Econ 352 - Money, Banking, Price, and Monetary Policy

(See Williamson Ch. 12)

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Introduction

- Thus far our model is "real"–no money
- But money helps overcome frictions and itself may open the door to new frictions
- So let's try to put in money
- Most important relationship between real and nominal worlds: the Fisher relation
- But first: what is money?

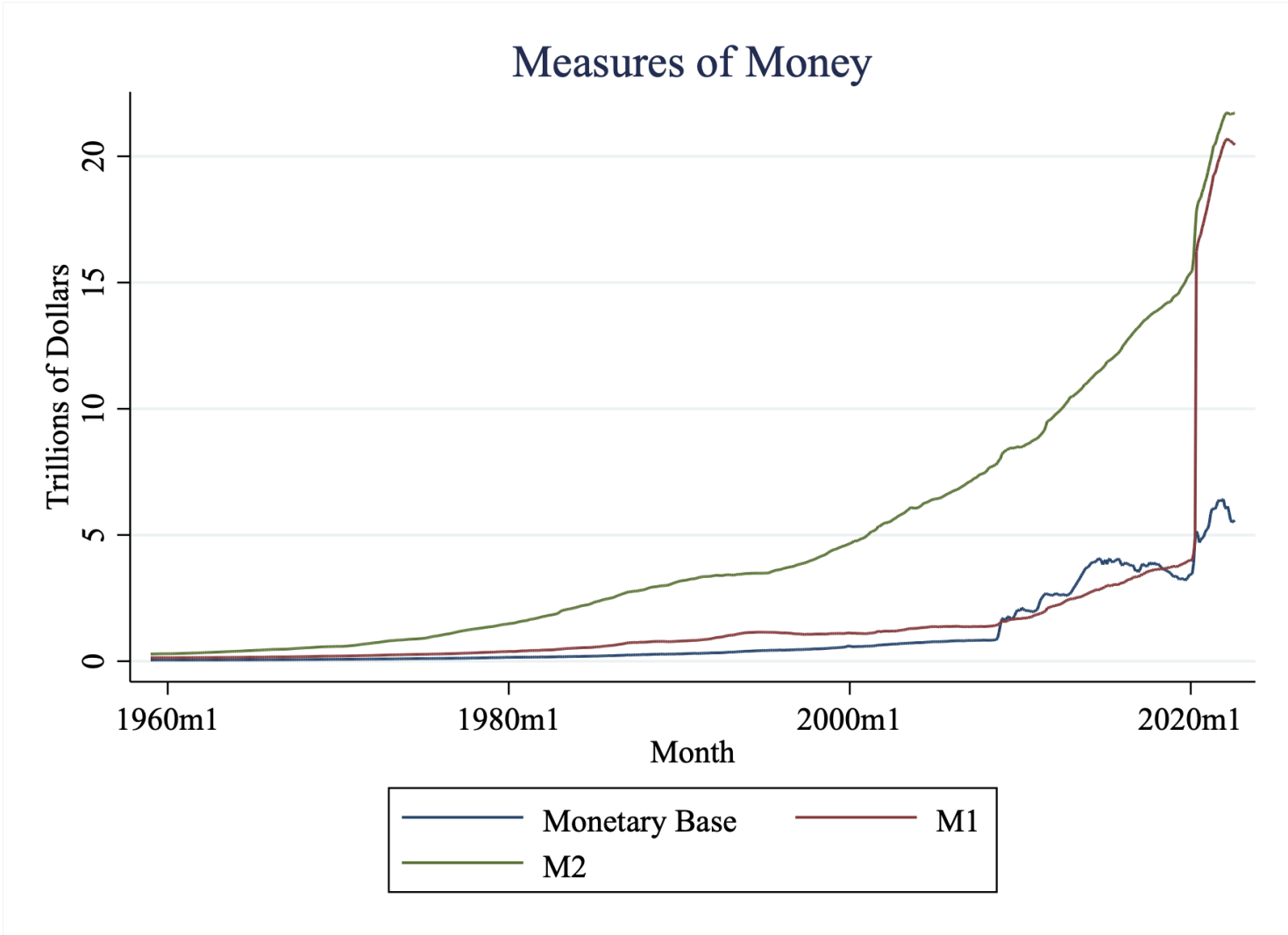
What is Money?

- Money has three functions:
  1. Medium of exchange: it's used to transact
  2. Store of value: money today can be used tomorrow
  3. Unit of account: we measure things in it
- The most important role is as a medium of exchange–stocks & bonds are stores of value
- How do we measure it?

Definitions of Money

- Many measures of money
  - M0, physical currency
  - Monetary Base: physical currency + bank deposits at Fed
  - M1: M0 + demand deposits at bank
  - M2: M1 + savings deposits, money market mutual funds
- Let's look at MB, M1, M2

Money over time



Monetary base was higher than physical currency & demand deposits briefly, because bank deposits at Fed (unrelated to demand deposits) were higher

Quantity of Money

- While the amounts of money have risen precipitously, it isn't a major focus of central bankers, as we'll see
- Instead, M will be treated as residual of another choice, rather than something to be controlled directly
- Rather than thinking about money demand directly, we'll first establish a relationship between real interest rates, nominal interest rates, and inflation, then about money demand

Fisher Relation

- Now, we have dollar assets.
- Call the "real" rate of interest r, the "nominal" rate of interest R, and the inflation rate i.
- Define the net inflation rate as the net change in the price level:

$$i = \frac{P' - P}{P}$$

- Invest \$1 today, get back $1+R$ dollars tomorrow. In real terms, invest real 1/P real goods today to get (1+R)/P' tomorrow:

$$1 + r = \frac{\frac{1+R}{P'}}{1/P} = \frac{1+R}{\frac{P'}{P}} = \frac{1+R}{1+i}$$

- This is known as the Fisher relation, which we sometimes write as:

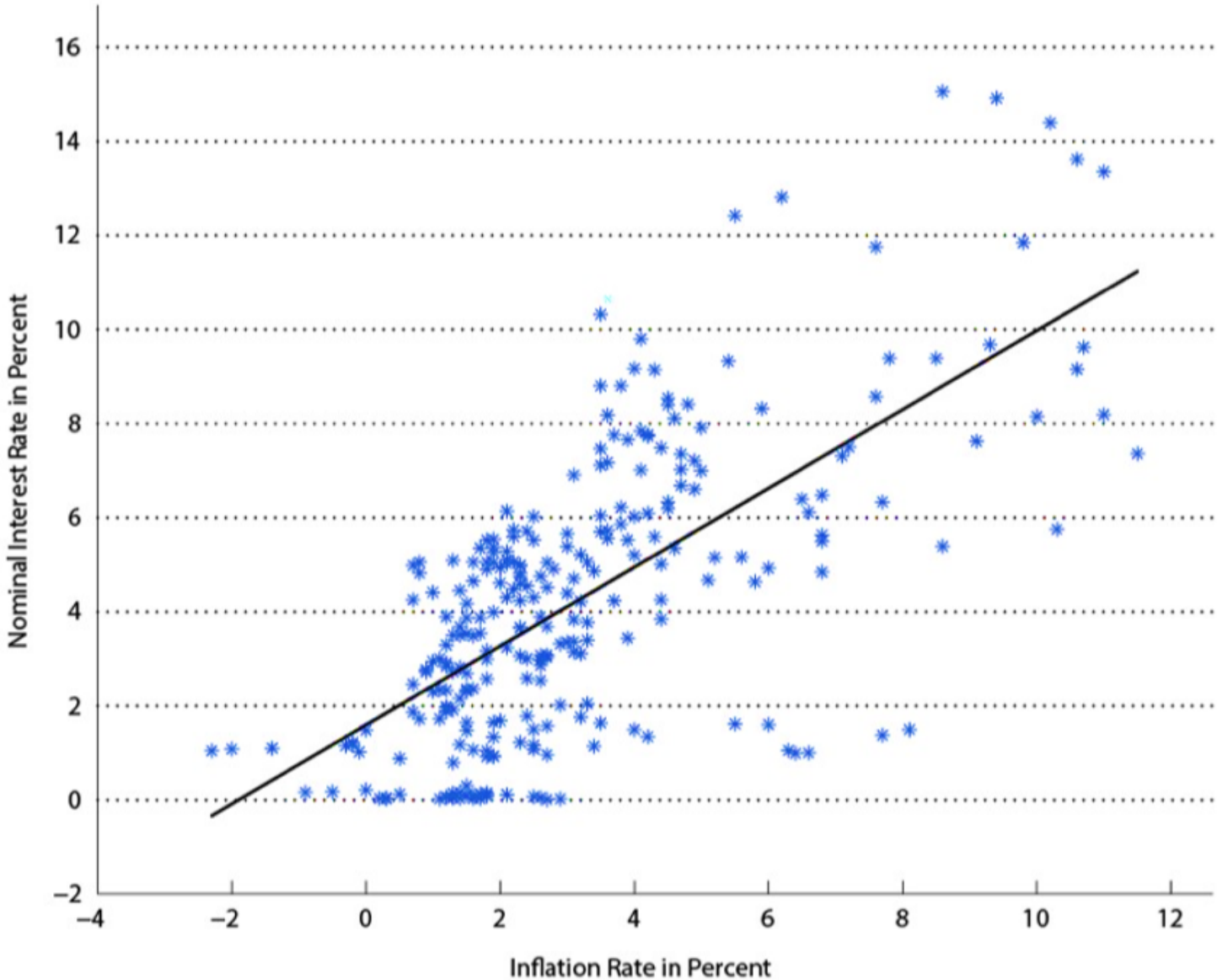
$$r = R - i$$

- This is a definition! Now the effect.

