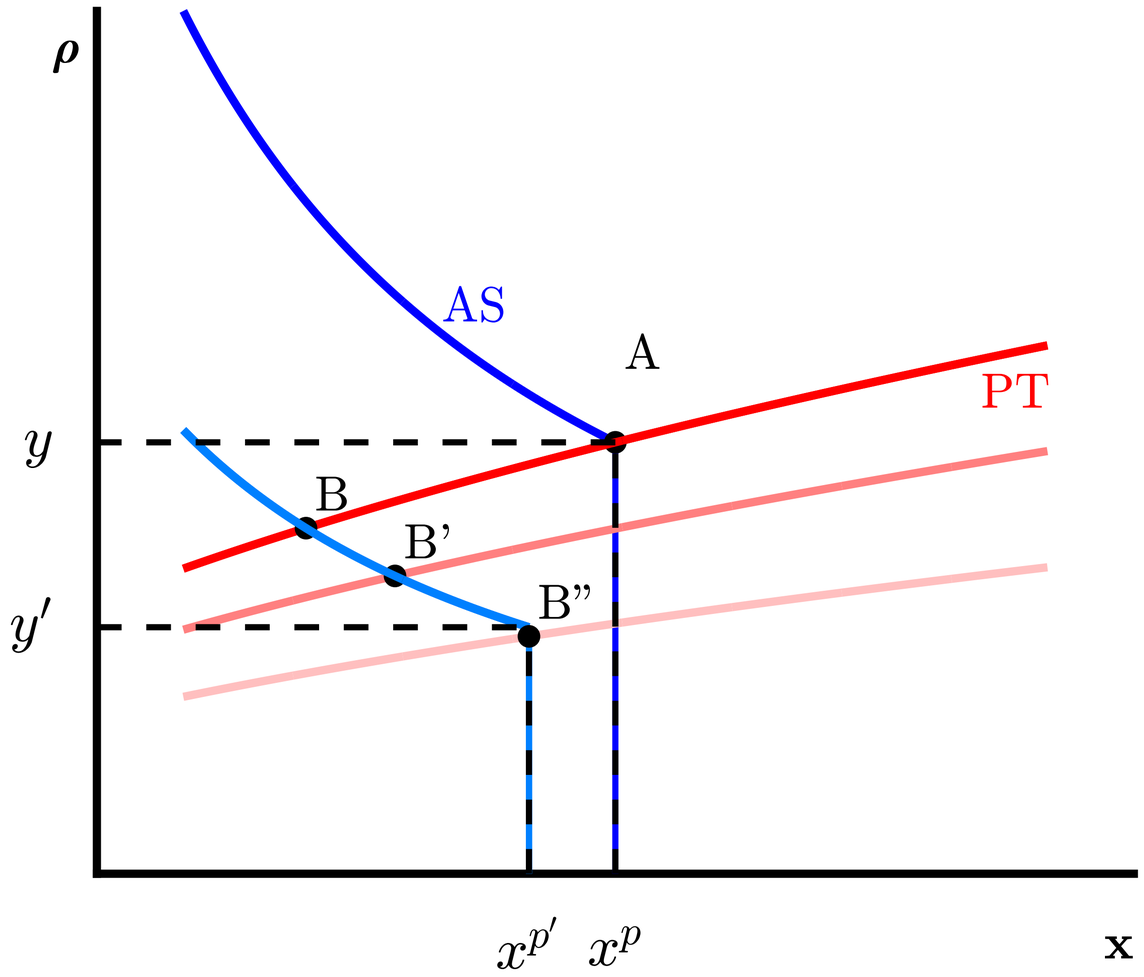
Government bonds and claims on rents

Policy challenge from high m-y world



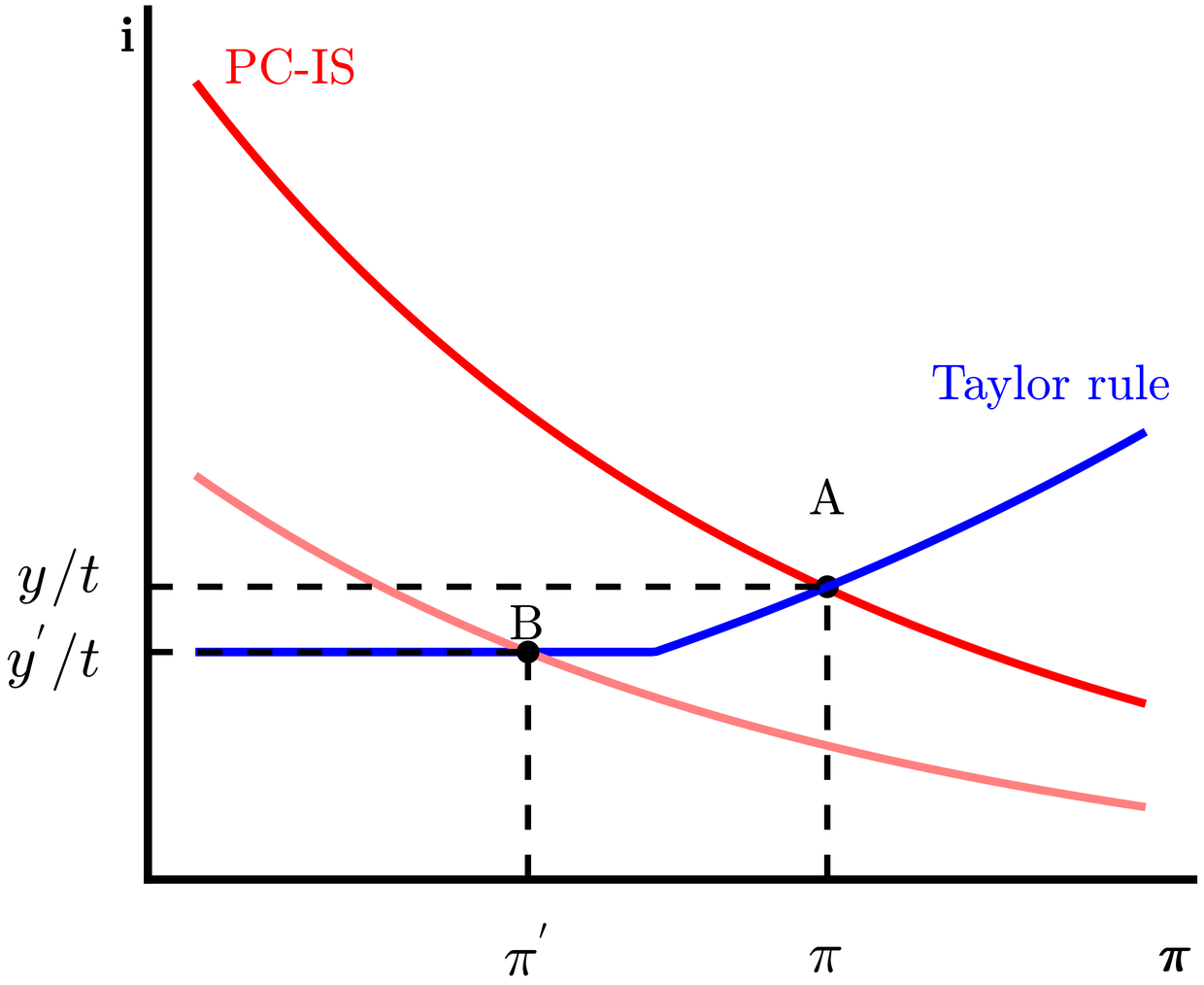
- ***AS*** shifted left-down
  - (1) less investment means less productive capacity
  - (2) higher markups
  - (3) higher depreciation rate
- Vertical kink is lower
  - (1) as ***y'*** is lower
- Underemployment with unchanged policy: 2010-15

