Lecture 10:
Money, Inflation, and Output

Macroeconomics (Quantitative)

Econ 101B

Jón Steinsson

University of California, Berkeley

Monetary Economics

- The role of money in the economy is one of the most mysterious aspects of economics
- Key questions:
  - What gives money value?
  - Why does its value change over time?
  - How and why does monetary policy affect output and employment?
- Keynesian economics / financial crises
- But we start with a parable

Great Babysitting Co-op Crisis

- Capitol Hill Babysitting Co-op
  - 150 couples
  - Exchange babysitting services
  - Use coupons (“scrip”) to keep track of things
    - Coupons are the “money” in the babysitting economy
  - Each coupon pays for ½ hour of baby sitting
    - “Constitutionally fixed” price

“Money” in the Babysitting Economy

- Early on:
  - Couples got 20 coupons upon entry
  - Must give back 20 coupons upon exit
- Everything worked well for a while
- But … quantity of coupons fell over time:
  - Some coupons lost in washing machine
  - Dues exceeded expenses
- Each couple had less and less coupons

Crisis in Babysitting Economy

- Each couple felt it didn't have enough coupons and started to try to acquire more
  - Everyone wanted to sit, but no one wanted to go out
- Does this work in the aggregate?
  - No! For someone to sit, someone else must go out.
  - So, the baby-sitting economy fell into recession. There was a fall in GBP (Gross Babysitting Product)
  - Lots of workers wanted to work but no one wanted buy what they produced

Crisis in the Babysitting Economy

- Being a bunch of lawyers, they:
  - Passed a bylaw: Everyone must go out at least every six months.
- Didn't work
- Finally, they resorted to monetary policy:
  - Everyone got 10 additional pieces of scrip
  - Each new couple gets 30 upon entering
  - Must give back 20 upon leaving
- Miraculously: Gross Babysitting Product boomed!!

New Problem in Babysitting Economy

- Balance of money supply:
  - New system implied that turnover of couples increased "money supply"
  - Dues and natural loss decreases money supply
- If there is "too much" turnover, couples will have more coupons than they need
- How do they react to this?
  - Everyone wants to go out.
  - No one wants to sit
  - Goods shortages

Lessons from the Babysitting Economy

- Too little money: Recession (too little demand)
- Too much money: Shortages (too much demand)
- Goldilocks economy:
  - Just the right amount of money
  - Balance between desire to produce and desire to consume
- What is the market failure?

What is Money?

- Lay English: “That person has a lot of money”
  - “That person is wealthy”
- In Economics:
  - “Money” has more specific meaning
  - Roughly: The asset that people use as a medium of exchange (whatever they use to make payment) and unit of account (post prices and wages in terms of)

Many Things Have Been Used As Money

- Cowrie shells, cattle, tobacco, beaver skins, etc.
- Island Yap: Large Stone wheels
- Iceland in Viking times:
  - Word for money same as word for sheep: “fé”
  - Money in viking times:
    - 1 cow = 6 sheep (with wool and young)
    - 1 sheep = 20 “forearms” of woven wool
    - 1 “forearm” of woven wool = 2 fish
- Precious metals: Gold, silver, bronze, etc.
- Prisons: Cigarettes
- Pieces of green paper with picture of George Washington

Traditional Functions of Money

1. Medium of Exchange
   - People can pay for things they purchase using money
2. Unit of Account
   - People generally quote prices and wages in terms of units of money (e.g., in dollar in the U.S. today)
3. Store of Value
   - People may hold money so as to be able to buy something tomorrow or later

Money in the U.S. Today

- Unit of Account:
  - Prices and wages are posted in “US dollars”
  - US dollar is clearly the unit of account in the US
- Medium of Exchange:
  - Complicated! Coins and bills not only medium of exchange
  - Debit cards, checks, credit cards, Venmo, Paypal, etc.
  - In most cases a bank deposit is real medium of exchange
- Store of value:
  - Coins and bills not important store of value (don’t pay interest)
  - Many other better stores of value (stocks, bonds, real estate, etc.)

The Purpose of Money

- Money is a device to lower transactions costs

- Instructive to start by thinking about money in a “primitive” society (i.e., one that involves little trade and specialization)
  - Helps us think about basic properties of monetary economics
- We will then add more and more “modern” elements until we arrive at a fully modern setting

Society of Yeomen Farmers

- Each household is self-sufficient in everything
  - Produce everything they consume
  - Make their own food, clothing, shelter, etc.
- No trade
- What is the role of money in such a society?
- Money has no role!
  - If there is no trade, no need for money
  - Money is a device for lowering transactions costs

Society of Yeomen Farmers

- At some point someone realizes they are particularly good at making, say, shoes
  - Specializes in making shoes
  - Sells shoes to others in exchange for other things
- Over time, more and more people specialize
- Important question arises:
  - How will trade work?

Specialization and Trade

- Baker makes bread, Shoemaker makes shoes, Janitor cleans, Teacher teaches, etc.
- How does trade work?
  - Barter trade: Baker and shoemaker exchange bread for shoes
- Problem: If teacher wants bread but baker doesn't want a math lesson, no scope for trade.
- Lack of double coincidence of wants
- What needs to happen?

Something Becomes Money

- Shoemaker may take bread as payment for shoes even if she doesn't want bread (Why?)
- Bread may thus becomes "money"
- Bread not ideal money (Why?)
- Baker can solve this problem by issuing bread tokens
  - Pieces of paper that entitle bearer to one loaf of bread
- Bread tokens circulate and become medium of exchange, i.e., become money

Bread Tokens as Money

- What are potential problems with this?
  - Counterfeiting!
    (Huge problem through the ages)
  - Baker may issue “too many” tokens
    (issuing tokens likely to be highly profitable)
  - Baker may “default” on tokens
    (i.e., not be able to deliver loaves of break on demand)
  - If people doubt baker’s ability to deliver, the may rush to convert tokens into bread (i.e., run on the baker (financial crisis))
  - Value of tokens depends on people’s confidence in baker

What Characteristics Should Money Have?