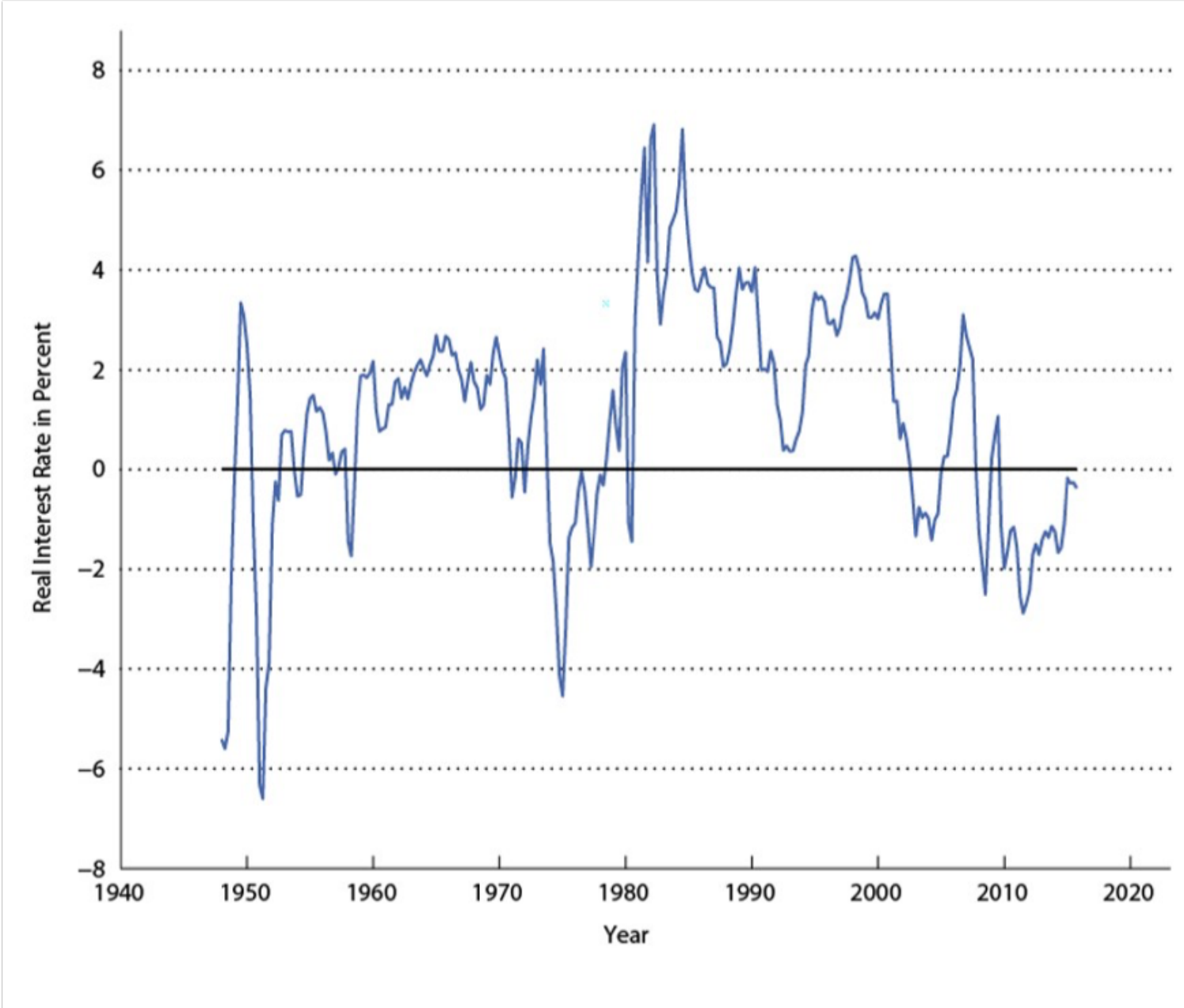
Fisher Effect

- Fisher effect: $\frac{dR}{di}\Big|_{r=\bar{r}} = 1$, nominal interest rates will follow inflation, if real rates are set by real economy/MPK
- Let's do a scatterplot with i on the x-axis and R on the y-axis
- We'll also show the real interest rate, calculated as $r = R - i$

Fisher Effect



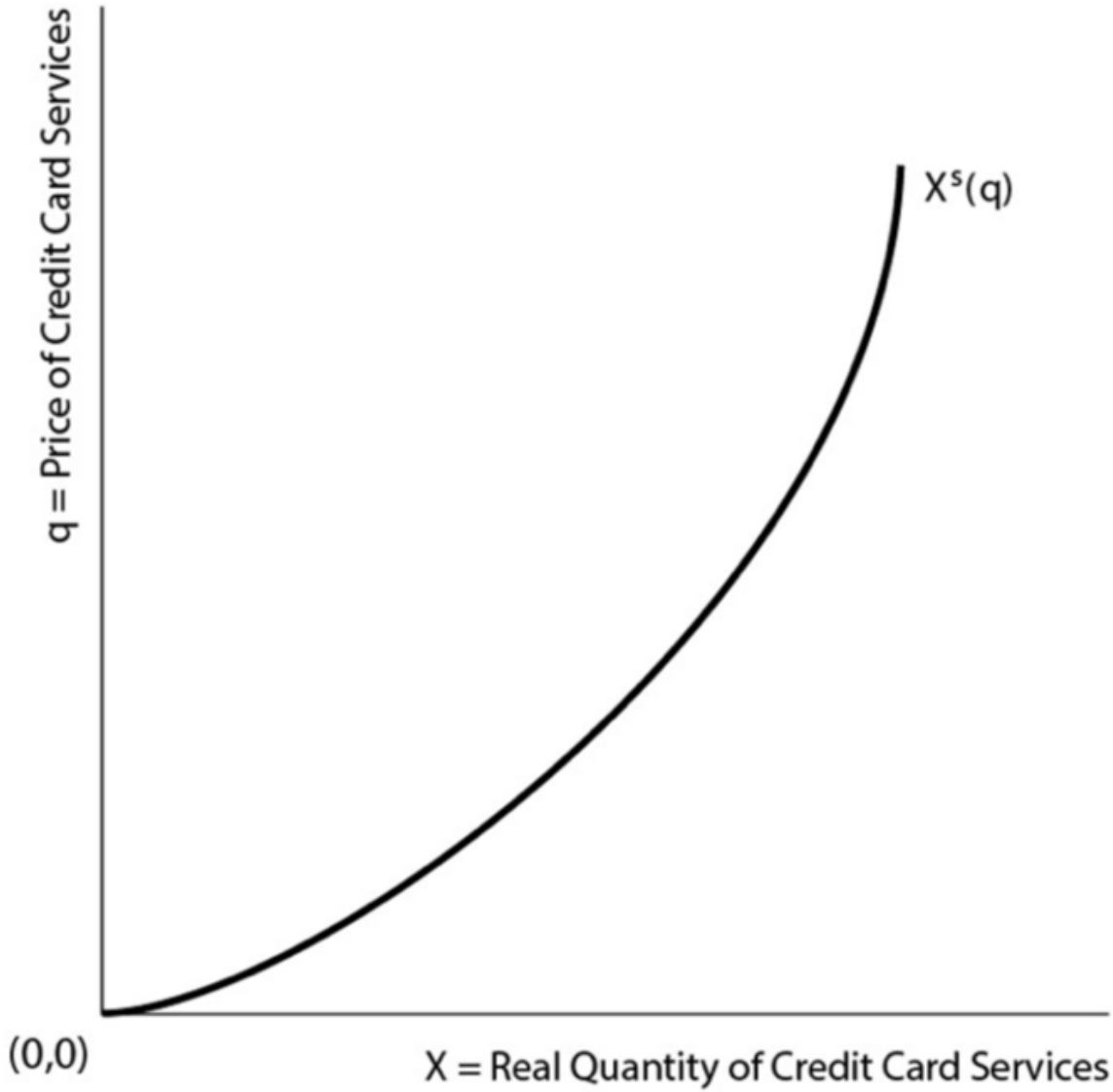
Real Interest Rate



Banks and Methods of Payment

- We need a market for money
- But there are many definitions of money!
- We'll have two big ones: actual currency (dollars and cents) and "other"
- Other means checks (15%), debit cards (38%), credit cards (21%), prepaid cards (7%), and ACH transfers (18%)
- We'll collapse all those "other" into "credit cards," which just means banks acting as an intermediary to create IOUs
- Credit cards cost money to operate, and so sell for some price q. Credit card supply curve is thus $X^s(q)$