Policy challenge of low r, high m world



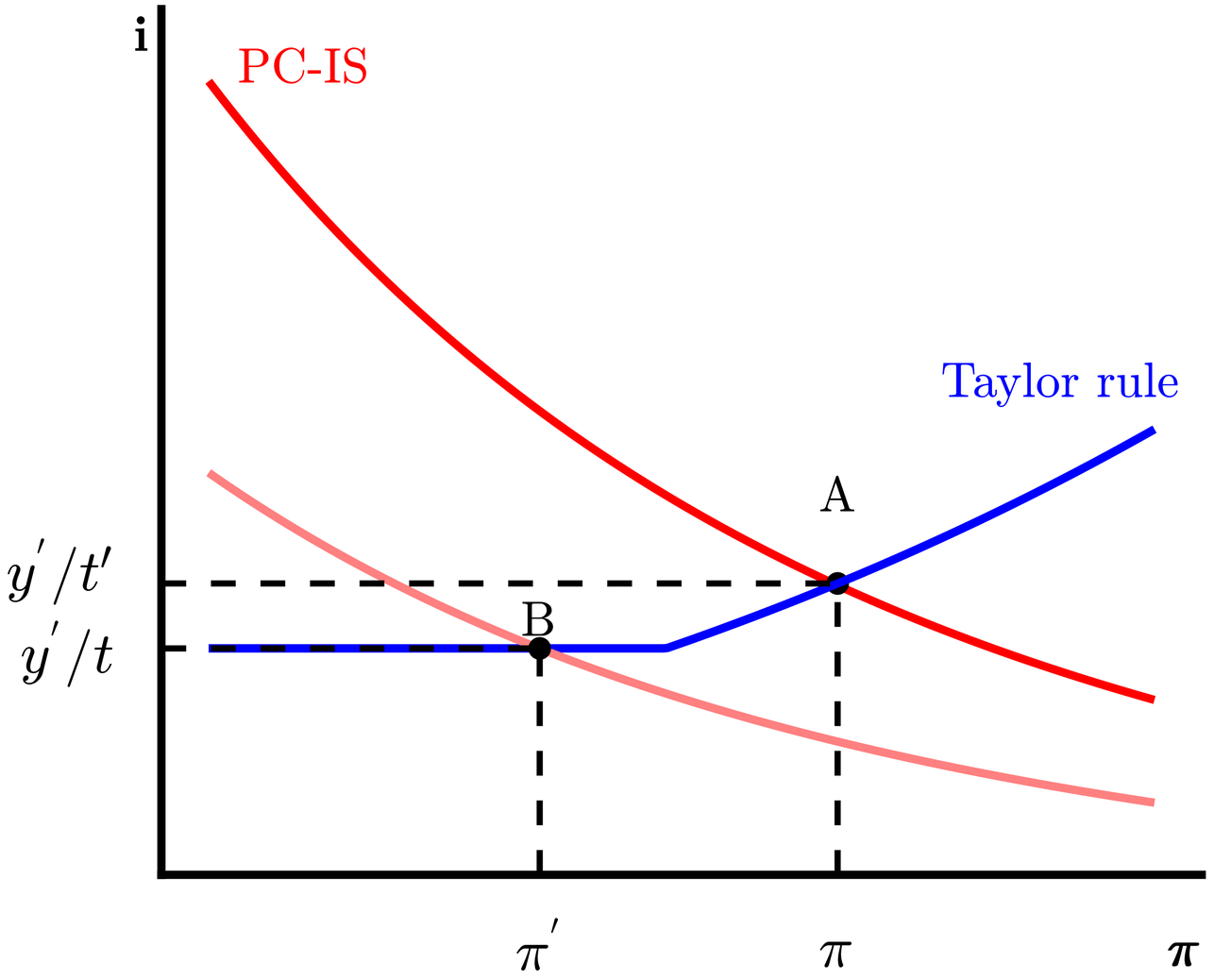
- Policy challenge: shift ***PT*** right-down from B towards B"
  - Fiscal policy large deficits
  - Monetary policy kept rates at zero.
  - Also, norms adjusted: persistently lower returns, lower inflation norm (less union power, Chinese "deflation" forces)
  - 2015-20

Inflation and the ZLB problem



- With a lower ***y***, then ***PC-IS*** shifted left-down
- Policy had to adjust policy to a lower interest rate, but with ZLB, low-inflation trap, point ***B***.
- The low inflation delivers the realized returns that led to under-employment, and ZLB explains why ***PT*** curve not shift enough, need for fiscal