1. Durable
2. Easily measured
3. Easily transferable
4. Easily divisible
5. Have stable value

The point of “money” is to lower transaction costs

Stable Quantity of Money

- Many people think that stable quantity is a desirable characteristic for money
  - E.g., Satoshi Nakamoto (creator of bitcoin)
- Not clear that this is true
- Stable value is what we are really after!
- If demand for money fluctuates, while quantity is fixed, then price of money will fluctuate (e.g., bitcoin)
- This will mean value is not stable

Why Gold and Silver?

Gold and Silver were dominant forms of money for many centuries. Why?

1. They are durable
2. Easily measured (Especially after advent of coinage)
3. Easily transferable (high value relative to volume and weight)
4. Stable value?

Our First Monetary / Business Cycle Model

- Goal: Understand influence of money on output and inflation
- Complicated subject. We do this in steps.
- First model: Medieval Economy
  - Contains certain central ideas in simple form
  - Leaves out many aspects of reality
  - We will add these one-by-one over the next few weeks

Money and Transactions

- Only medium of exchange: gold coins
  - All payments made with gold coins
  - Gold is only asset people accept as payment in transactions
- In every transaction, gold coins much change hands
- People hold money to be able to engage in transactions
  - Just like scrip in babysitting economy
- Transactions based demand for gold coins

Demand for Money

- People's demand for money (gold coins) is proportional to the nominal value of output:

$$M_t = kP_tY_t$$

  - Y_t is real value of output
  - P_t is the price level
  - k is a (constant) parameter
- P_tY_t is the nominal value of output

Demand for Money

$$M_t = kP_tY_t$$

- Our money demand curve is motivated by the following ideas:
  - Amount of money people hold is increasing in nominal value of transactions they engage in
  - Nominal value of transactions is increasing in the nominal value of output
- But these are rather loose notions
  (ours is a simple model)

Quantity Equation

- Define: $\mathrm{V} = {}^{1}/_{k}$
- We can rewrite the money market equilibrium:

$$M_t = kP_tY_t \quad \Rightarrow \quad M_tV = P_tY_t$$

- Velocity of money:
  - "Number of times each gold coin must change hands per year" (catchy but overly simplistic idea)
- This is called the "Quantity Equation"

What Determines Velocity?

$$M_t V = P_t Y_t$$

- Initially we assume velocity is constant
- More generally velocity determined by:
  - Transaction technology (ATMs, checks, credit cards)
  - Uncertainty about future transactions
  - Opportunity cost of holding money (interest rate)
    - Gold coins don't not pay interest
- In our middle ages economy: Say people try to maintain a months worth of expenses in gold coins

Supply of Money

- Money supply in medieval economy is simply the stock of gold coins in the country
- Exogenously given: M_t is exogenous
- Most of the time, M_t doesn't change
  - Economy is on an island and doesn't trade with other countries
  - Country has no gold mines

Two Perspectives

$$M_t V = P_t Y_t$$

1. Household perspective:
   - M_t is a choice. Each household chooses how much money to hold as a function of nominal value of output
   - Money demand
2. Economy-wide perspective:
   - Total M_t in the economy is given!
   - Collectively, households must end up holding the number of gold coins that actually exist in economy
   - Quantity equation helps determine P_t and Y_t
   - Money market equilibrium

Production in the Medieval Economy

- Suppose every household owns a small business:
  - Pub, bakery, potato farm, shoe shop, etc.
- Production function:

$$Y_t = AL_t$$

  - Constant returns to scale
  - For simplicity, labor is only factor of production
  - A is exogenous

Labor Supply in the Middle Ages

- Businesses post a price at the beginning of each period (before they observe demand)
- They then service all customers that demand their goods
  - If demand is high, they have to work more
- These are key assumptions of Keynesian models (prices set in advance and firms meet demand)
- Implies that output is determined by demand in the short run

Demand Management in Middle Ages

- Desired labor supply: L^*
  - Amount they want to work
  - But they will work more if demand is high and less if demand is low
- Suppose demand is high in a particular period and shopkeepers find themselves working more than they want.
- What do they do about this?

Price Adjustment in the Middle Ages

- At the end of the period they take stock and think about whether they should change their price
- They are not sure why demand was high
  - Maybe just some temporary thing
  - Maybe a permanent thing
- If demand is temporary they don't want to change prices. But if it is permanent they should change their price

Price Adjustment in the Middle Ages

- They decide to adjust prices a bit:
  - Demand “too” high => raise prices somewhat
  - Demand “too” low => lower prices somewhat

$$\frac{P_{t+1}}{P_t} = \left(\frac{L_t}{L^*}\right)^{\theta}$$

  - θ captures speed of price adjustment

Reasons for Stickiness of Prices

In reality, prices are “sticky” for many reasons:

- Imperfect attention: Firms have other things to worry about than the money supply
- Costs of changing prices (“menu costs”)
- Fear of antagonizing customers
- Worry that competitors will not change price (coordination problem)

Price Rigidity Evidence

Table 1: Price Rigidity in the United States

	Median Duration of Prices	
	Regular Prices	Raw Prices
Services	12.9	12.8
Household Furnishing	10.2	3.8
Recreation Goods	10.0	5.5
Apparel	8.8	2.2
Processed Food	8.5	3.2
Other Goods	5.9	5.3
Unprocessed Food	3.4	2.1
Transportation Goods	2.2	2.2
Utilities	2.1	2.1
Travel	1.8	1.7
Vehicle Fuel	0.5	0.5
All	8.7	4.4