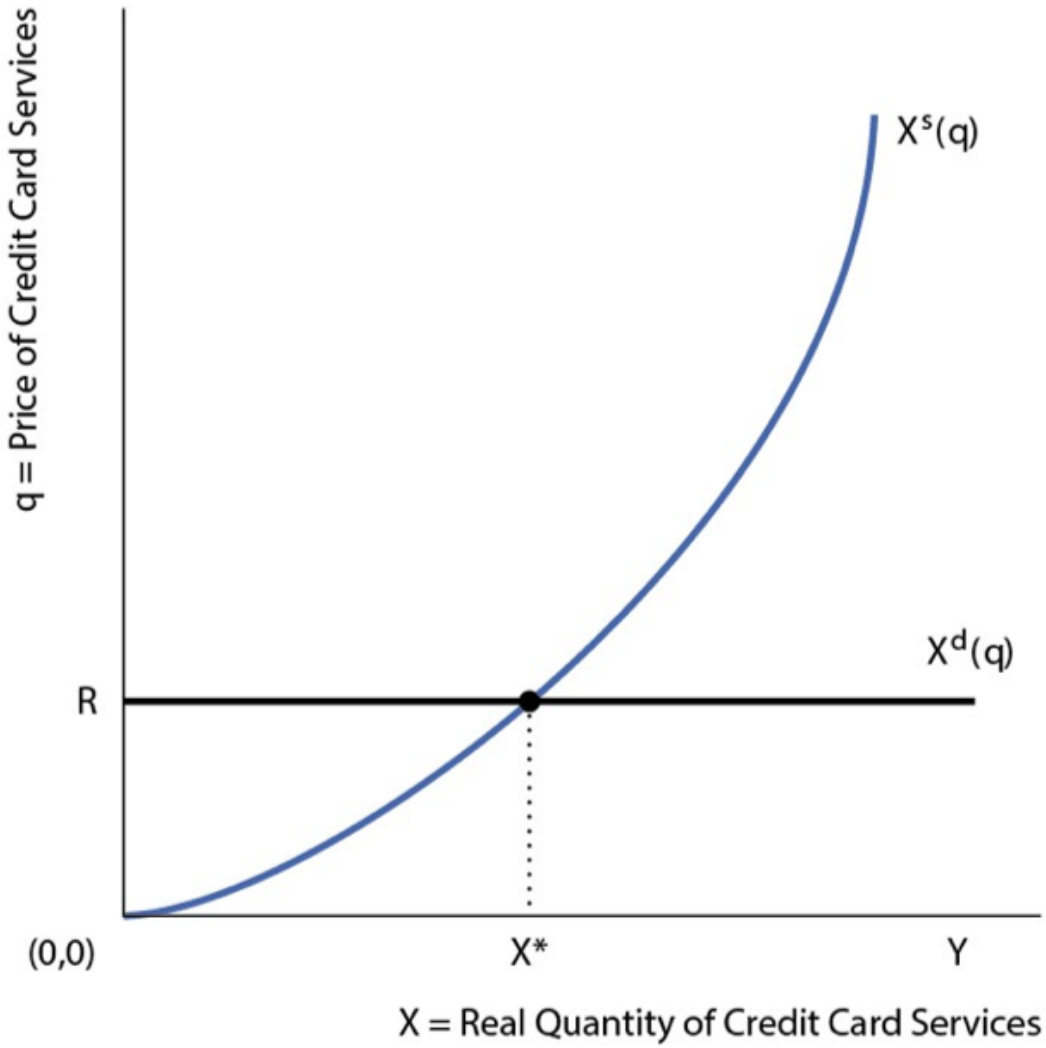
Credit Supply



Credit Demand

- Households have spending Y, and purchase $X^d(q)$ of it with credit cards, and $Y - X^d(q)$ in cash
- What is marginal benefit, marginal cost of credit?
- If purchase with credit, then over course of month make $P(1+R)$, but must pay $P(1+q)$ units to the credit card company
- Can see that for households to be on interior solution (do both) need $q = R$, perfectly elastic demand
- Now we have equilibrium

Credit Supply & Demand



Equilibrium

- What happens when nominal interest rates rise?
- Benefit to using credit increases
- Demand shifts up, so we shift out on the credit supply curve
- And we can write money demand as the amount of dollars we need for our non-credit transactions, where X^* is the equilibrium credit demand/supply:

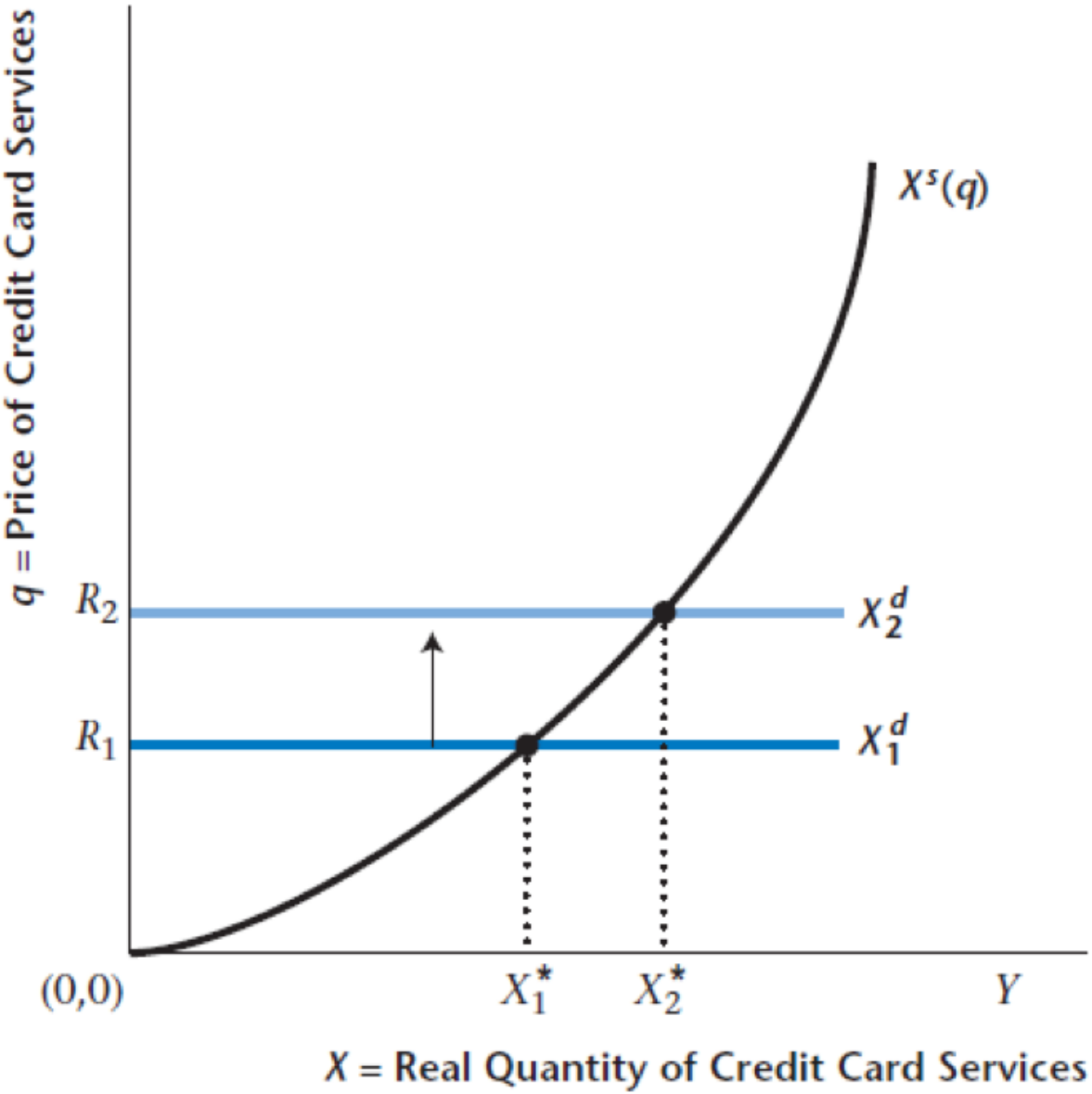
$$M^D = P(Y - X^*(R))$$

- Which we can instead write using the real money demand function L as:

$$M^D = PL(Y, R)$$

- Money demand is increasing in Y and decreasing in R

Effect of Nominal Interest Rate on Credit



Money Demand

- Money demand is:

$$M^D = PL(Y, R)$$

- Or:

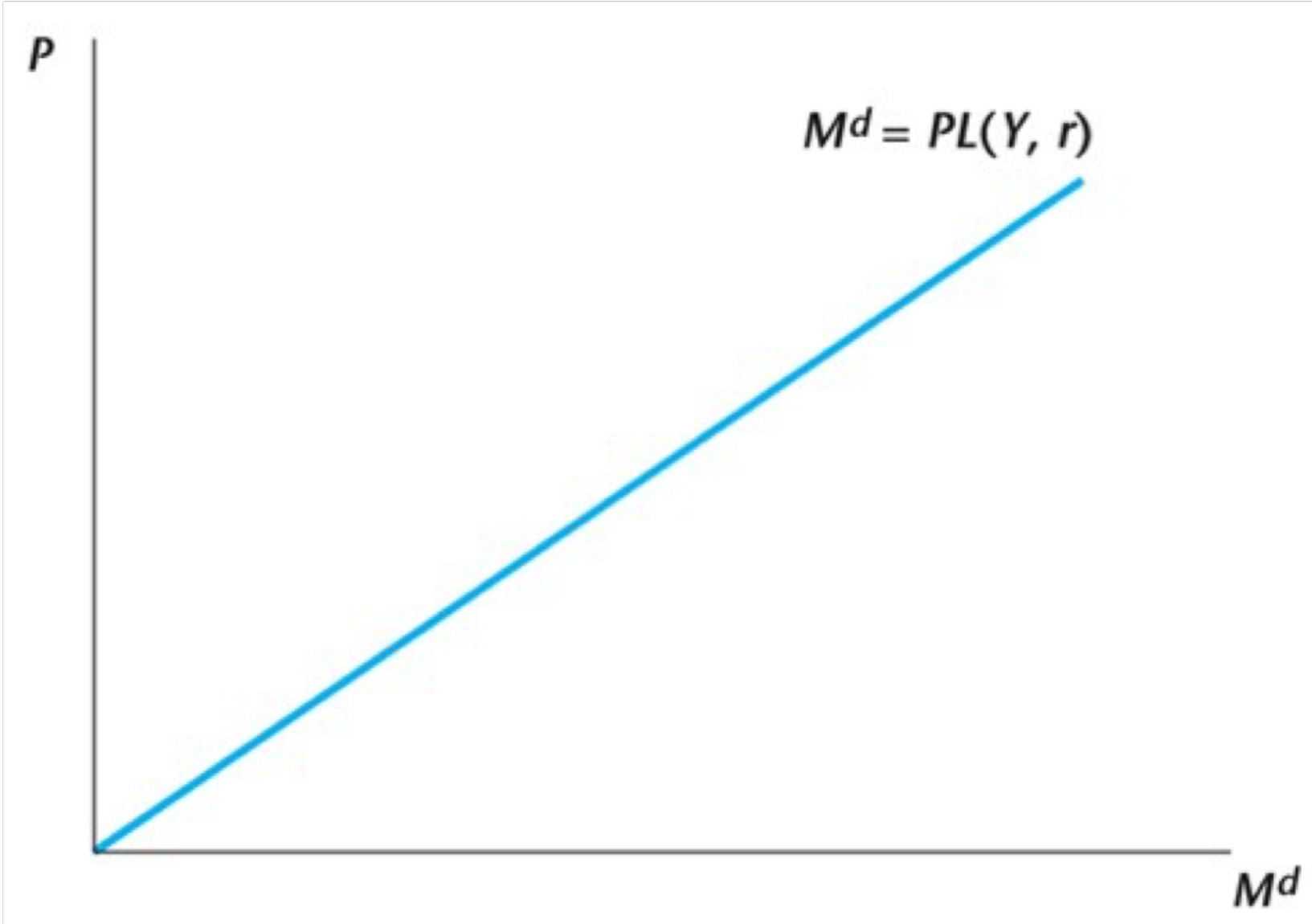
$$M^D = PL(Y, r + i)$$

- For now, ignore i (assume zero) and just look at r:

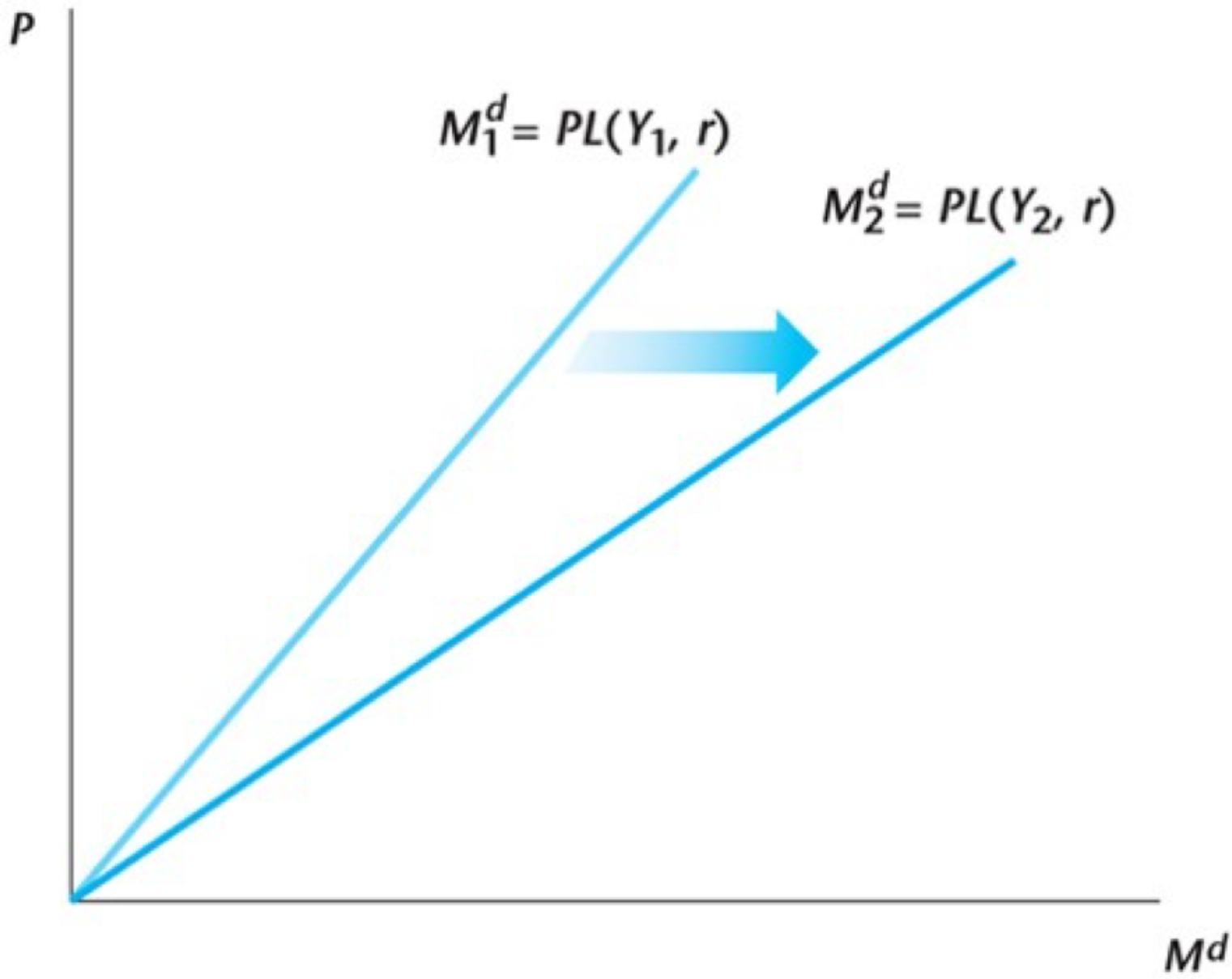
$$M^D = PL(Y, r)$$

- Graph out P as a function of M^d and how it shifts when Y increases

Money Demand



Increase in Money Demand



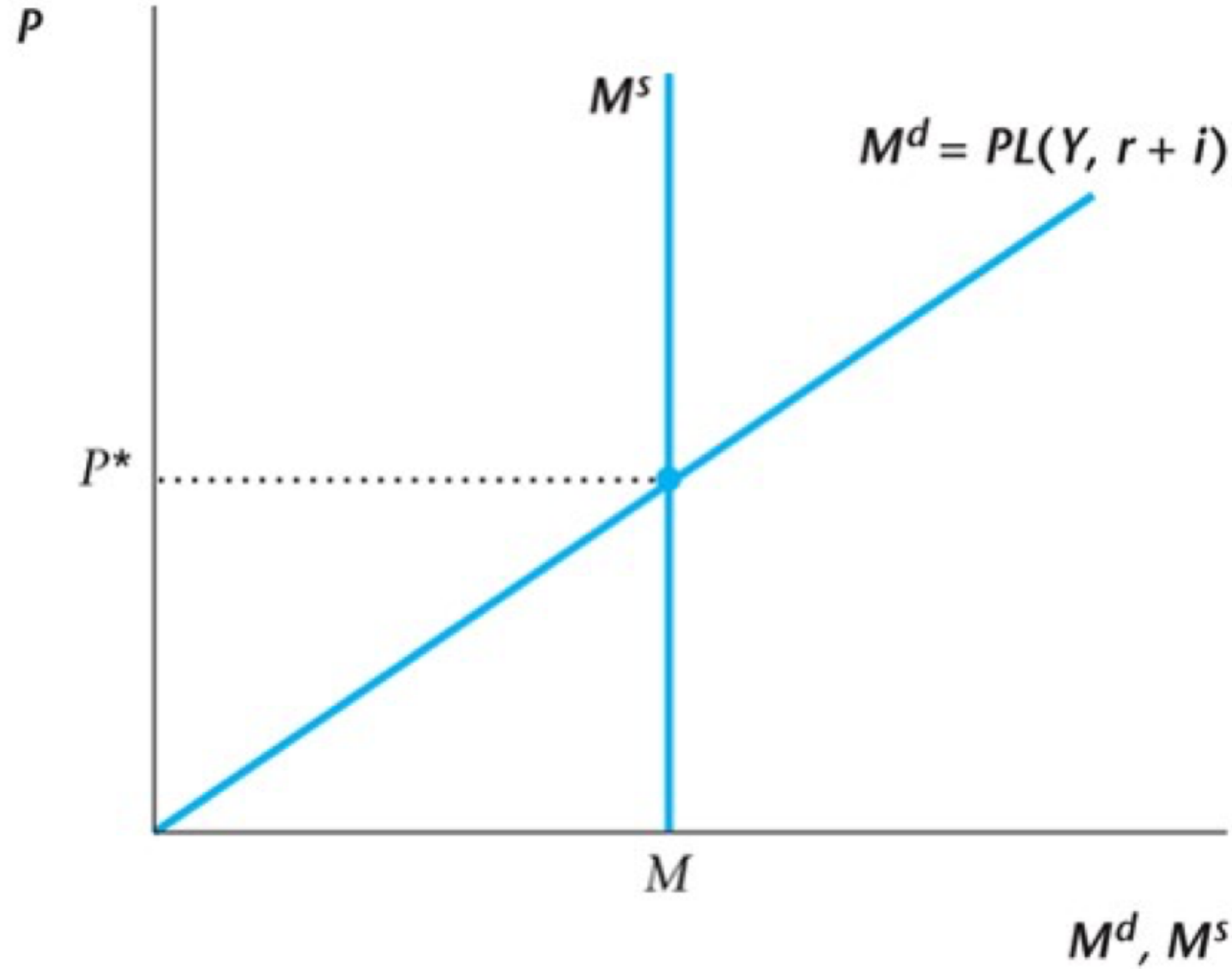
Money Supply

- We assume government prints money M
- Government budget constraint:

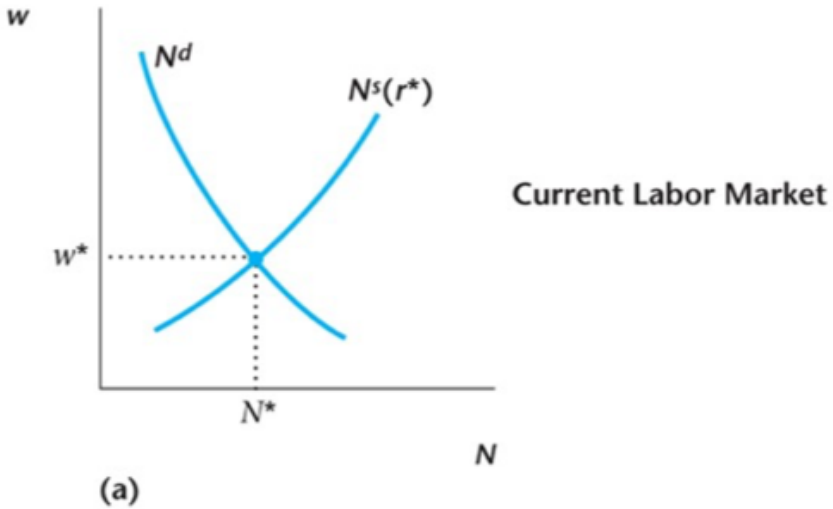
$$PG + (1 + R^-)B^- = PT + B + M - M^-$$

- Where PG is nominal expenditure
- $(1 + R^-)B^-$ is retired debt+interest on last period's bonds
- PT is nominal taxes
- B is newly-issued bonds
- $M - M^-$ is newly-issued money
- Now we have money creation and a source for money supply
- In equilibrium, $M^s = M$, and the price level is determined

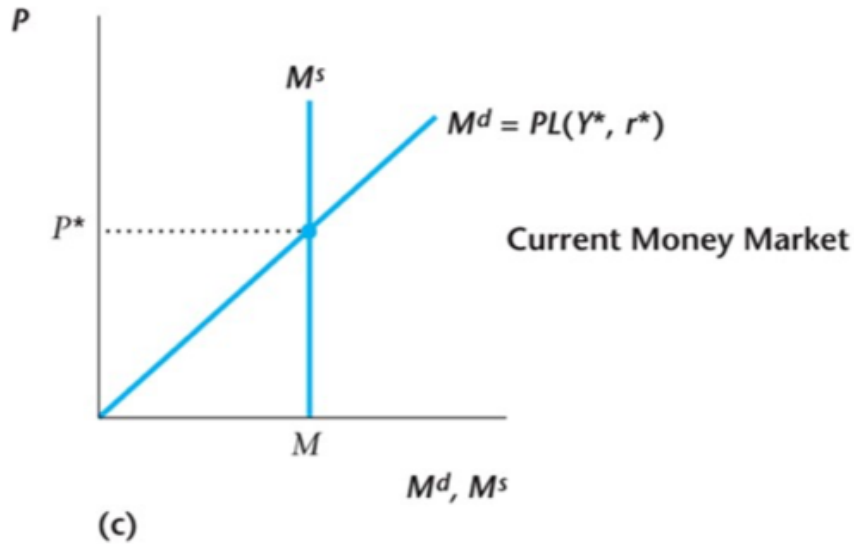
Money Supply=Money Demand gives Price Level



Adding in the Price Level to our Intertemporal Model



Current Labor Market



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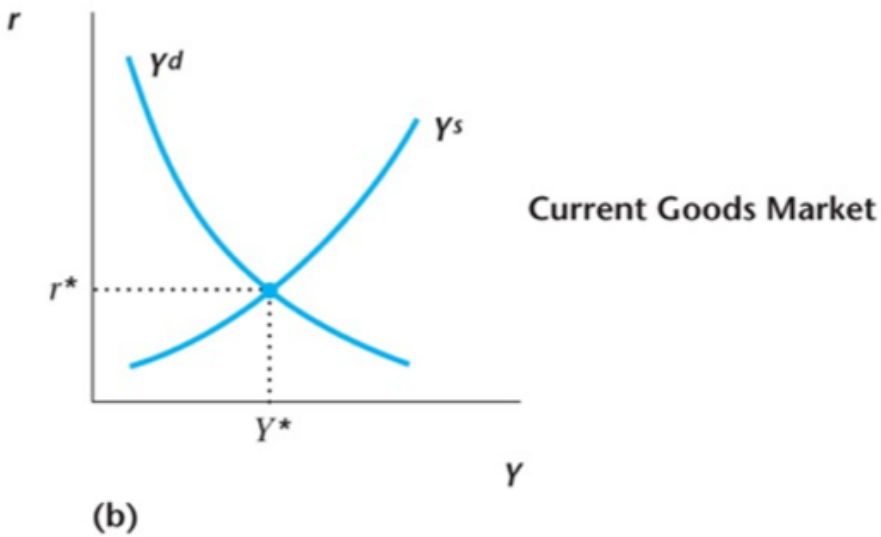
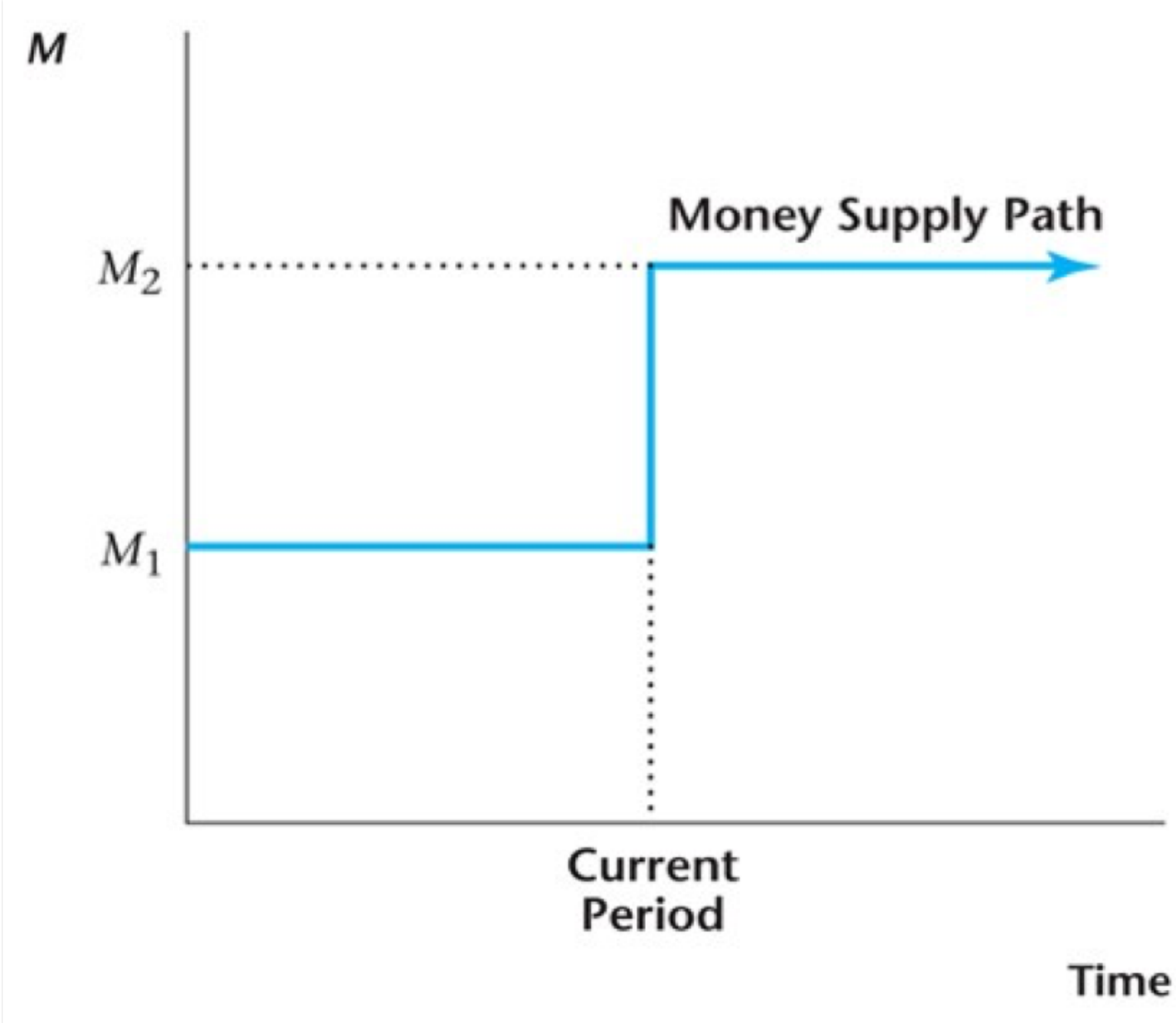