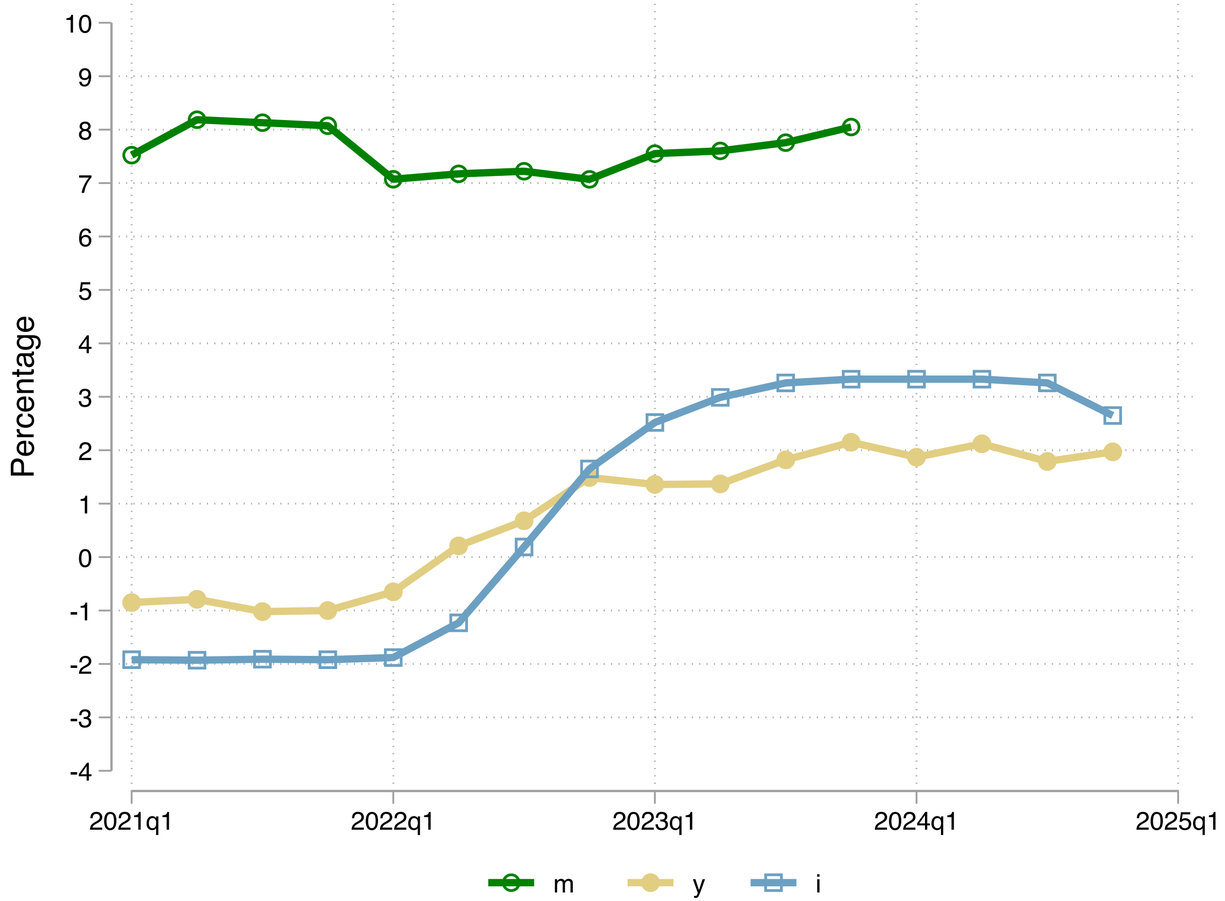
The term premium to the rescue

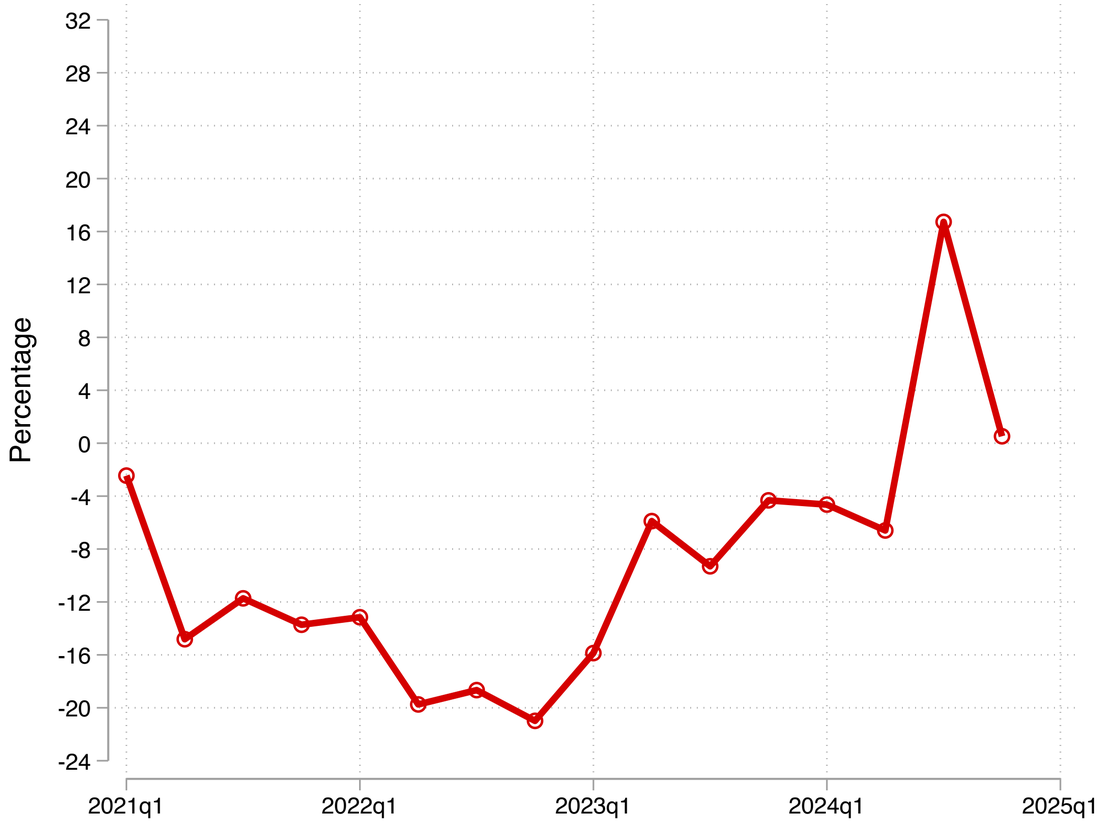


- Unconventional monetary policy (QE and others) lowered term premium to get out of ZLB and raise inflation.
- Get back to ***A*** by lowering ***t'***
- In EZ, not quite all the way, but towards there.

THE PRESENT

What are the data showing?



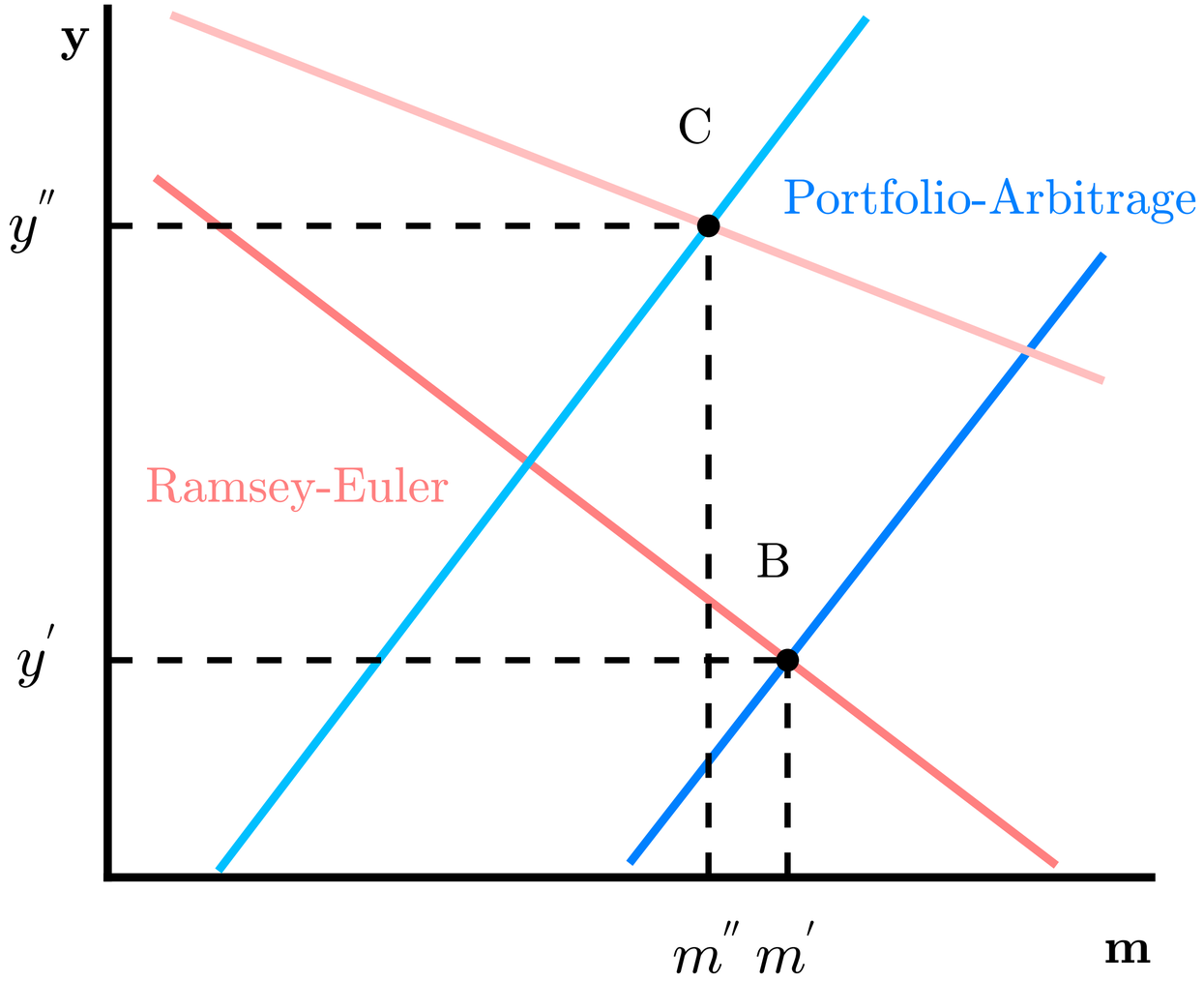


m: slightly lower and investment picked up

y: much higher, with ***i*** lagging

ρ: extremely low, unexpected inflation

If last few years persist: why higher y?