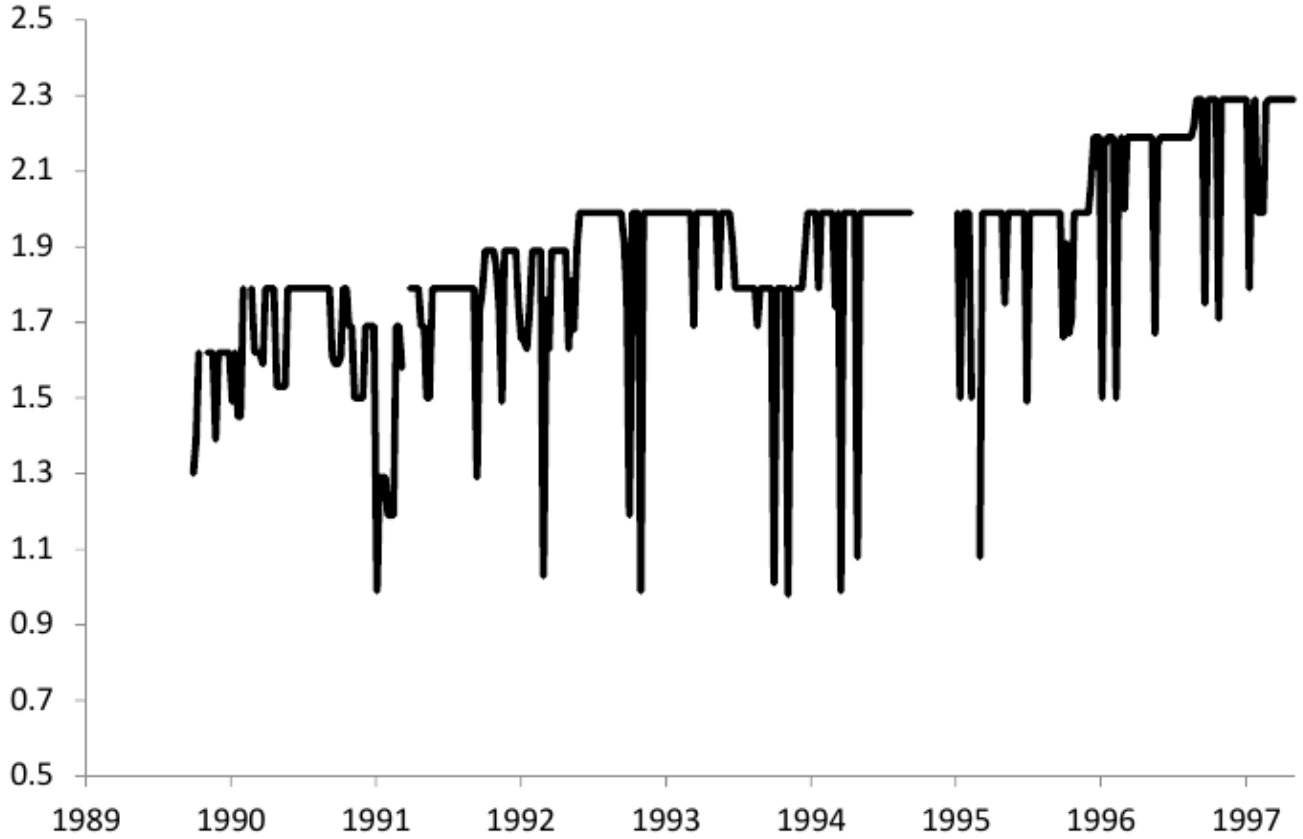


Figure 1: Price of Nabisco Premium Saltines (16 oz)

Model of Medieval Economy

- Money Market Equilibrium:

$$M_t V = P_t Y_t$$

- Production:

$$Y_t = AL_t$$

- Price Adjustment:

$$\frac{P_{t+1}}{P_t} = \left(\frac{L_t}{L^*}\right)^{\theta}$$

Simplifying the Model

- Let‘s get rid of L_t to simplify the model
- Desired level of production:

$$Y^* = AL^*$$

- Use production function (and desired version) to eliminate L_t and L^* from price adjustment equation:

$$\frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta}$$

Model of Medieval Economy

- Money Market Equilibrium:

$$M_t V = P_t Y_t$$

- Price Adjustment:

$$\frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta}$$

- Endogenous variables: Y_t and P_t
- Exogenous variables: M_t
- Parameters: θ, V, Y^*

Vikings Bring Back Gold Plunder

- Say our medieval economy sends off a ship of vikings to plunder gold from unsuspecting monasteries in a neighboring country
- Vikings bring back shipload of gold coins
- What happens to the economy?
  - What happens in the very short run?
  - What happens over time?
  - What is the result of this in the long run?

Vikings Bring Back Gold Plunder

- At first: Vikings go on a spending spree
  - Gold coins slowly diffuse through the economy
- Everyone has more gold coins than before
  - People have more gold coins than they want
  - So, what do they do?
- Try to spend them. Boom time!!
- On aggregate this doesn't help
  - If one person spends someone else gets a gold coin
  - "Too much money chasing too few goods"

Boom Time in the Middle Ages

- Producers face increased demand for their goods
  - How do they respond to this?
- Prices start to rise
- How much do prices rise?
- How does this affect the boom in output?