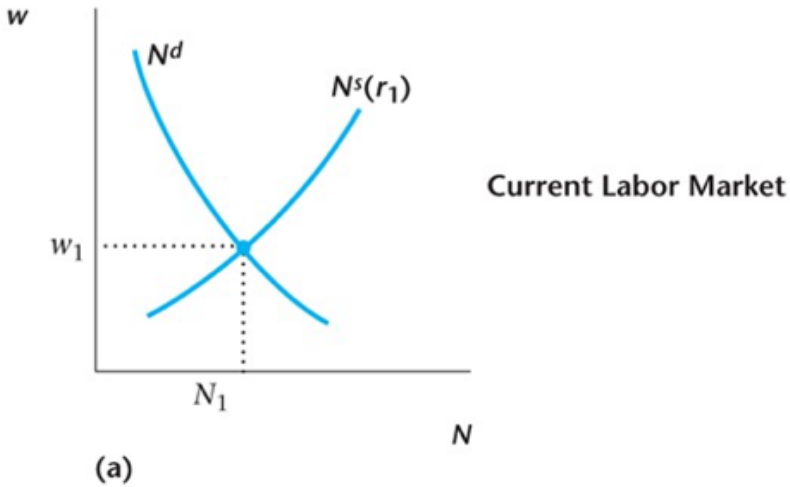
Current Goods Market

Monetary Neutrality

- Let's run a one-time experiment of money creation



Monetary Neutrality



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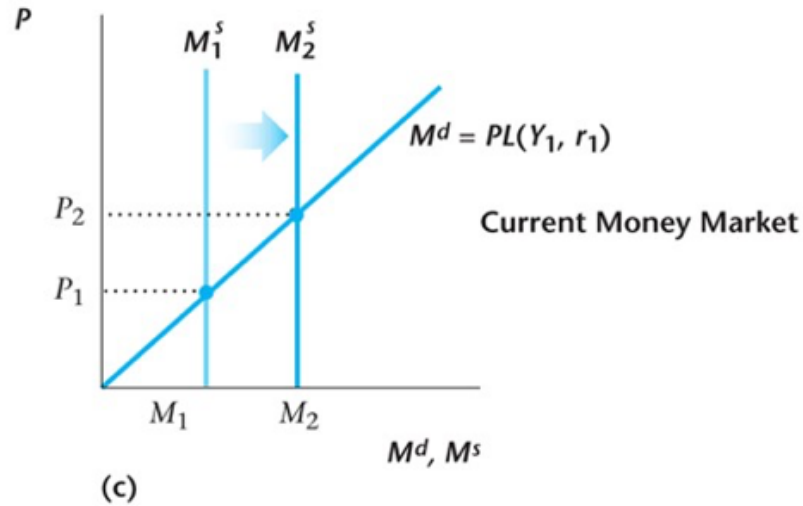
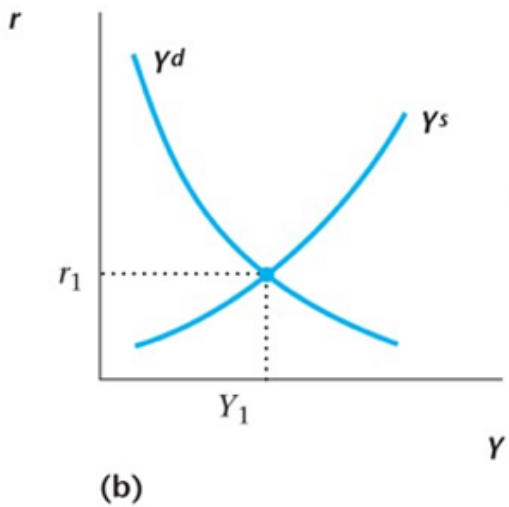


Current Money Market



Current Goods Market

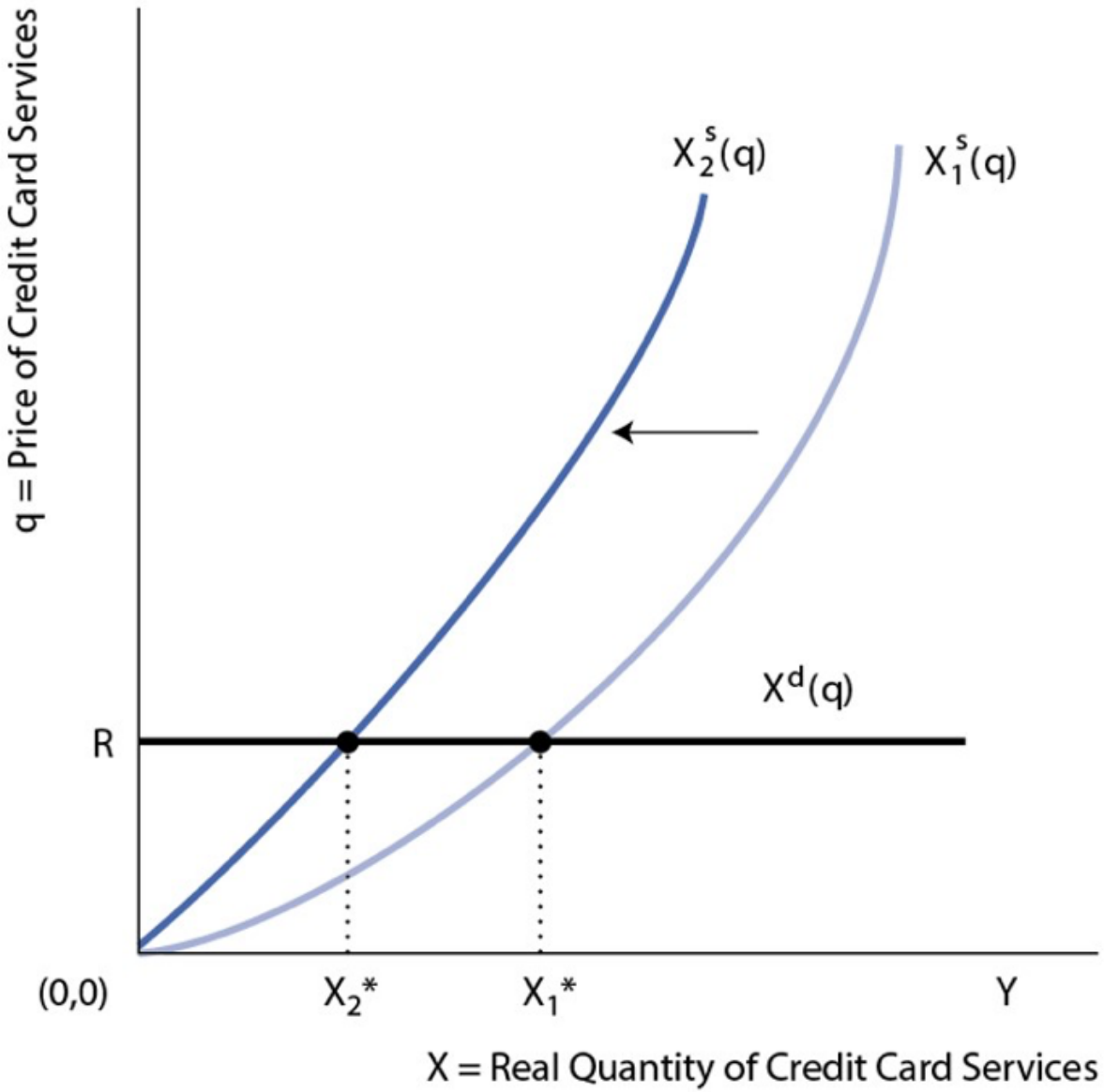
Monetary Neutrality

- Q: Why is money neutral?
- A: It doesn't enter into any of the decisions people make, which are based on *real* considerations (real wage, real interest rate)

Shifts in Money Demand

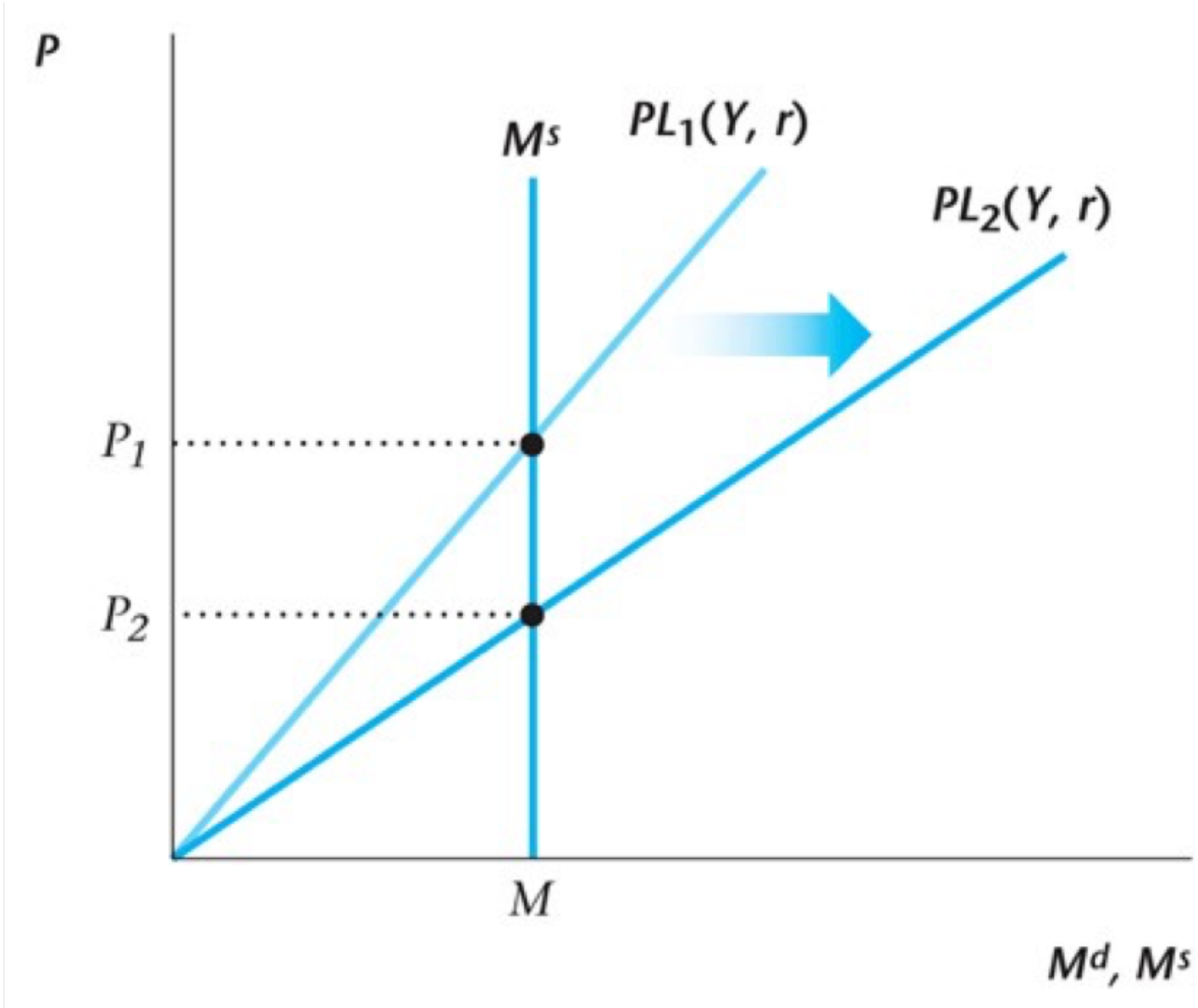
- What happens when there's a shift in money demand? For instance, because the supply of credit becomes tighter
- Higher demand for money
- Price level falls