- Shift left-up in *P-A*:

(1) Government bonds no longer perceived as safe and liquid

(2) Global imbalances reversal

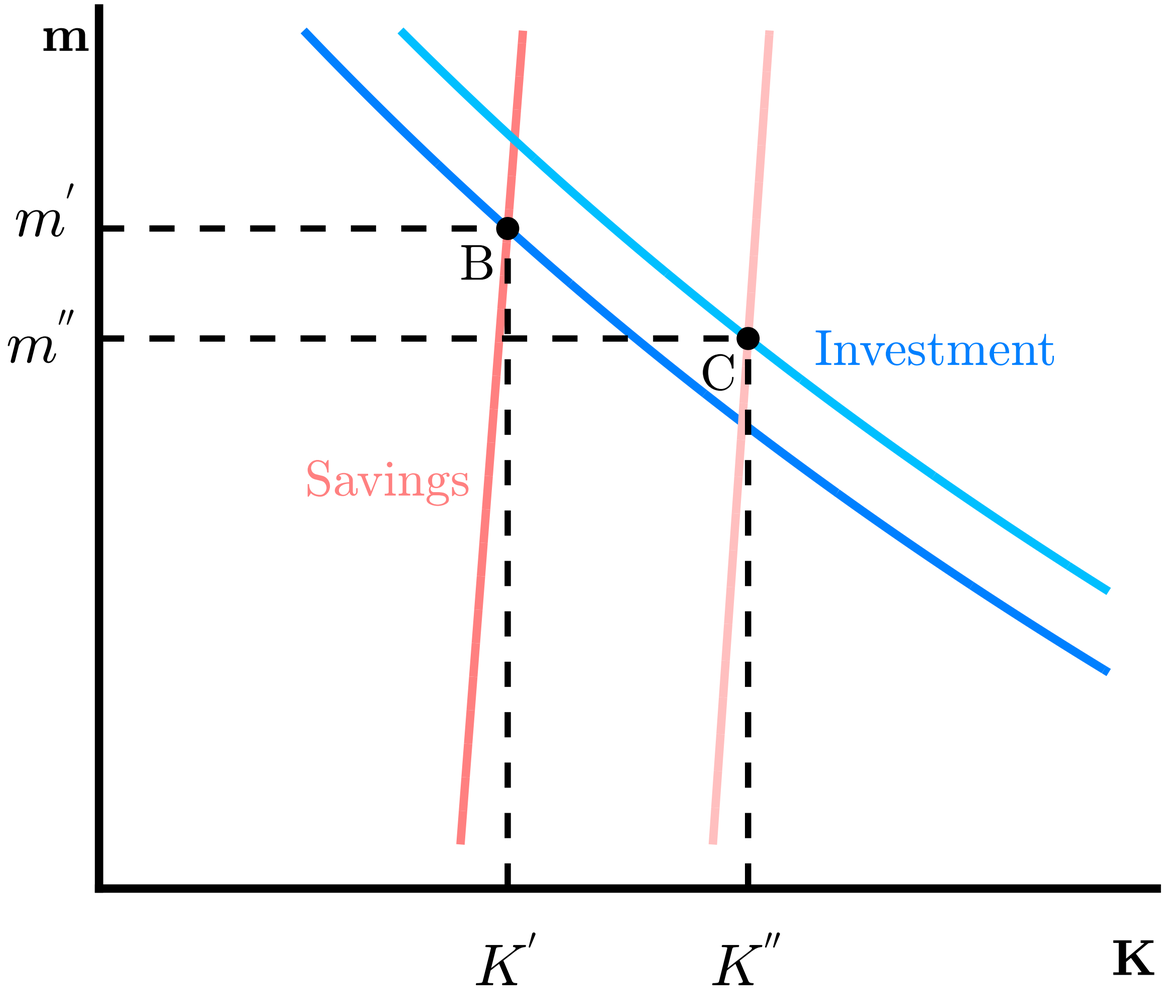
(3) Elections and fiscal/monetary mix going forward

- *R-E* shift up-right for ***m*** stable:

(4) Consumption spree post pandemic,

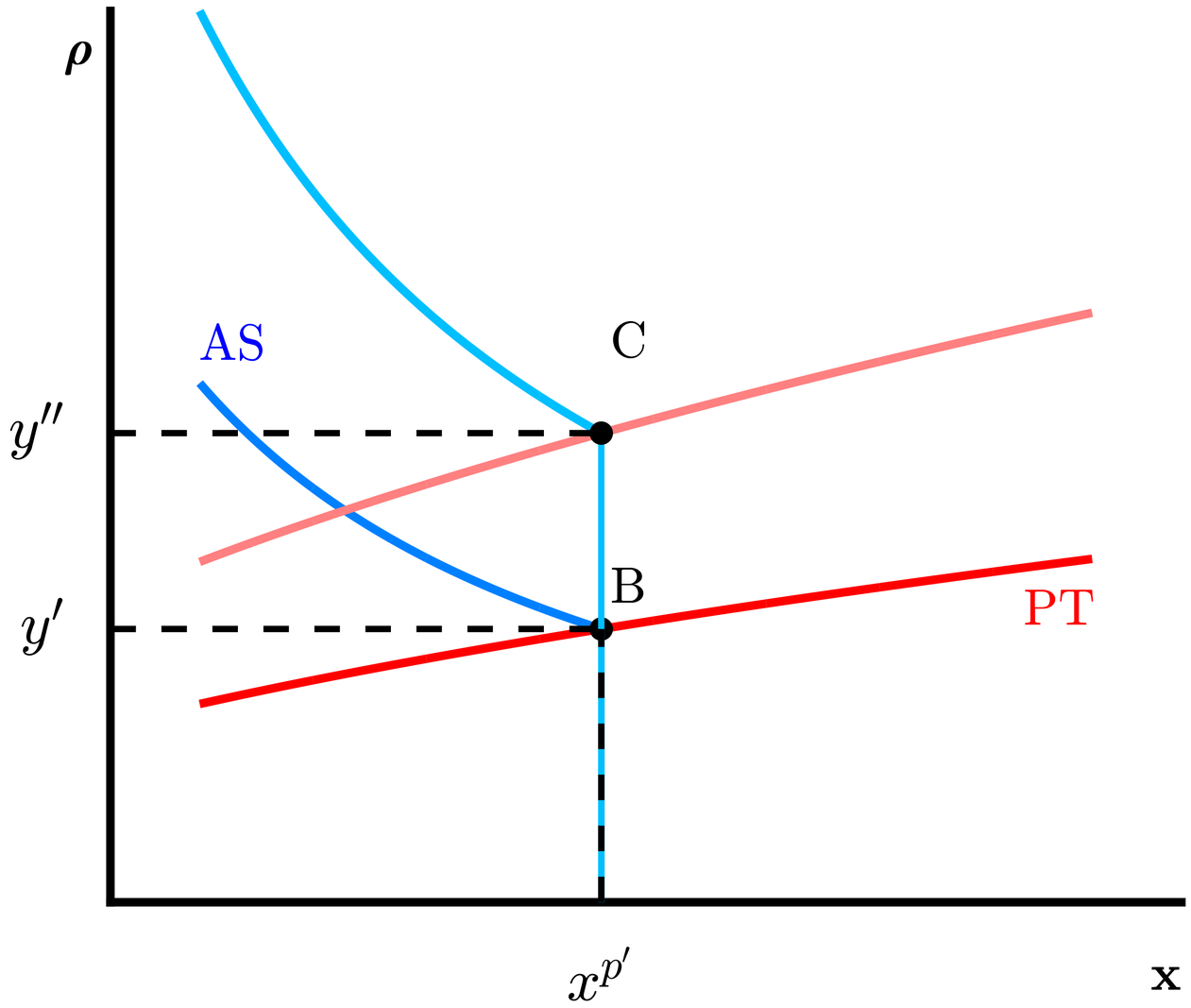
(5) Pptimism about AI

If last few years persist: m



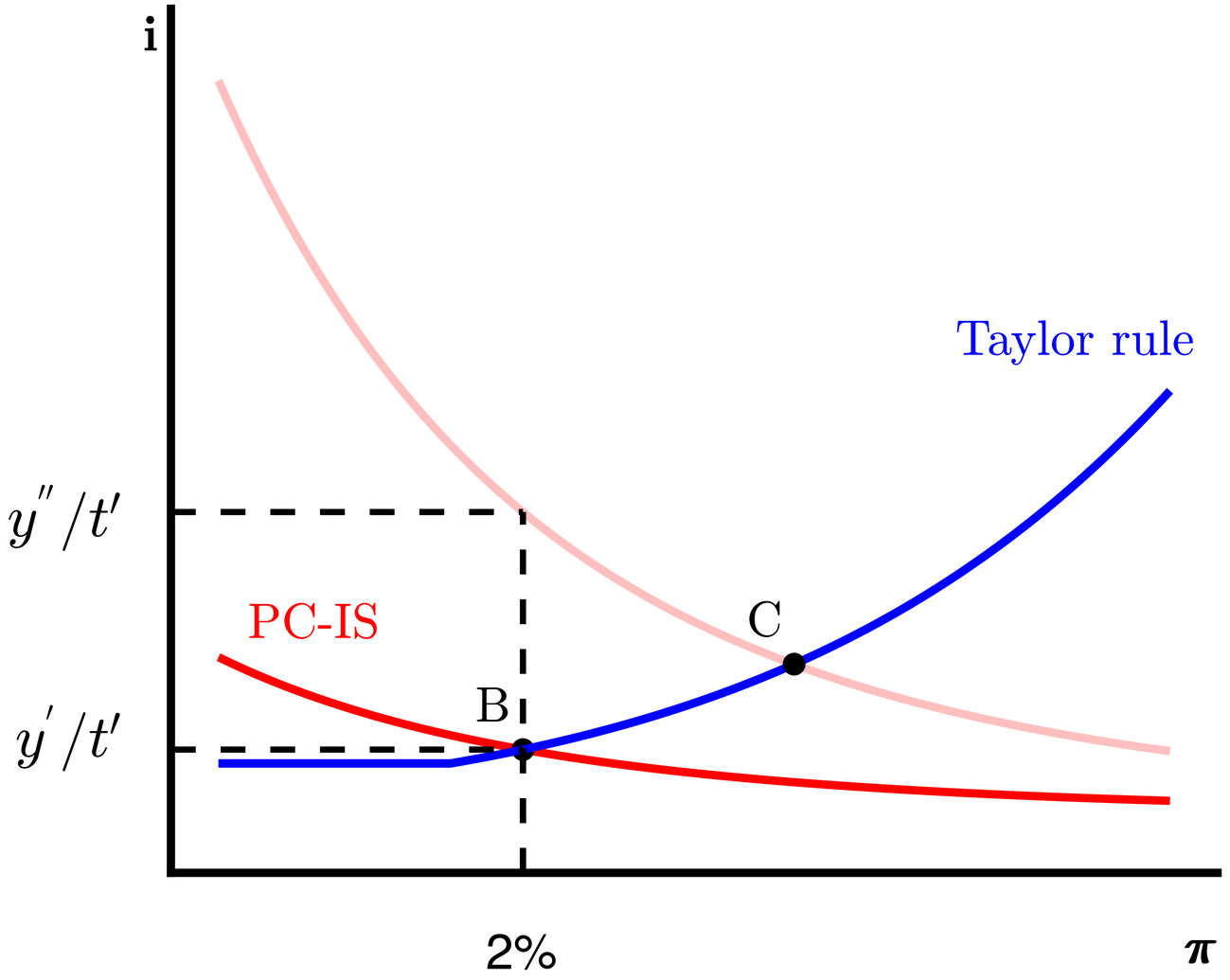
- Shift down/right of ***S***avings line from previous slide, brings down ***m*** and *K*
- Shift up/right in ***I***nvestment keeps ***m*** high, as a result of:
  (i) AI optimism
  (ii) rise in public investment
- These are small for now, but if keep on picking up, rise in investment and gradual drive down of ***m***

What happened in last few years: inflation



- With persistently higher ***y***, then vertical kink becomes higher.
- With unchanged policy: ***B'*** higher inflation, low returns for bondholders
- Why tolerated in 2021-22?
  (i) to avoid under-employment
  (ii) pressure to inflate debt.
- Eventually adjust, ***PT*** shifts up-left, towards point C, 2023-24