- Not clear
- Helpful to use our formal model

Steady State Before Viking Voyage

- Suppose $M_t = M$ and has been for a long time
- Steady state: Nothing changing over time

$$\frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta} \quad \text{becomes} \quad 1 = \left(\frac{Y}{Y^*}\right)^{\theta}$$

- Steady state output:

$$Y = Y^*$$

Equal to desired level of output

Steady State Before Viking Voyage

- Steady state output $Y = Y^*$
- What about steady state price level?

$$MV = PY^* \quad \rightarrow \quad P = \frac{MV}{Y^*}$$

- Notice that we have solved for Y and P as a function of exogenous variables

Viking Voyage Raises Money Supply

- Economy is knocked out of steady state by the "shock" of having more gold coins (bigger money supply): $\tilde{M} > M$
- Eventually gravitates to a new steady state
- Same math as before yields:

$$\tilde{Y} = Y^* \quad \text{and} \quad \tilde{P} = \frac{\tilde{M}V}{Y^*}$$

- Difference in price level in steady states:

$$\frac{\tilde{P}}{P} = \frac{\tilde{M}}{M}$$

Long-Run Change in Prices

$$\frac{\tilde{P}}{P} = \frac{\tilde{M}}{M} \qquad \tilde{Y} = Y = Y^*$$

- In the long run:
  - Prices rise proportionately with the money supply
  - Output is unaffected by changes in the money supply
- Classical Dichotomy: Change in the money supply leaves output unchanged in the long run
- Also called Long Run Monetary Neutrality

Long Run Monetary Neutrality

- If the money supply doubles, in the long run:
  - Prices will double
  - Output unaffected
- Why?: Only relative prices matter
  - Labor supply is a function of “real wage”, i.e., how much stuff you get for working an extra hour
  - Investment is a function of “real interest rate”, i.e. how much extra stuff you get for lending money
- Nominal variables are determined by money supply

What About the Short Run?

- For dynamics, convenient to take logs:

$$M_t\bar{V} = P_tY_t \quad \text{and} \quad \frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta}$$

become

$$\ln M_t + \ln \bar{V} = \ln P_t + \ln Y_t$$

$$\ln P_{t+1} - \ln P_t = \theta(\ln Y_t - \ln Y^*)$$

- Notice that model is linear in logs

Quantity Equation in Changes

- Useful to write quantity equation in changes

$$\ln M_t + \ln V = \ln P_t + \ln Y_t$$

$$\ln M_t - \ln M_{t-1} + \ln V - \ln V = \ln P_t - \ln P_{t-1} + \ln Y_t - \ln Y_{t-1}$$

$$\Delta \ln M_t = \Delta \ln P_t + \Delta \ln Y_t$$

  - Where $\Delta \ln M_t = \ln M_t - \ln M_{t-1}$

- Notice that $\ln V - \ln V = 0$

Day Before Arrival of Gold

- Suppose Vikings arrive at $t = 0$.
- In period $t = -1$, economy is in old steady state:

$$\ln Y_{-1} = \ln Y^*$$
$$\ln P_{-1} = \ln M + \ln V - \ln Y^*$$

- Evening before Viking arrive:
  - Producers set prices for next day:

$$\ln P_0 - \ln P_{-1} = \theta(\ln Y_{-1} - \ln Y^*)$$
$$\ln P_0 = \ln P_{-1}$$

  - I.e., no change in prices (nothing has happened yet)

Day Gold Arrives

$$\Delta \ln M_0 = \Delta \ln P_0 + \Delta \ln Y_0$$

- But we know from before that

$$\Delta \ln P_0 = \ln P_0 - \ln P_{-1} = 0$$

(Producers didn't change their prices for that day)

- So, we have that:

$$\Delta \ln M_0 = \Delta \ln Y_0$$

- Initially, output increases as much as the money supply

Day Gold Arrives

- Recall that

$$\Delta \ln M_t \cong \frac{M_t - M_{t-1}}{M_{t-1}}$$

- I.e., log change is approximately equal to percentage change (for small changes)
- So, percentage change in output is the same as for money supply initially
- If money supply increases by 5%, then initially output will increase by 5%

Evening of Day Gold Arrives

- Producers take stock of the day:
  - Demand was higher than they expected
  - They had to work more than they expected/wanted

$$Y_0 > Y^* \qquad (L_0 > L^*)$$

- Producers are not sure why:
  - Perhaps a temporary thing
  - Perhaps Vikings brought back more gold
- Producers decide to adjust partially:

$$\ln P_1 - \ln P_0 = \theta(\ln Y_0 - \ln Y^*)$$

Next Day

- Prices higher than before:

$$\begin{aligned} \ln P_1 - \ln P_0 &= \theta(\ln Y_0 - \ln Y^*) \\ &= \theta \Delta \ln M_0 \end{aligned}$$

- Now use money market equation to solve for output at $t = 1$:

$$\Delta \ln M_1 = \Delta \ln P_1 + \Delta \ln Y_1$$

$$\Delta \ln Y_1 = -\theta \Delta \ln M_0$$

($\Delta \ln M_1 = 0$ since no more gold arrives on day 1)

Next Day

$$\Delta \ln Y_1 = -\theta \Delta \ln M_0$$

- Since prices rise, output starts falling back to normal level
- This was the intention of the price setters
- But output is still above Y^*

$$\begin{aligned} \ln Y_1 - \ln Y^* &= \Delta \ln Y_1 + \Delta \ln Y_0 \\ &= -\theta \Delta \ln M_0 + \Delta \ln M_0 \\ &= (1-\theta) \ln M_0 \end{aligned}$$