A Shift in the Supply of Credit Card Services



Higher costs of credit decreases credit use

Demand for money increases when credit becomes tighter



Shocks to Money Demand

- What might shock the money demand function?
  - New information technologies like ATM's
  - New financial instruments like sweep accounts
  - Changes in government regulations
  - Fear of banks
  - Day-to-day fluctuations (treasuries purchased that day, for instance)

Shocks to Money Demand

- Okay, so we have a model of price, and how it relates to credit services and money demand and supply
- It seems like the central bank can control P by controlling M, so why did we say it doesn't target/"think about" M very much?
- Let's look at $L(Y, R)$ in the data

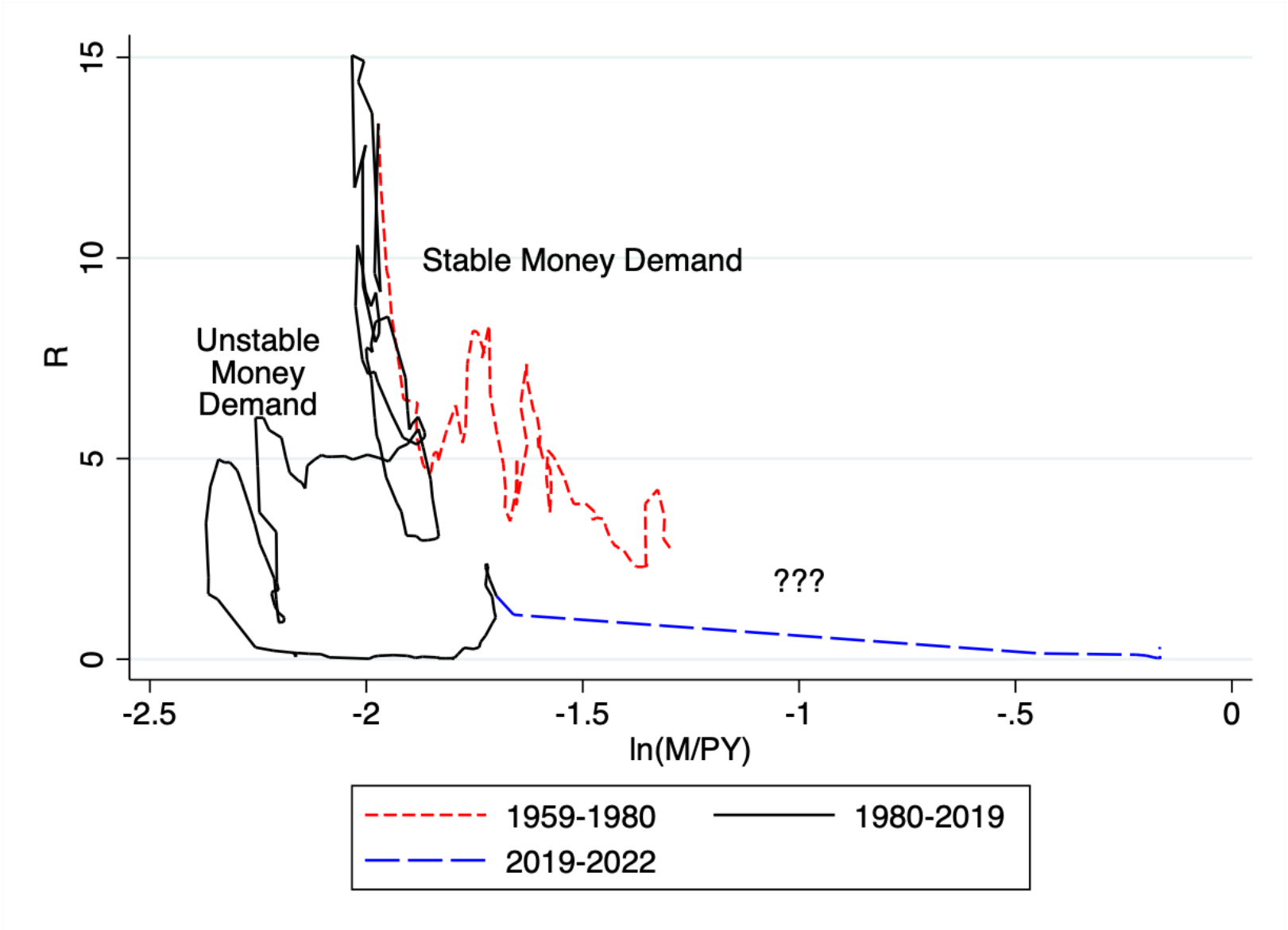
Fitting the Money Demand Function

- Let's say we want to match theory and data to answer the question: "is money demand stable?"
- Let's try to fit: $L(Y, R) = Ye^{aR}$, where a is a parameter to be estimated
- Then in equilibrium: $M = PYe^{aR}$, or taking logs:

$$\log\left(\frac{M}{PY}\right) - aR$$

- Let's graph it!

Money Demand Instability

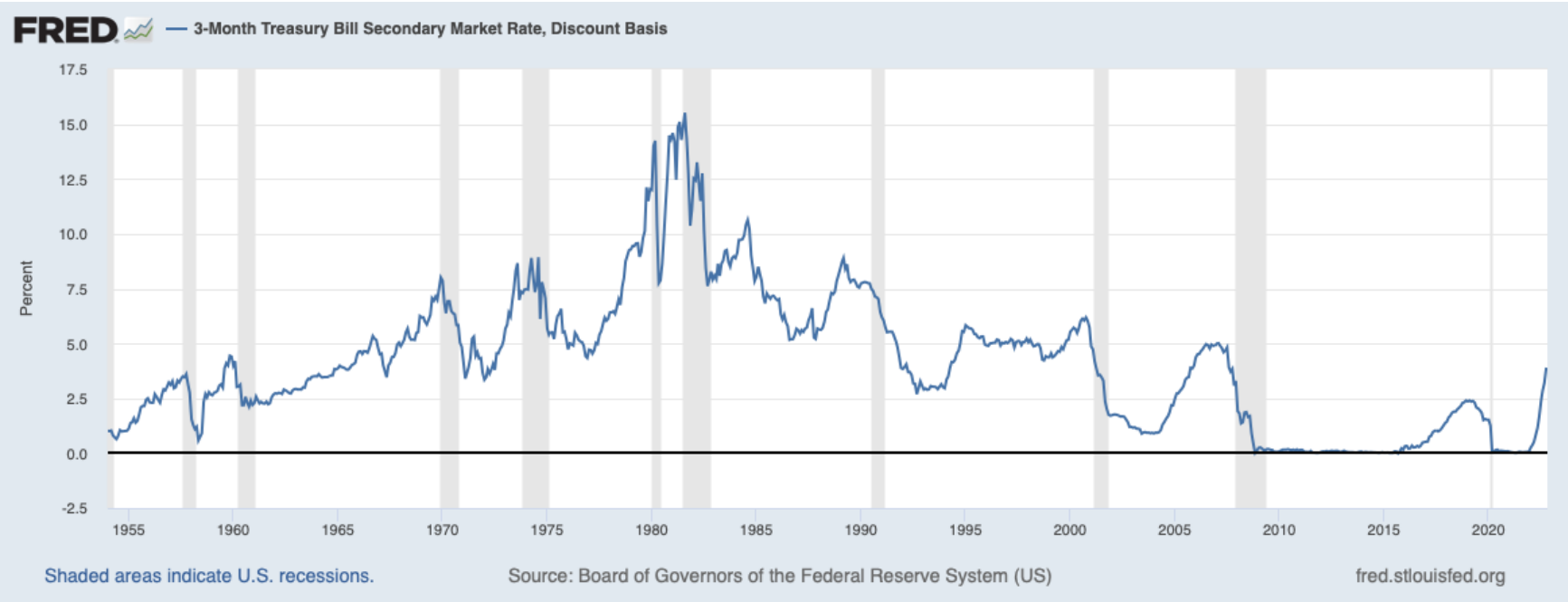


Money demand is not very stable post-1980!