Policy in last few years

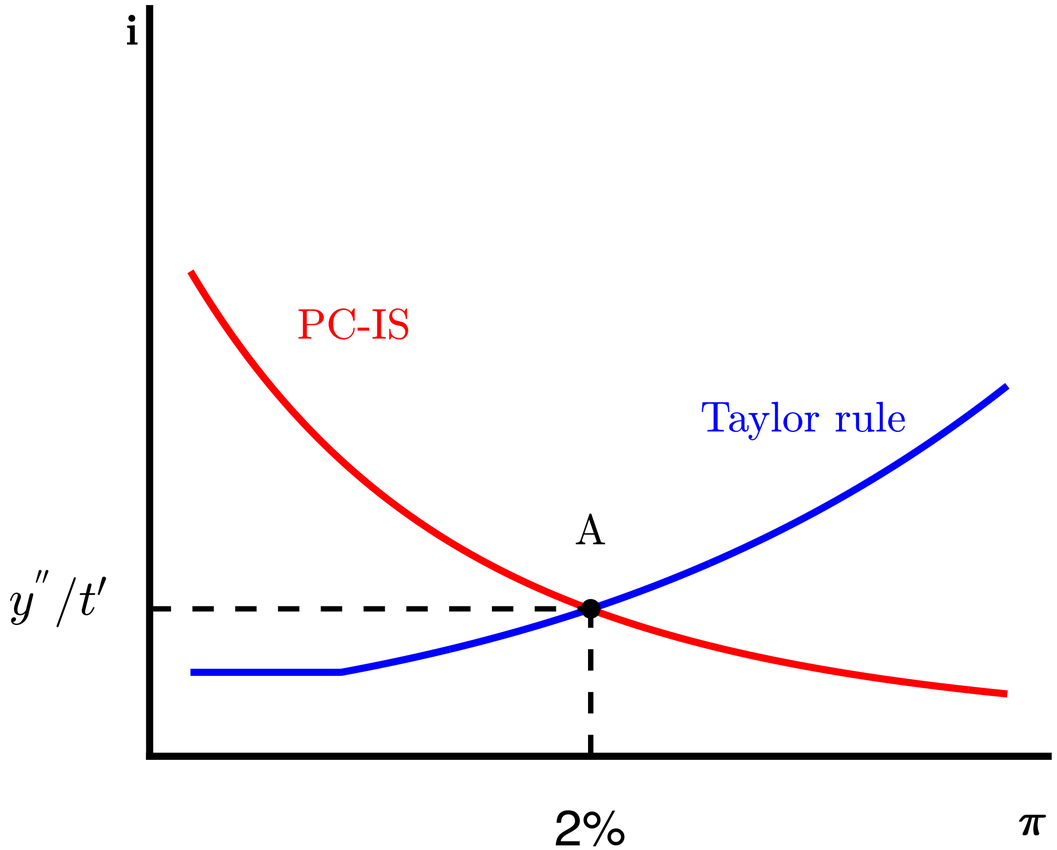


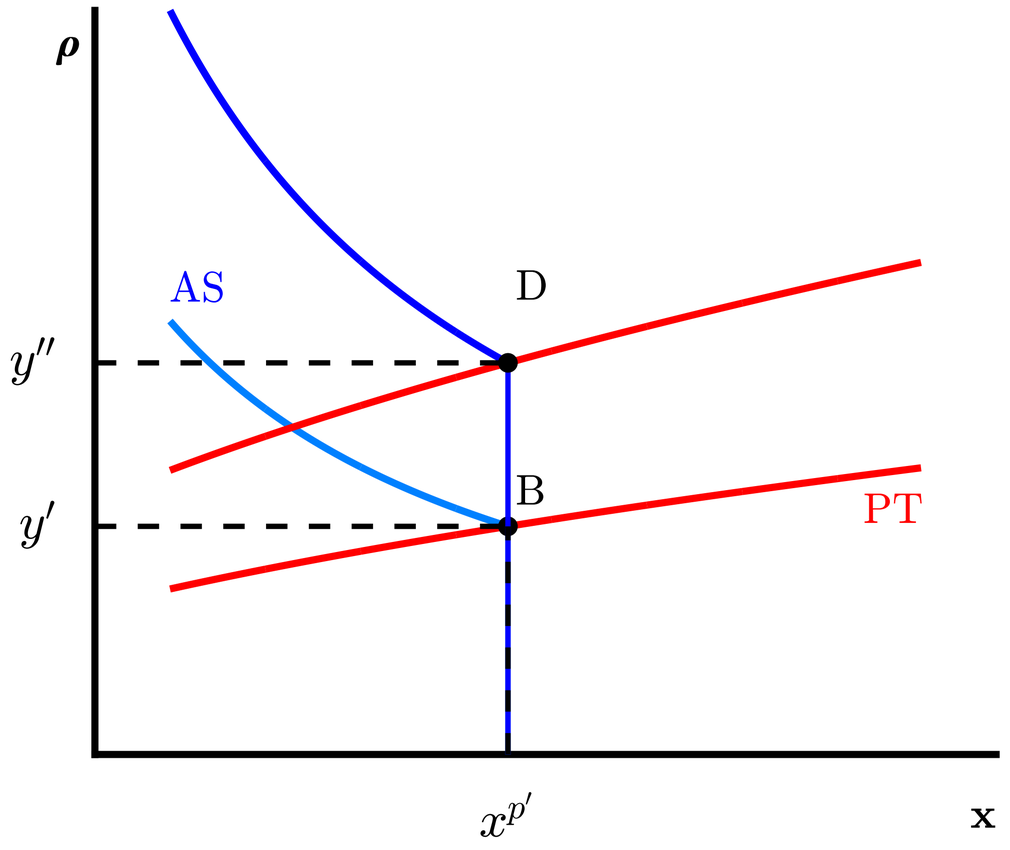
- Higher ***y*** meant that ***PC-IS*** shifted up/right.
- Economy moved to higher inflation at point ***C***
- Keeping inflation on target would have required raising "neutral rate" in the Taylor rule, shifting it up, so deliver same inflation through significant higher rates, vertically above point B