- Producers again want to raise their prices

Dynamics over Time

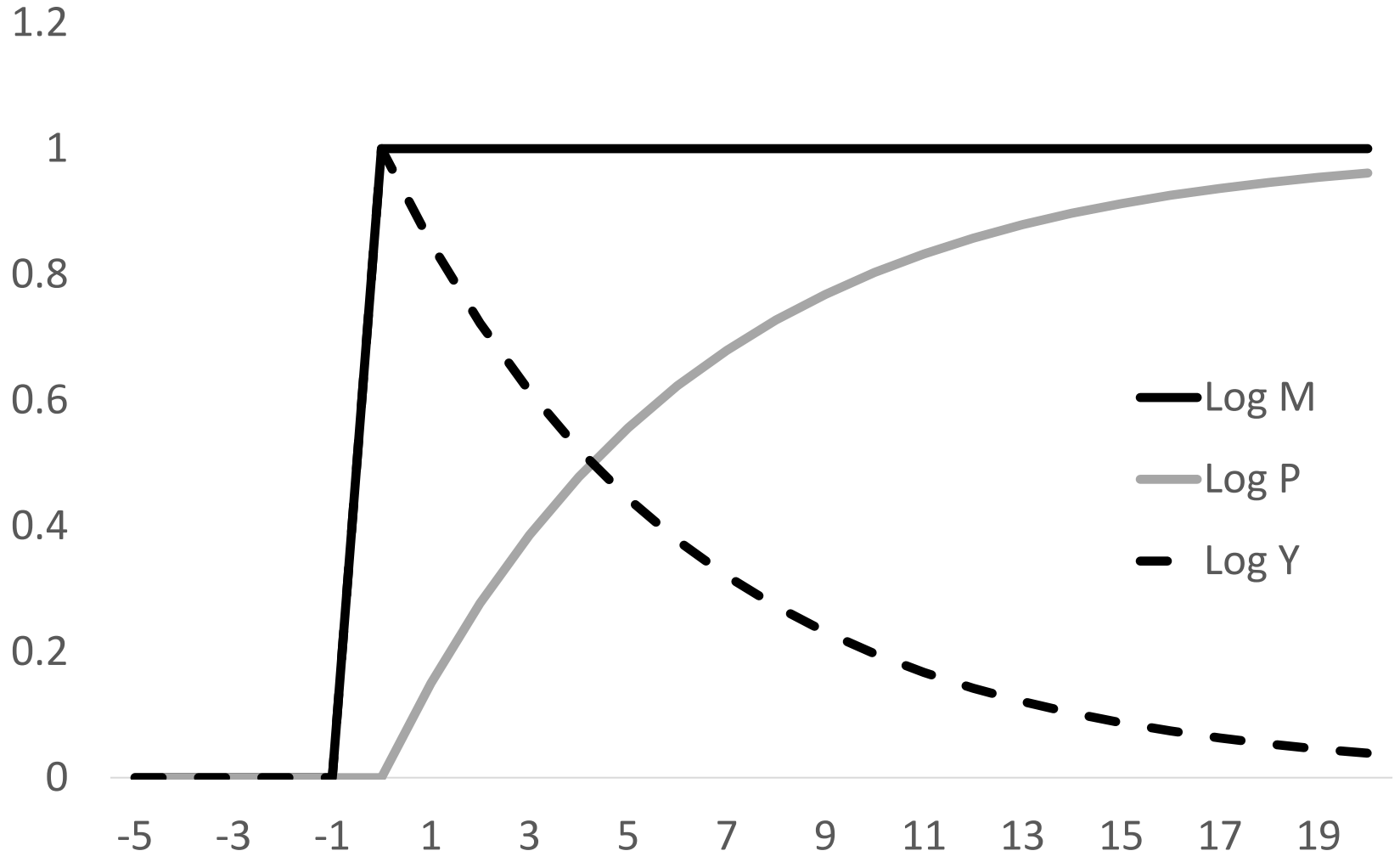
- We can use equations:

$$\ln M_t + \ln \bar{V} = \ln P_t + \ln Y_t$$

$$\ln P_{t+1} - \ln P_t = \theta(\ln Y_t - \ln Y^*)$$

to trace out dynamics over time

Dynamics of Economy after Bounty Arrives



Response to Monetary Shock in Medieval Economy

- Short run:
  - High demand takes businesses by surprise
  - Output increases
  - Prices respond sluggishly
- Long run:
  - Prices respond proportionately: $\%\Delta P = \%\Delta M$
  - Output unaffected
  - “Money is neutral in the long run”

Did the Gold Plunder Make People Better Off?

- In the short run?
  - Boom in output
  - But they had to work more to create the output
  - Actually, they worked more than they wanted
- In the long run?
  - Output the same as before
  - Prices higher
- Striking gold is good for the individual but perhaps not for society as a whole.

Change in the Supply of Gold Coins

- Neoclassical Economics:
  - All prices rise immediately (by same fraction as money supply)
  - Output unchanged
  - Money “neutral” (no effect on output)
- Keynesian Economics:
  - Prices slow to react
  - Output responds to monetary shocks
  - Recessions and booms can be caused and alleviated by monetary policy