More Modern Monetary Policy

- 1970's were dominated by high money supply growth and high inflation
- "Monetarists" called for reducing money supply growth to control inflation
- This occurred, and inflation cooled–but the instability in money demand meant money supply wasn't a fine tool for controlling inflation
- Now: eight Federal Open Market Committee Meetings/year, choose the "federal funds rate", (short-term R)
- Buy/sell treasuries until market R is target R.
- But, a problem–what if target $R < 0$? "zero lower bound"

We hit the "zero lower bound"



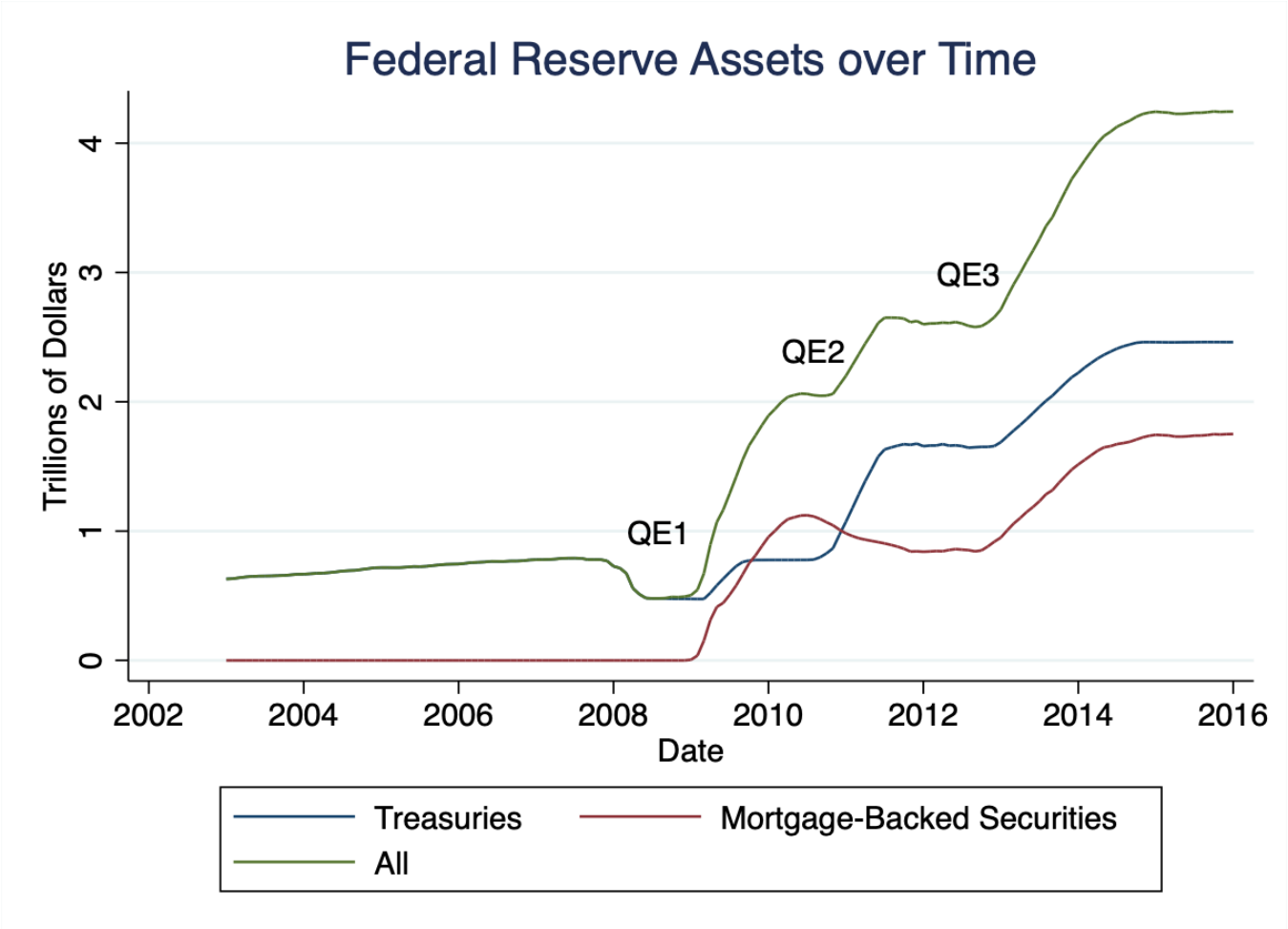
Zero lower bound

- Targeting R worked well for a while
- But, a problem–what if target $R < 0$? "zero lower bound"
- Bank can't force people to accept less than zero–otherwise just hold cash
- When $R = 0$, then bonds and money are the same (both return zero) so Fed can't do anything by switching bonds and cash: open market operations are useless

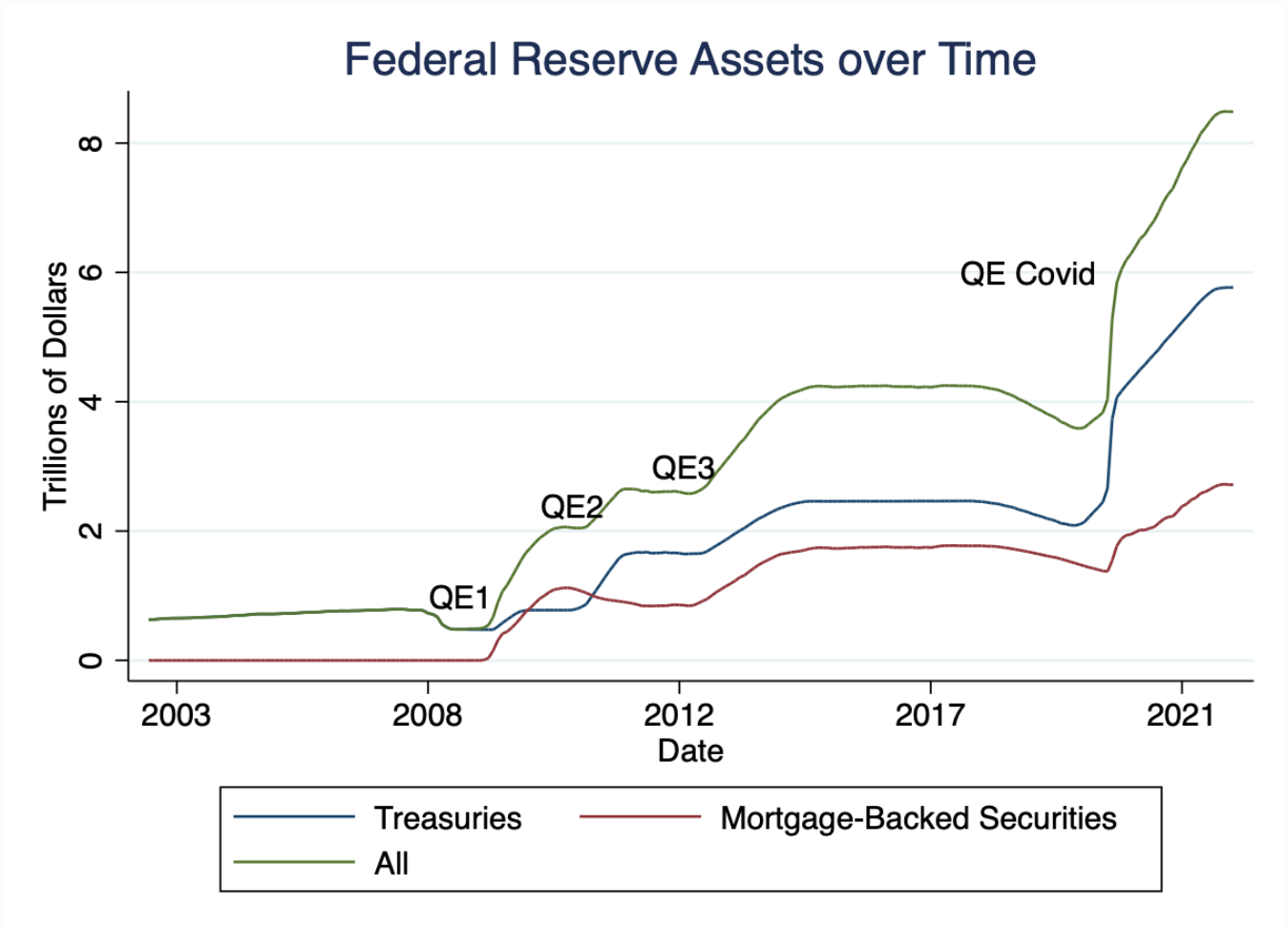
Quantitative Easing

- What can we do at the zero lower bound? Short-term B and M are equivalent
- Could exchange longer-term B for M!
- This is the heart of "quantitative easing," purchasing longer-term securities (shifting demand for such assets out) to drive down prices (interest rates)

QE


Federal Reserve Assets over Time
Trillions of Dollars
0
1
2
3
4
2002
2004
2006
2008
2010
2012
2014
2016
Date
QE1
QE2
QE3
Treasuries
Mortgage-Backed Securities
All

QE-New!


Federal Reserve Assets over Time
Trillions of Dollars
0
2
4
6
8
2003
2008
2012
2017
2021
Date
QE1
QE2
QE3
QE Covid
Treasuries
Mortgage-Backed Securities
All

Summary

- Now we have money in our model!
- But it doesn't do much...monetary neutrality!
- Evidence monetary neutrality is true!
- Can analyze the effects of different shifts on the price level
- Can discuss monetary policy: OMO, QE