THE FUTURE

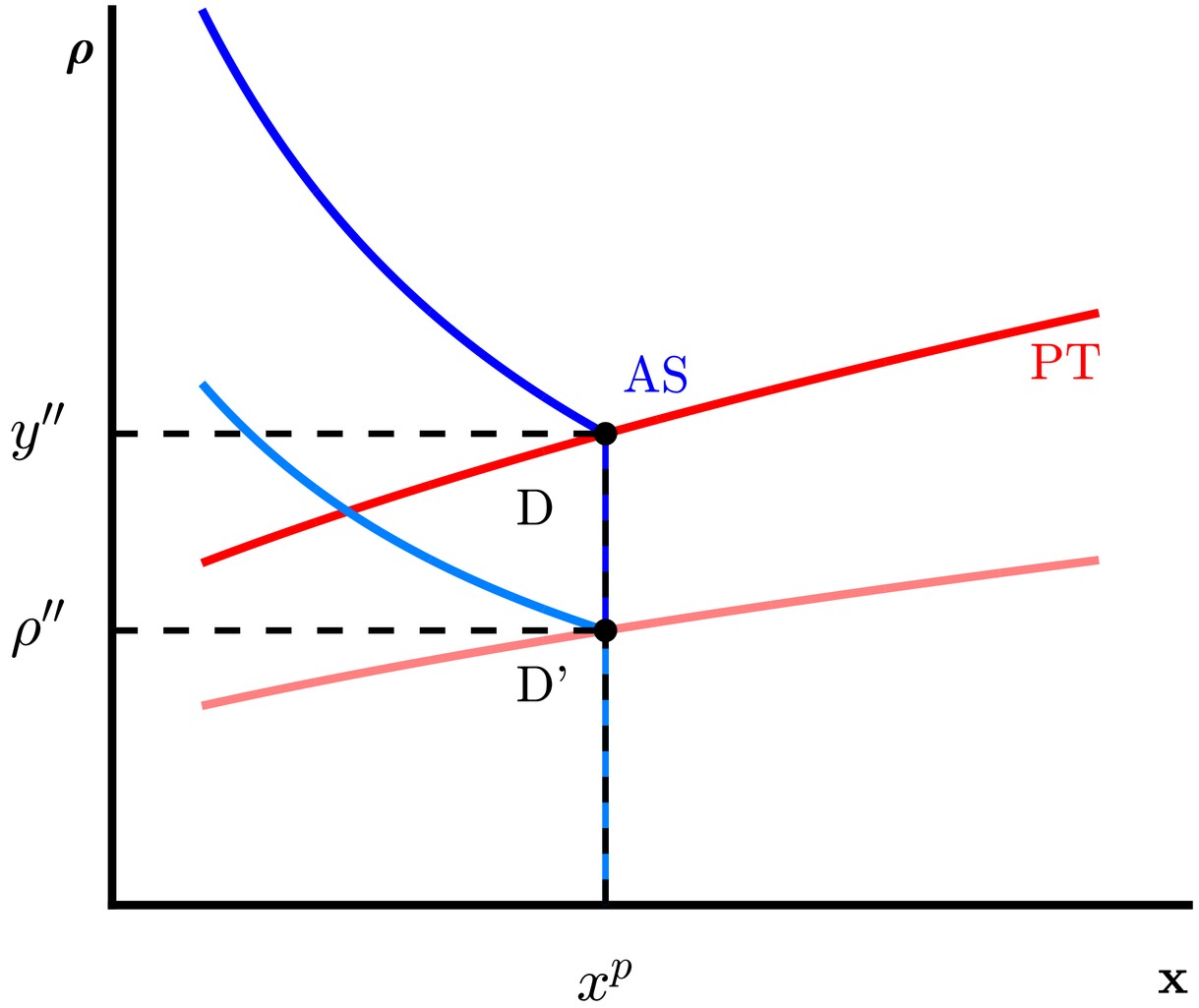
Scenario 1. Benevolent benchmark

- *TR*: back to inflation target 2% requires higher i forever to match y.
- *PT*: back to kink, $\rho = y$, inflation comes down as monetary/fiscal restraint
- Challenges (i) bumpy road, (ii) higher interest burden on public debt



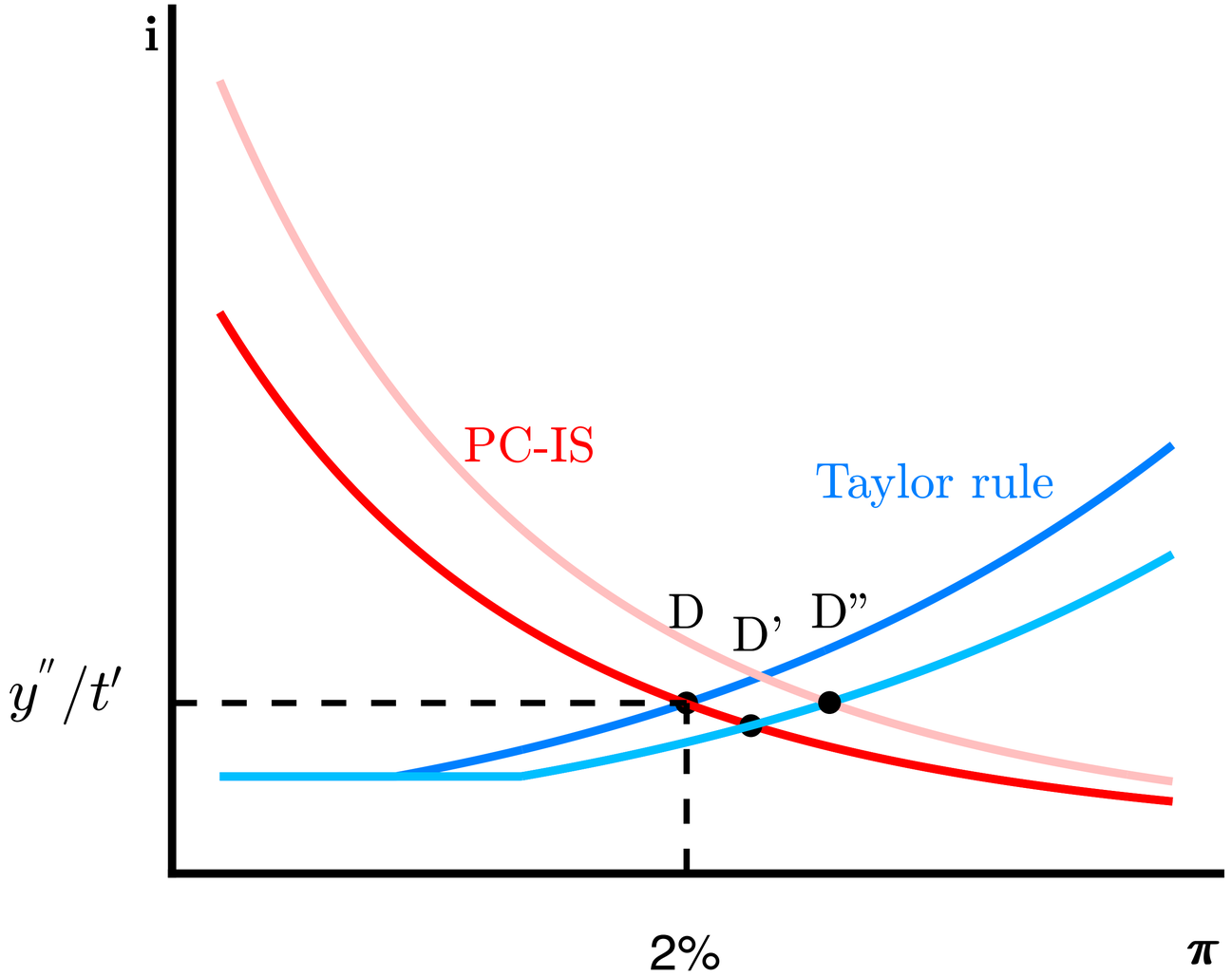


Scenario 2. Forever-higher inflation



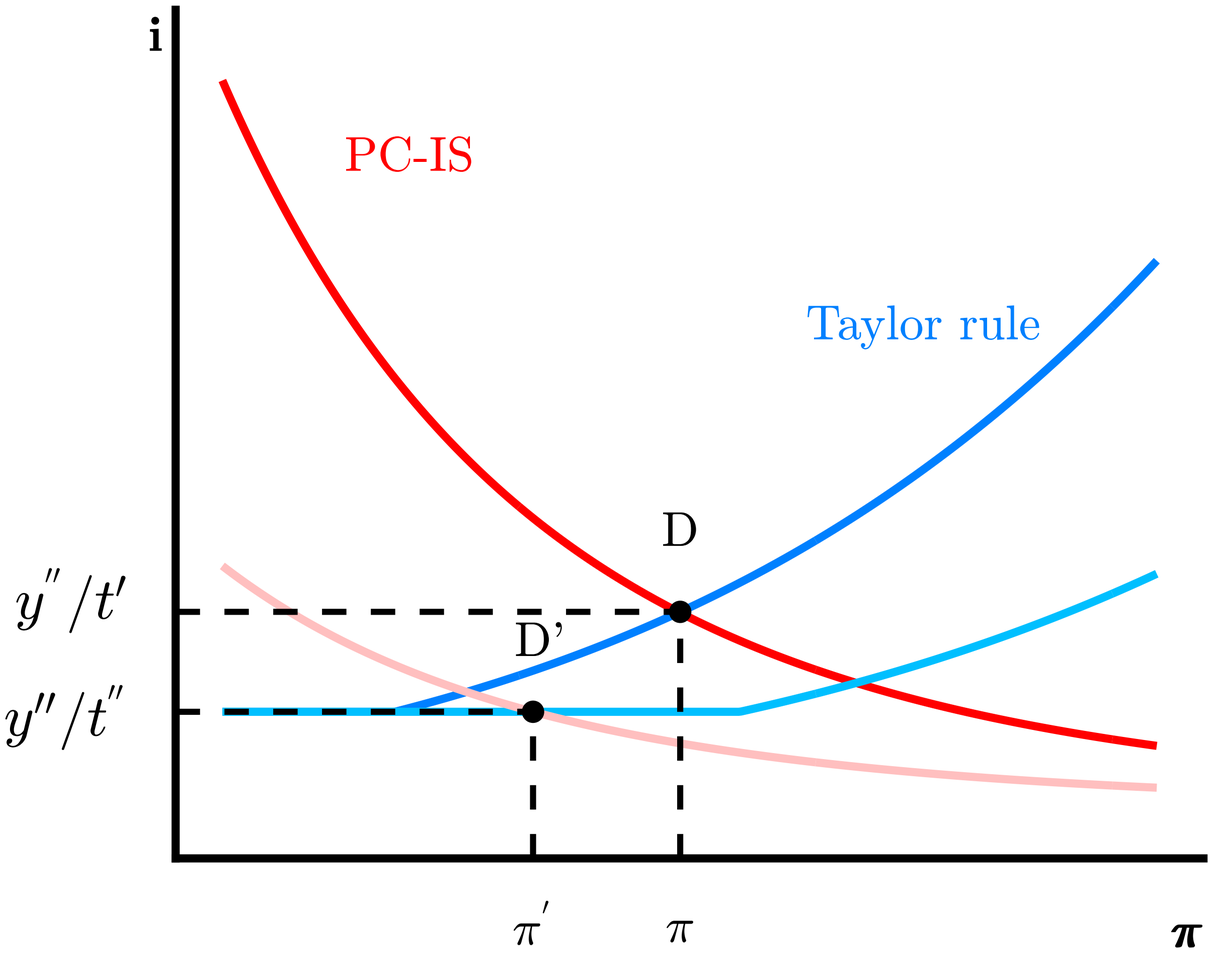
- Give in to fiscal pressure, want to "run economy hot"
- Move ***PT*** right-down, point ***D'***.
- Forever high inflation, lower returns to bondholders.
- But, norms adjust, ***PT*** goes up-left, policy keeps pushing right-down
- Forever higher inflation, shuffling between ***D*** and *D'*