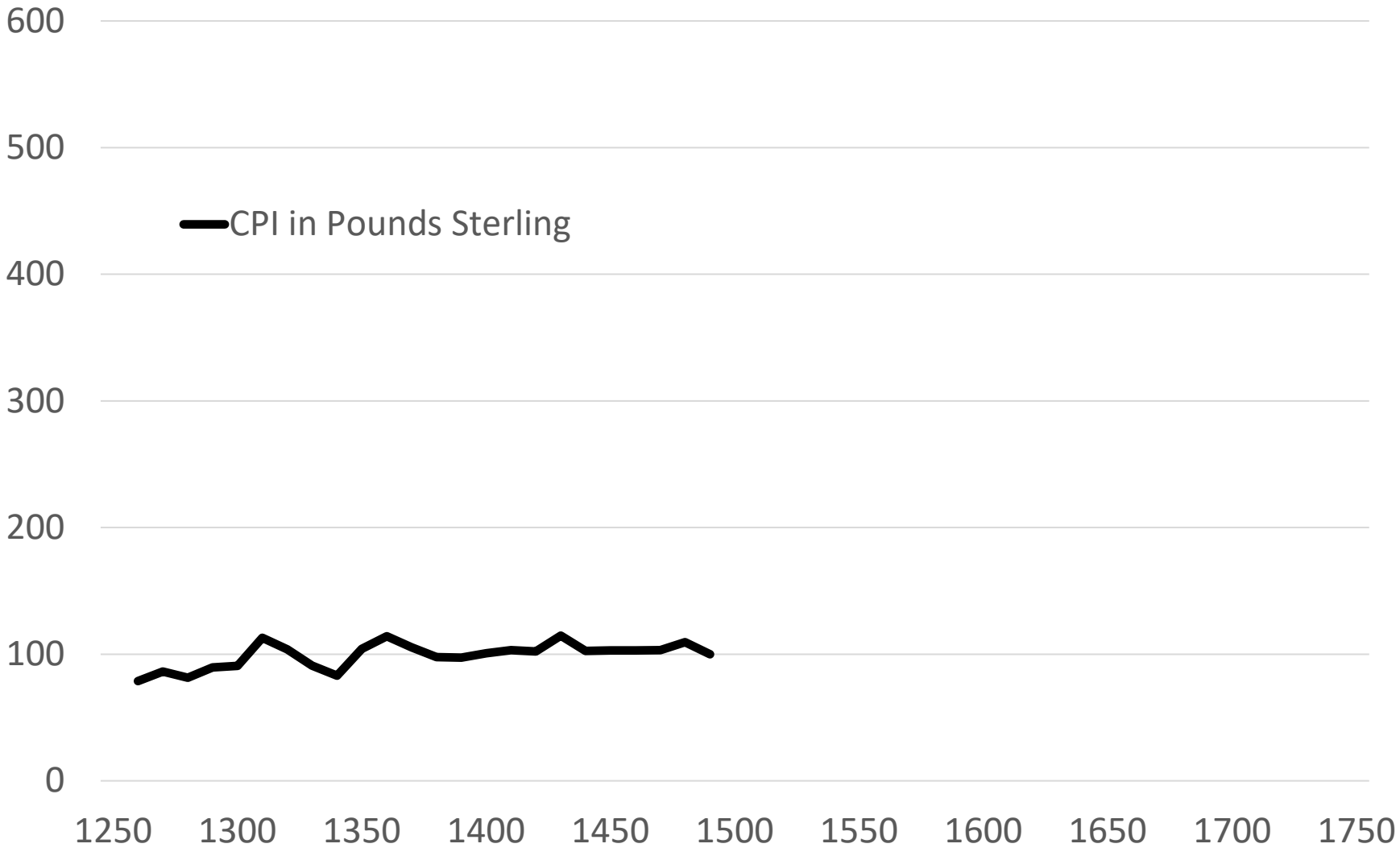
Three Historical Episodes

1. The Price Revolution
2. The Big Problem of Small Change
3. The Crime of 1873

Does Gold have Stable Value?

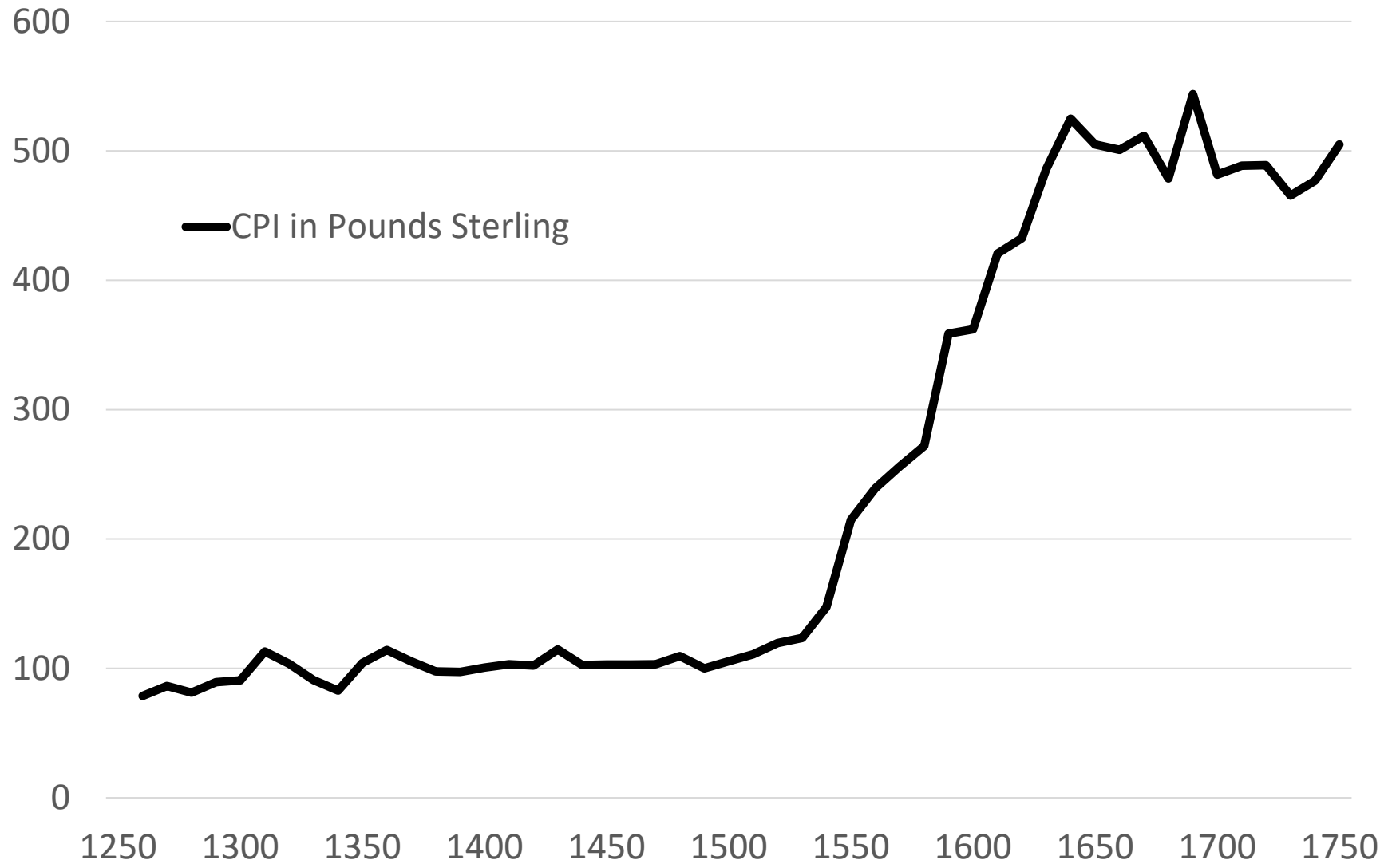
- Gold and silver were used as money for many centuries in large parts of the world
- Today most countries opperate fiat currencies
  - I.e., currencies not backed by anything
- Many people say we should return to the gold standard today!
  - Argue that this will yield a currency with more stable value
- Key question: Did gold and silver have stable value?

Price Level in England 1200-1490



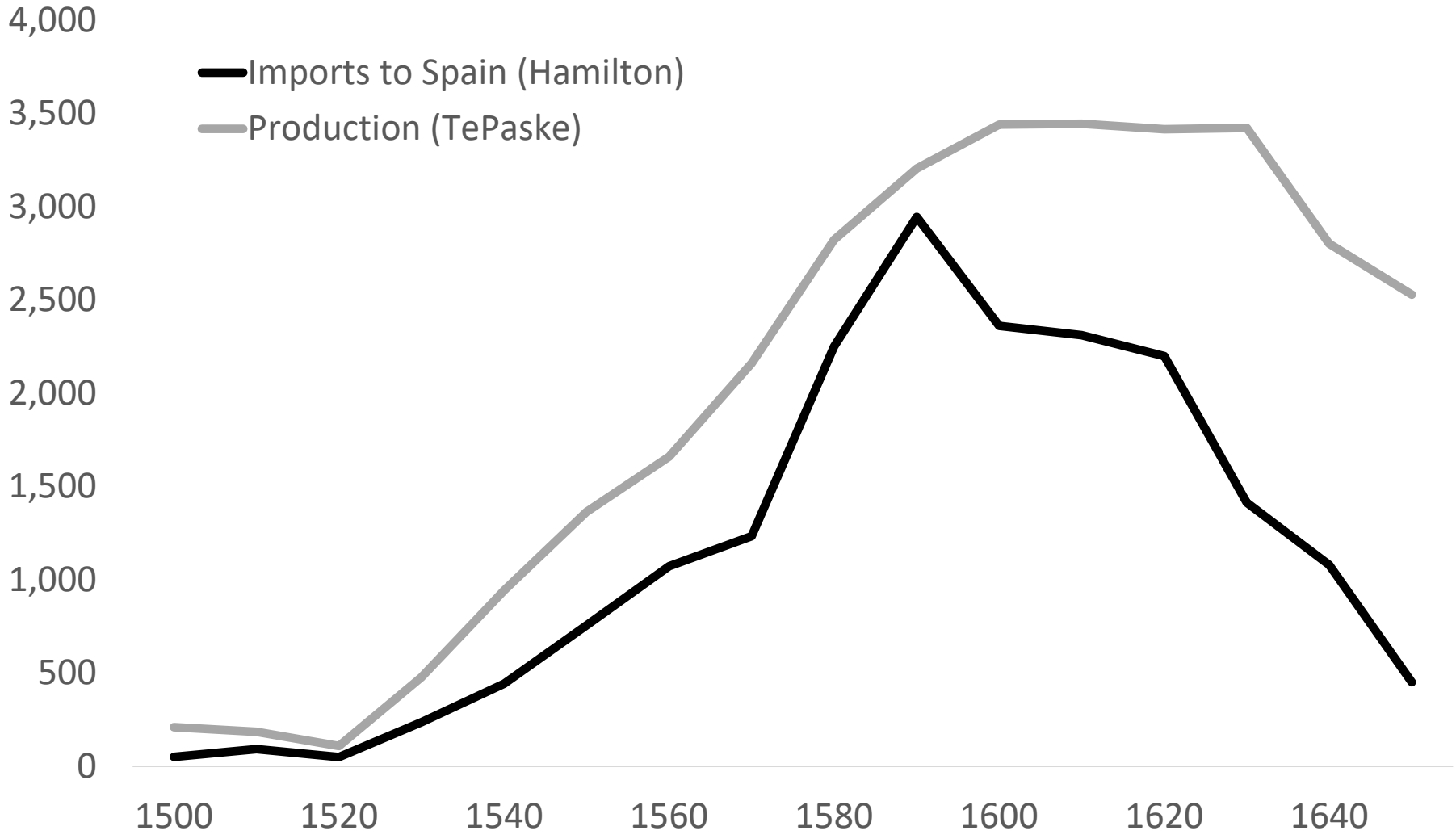
Source: Allen (2001)

Price Revolution



Source: Allen (2001)