Scenario 2. Forever-higher inflation



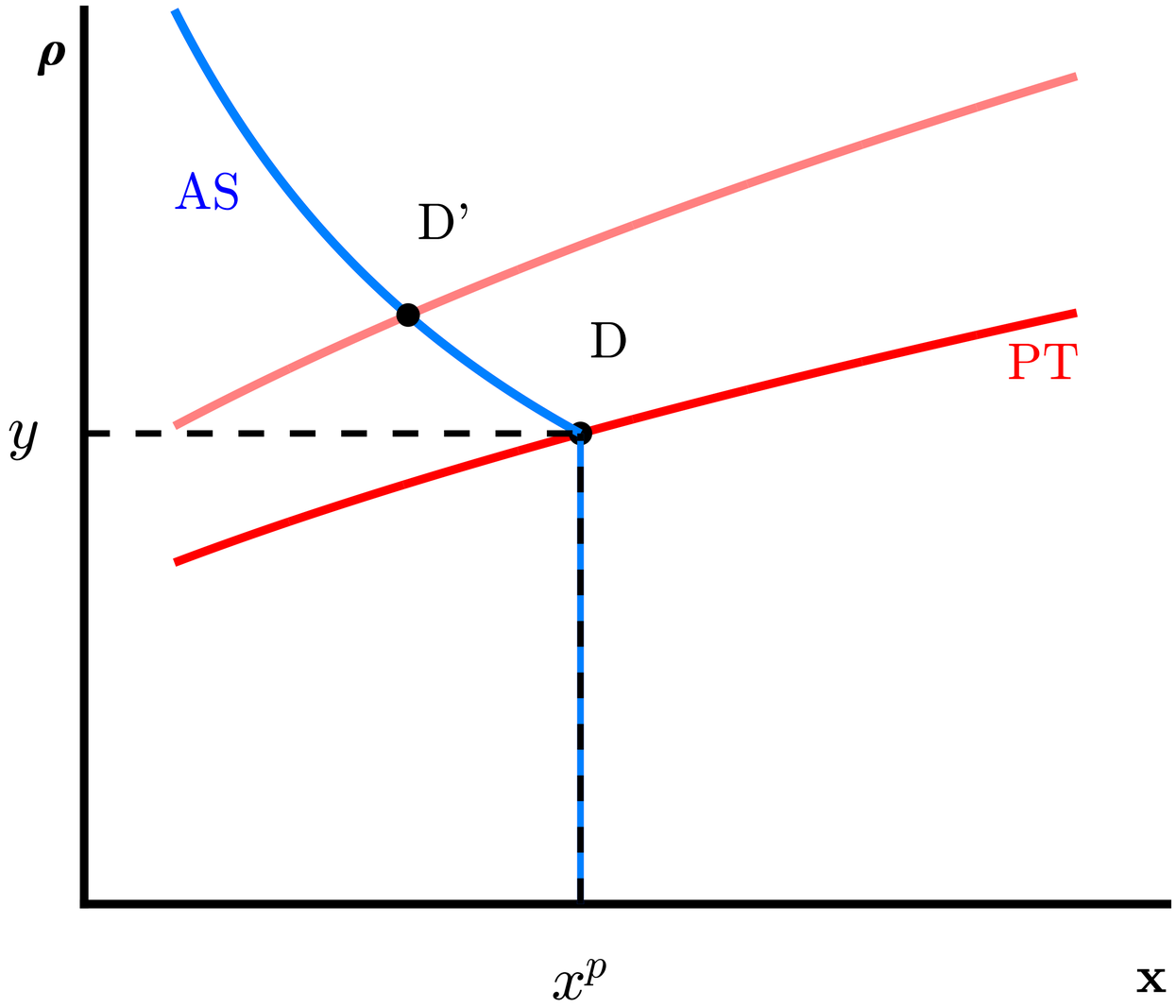
- This is achieved by too low policy rates, ***Taylor rule*** to the right-down
- First get point *D'*.
- But then ***PC-IS*** shifts right-up as expected inflation rises,
- Economy moves to *D"*, inflation higher, and so on, both forever shifting right.
- The 1970s.

Scenario 3. A double trap



- Say term premium (***t***) rises:
  (i) unwinding QE,
  (ii) higher inflation risk premia after recent inflation disaster,
  (iii) financial repression coming
- ***PC-IS*** left down, low inflation. Policy responds by forward guidance, but ZLB hits, end up at ***D'***
- The higher term premium offsets the higher long-term interest rate to leave policy rate near zero.

Scenario 3. A double trap



- Monetary policy cannot move ***PT*** to the right, since constrained by the ZLB.
- Fiscal policy neither: austerity given high yields, constrained by fiscal capacity
- Tight AD policy means ***PT*** up-left, economy at ***D'***, recession
- A stagnation trap.

CONCLUSION

Where is r* going?

- Forecasting may be hard, but ignoring the question is foolish
- This talk: distinguished four ***r****'s, proposed a framework, calibrated it with past trends, looked into the future.
- Scenario where ***y*** rises a lot, ***m*** falls some: loss of safety, global imbalances, public investment, AI optimism, (demography and inequality?)
- Three scenarios for ρ and i via π
  - Accept higher policy rates forever, inflation back on target
  - Persistent higher inflation, low-then-high policy rates, low-then-normal returns
  - Persistent low inflation, stagnation with under-employment, high returns