American Treasure

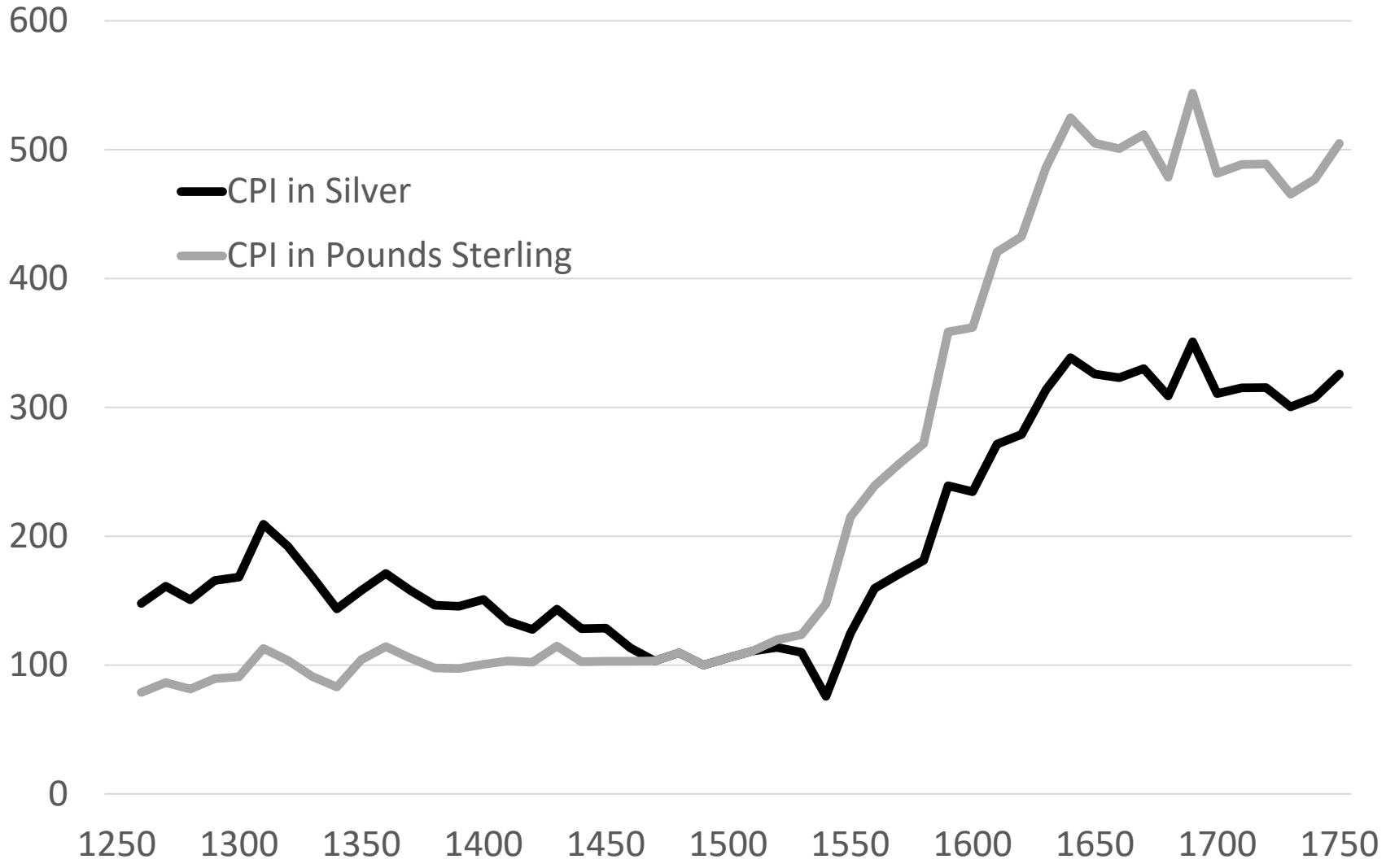


In metric tons of silver. Glassman and Redish (1985) estimate stock of gold and silver
In Europe in 1492 to be worth about 3,500 metric tons of silver

Popular Culprits for Inflation

- During Price Revolution, many believe inflation is due to:
  - Middlemen, speculators, and monopoly profits
- Such discussion often fails to understand difference between one particlar price being high and the overall price level being high
- Monopoly power leads to a high relative price of a paricular product, not a high overall price level

Debasement of Sterling



Source: Allen (2001)

The Big Problem of Small Change

- Important challenge:
  - How to maintain coins of different value in circulation simultaneously
- Silver coins:
  - (Reasonably) good for smaller transactions
  - Bulky for merchant trade
- Gold coins:
  - Way too valuable for everyday transactions
  - Good for merchant trade

Bimetallism

- Bimetallism is a monetary system based on a combination of silver and gold coins
  - Benefit: Coins with a wide range of value
  - Drawback: Difficult to maintain silver and gold coins in circulation simultaneously
- Why difficult?

Difficulties with Bimetallism

- Two reasons why it was difficult to maintain gold and silver coins in circulation simultaneously:
  - The relative price of silver vs. gold changed over time
  - Silver coins were clipped and got worn (silver content fell)
- Suppose market price of gold for silver is 13 (i.e., 13g of silver buy 1g of gold)
- If silver and gold coins are minted with this weight ratio, both will circulate

Undervalued Coins

- Suppose market price of gold rises to 14-to-1 vs. silver
- Gold becomes “undervalued” at the Mint
  - You get 13 pennies per gram of gold at the Mint
  - You get 14 pennies worth of silver per gram of gold on the market!
- Consequence:
  - No one brings gold to the Mint
  - Gold coins start being exported / melted down
  - Eventually no more gold coins!

Undervalued Coins

- Another problem:
  - Silver coins are clipped or get worn
- Silver coins no longer 1g. Rather (say) 0.8g
- Consequences:
  - Profitable to create counterfeit “worn” coins (i.e., 0.8g coins)
  - Value of coins falls to reflect lower weight
  - But then market price of silver in pence rises above price at the mint
  - New silver coins become undervalued at the Mint
- Eventually sovereign decides to debase

Big Problem of Small Change

- Huge problem for hundreds of years
- One example: In 1717 Isaac Newton as Master of the Mint, overvalued gold coins (undervalued silver coins)
- Consequence: Chronic shortage of small change (silver coins) in Britain throughout 18th century

Big Problem of Small Change

- Solution: Adopt token coins
  - I.e., coins worth more than their metallic content
- Britain did this first in 1816 (U.S. in 1853, France in 1865)
- Why not earlier?
  - Widespread metallist fallacy
  - Needed high quality coins to avoid counterfeiting
  - Needed government to guarantee value of coins

Money in America

- U.S. on a bimetallic standard from 1792 until Civil War
  - Until 1834: Gold-silver ratio at U.S. Mint 15-1 (gold undervalued)
  - After 1834: Gold-silver ratio at U.S. Mint 16-1 (silver undervalued)
- Free coinage: U.S. Mint stands ready to convert all specie (gold and silver) individuals bring to the mint into legal-tender coins

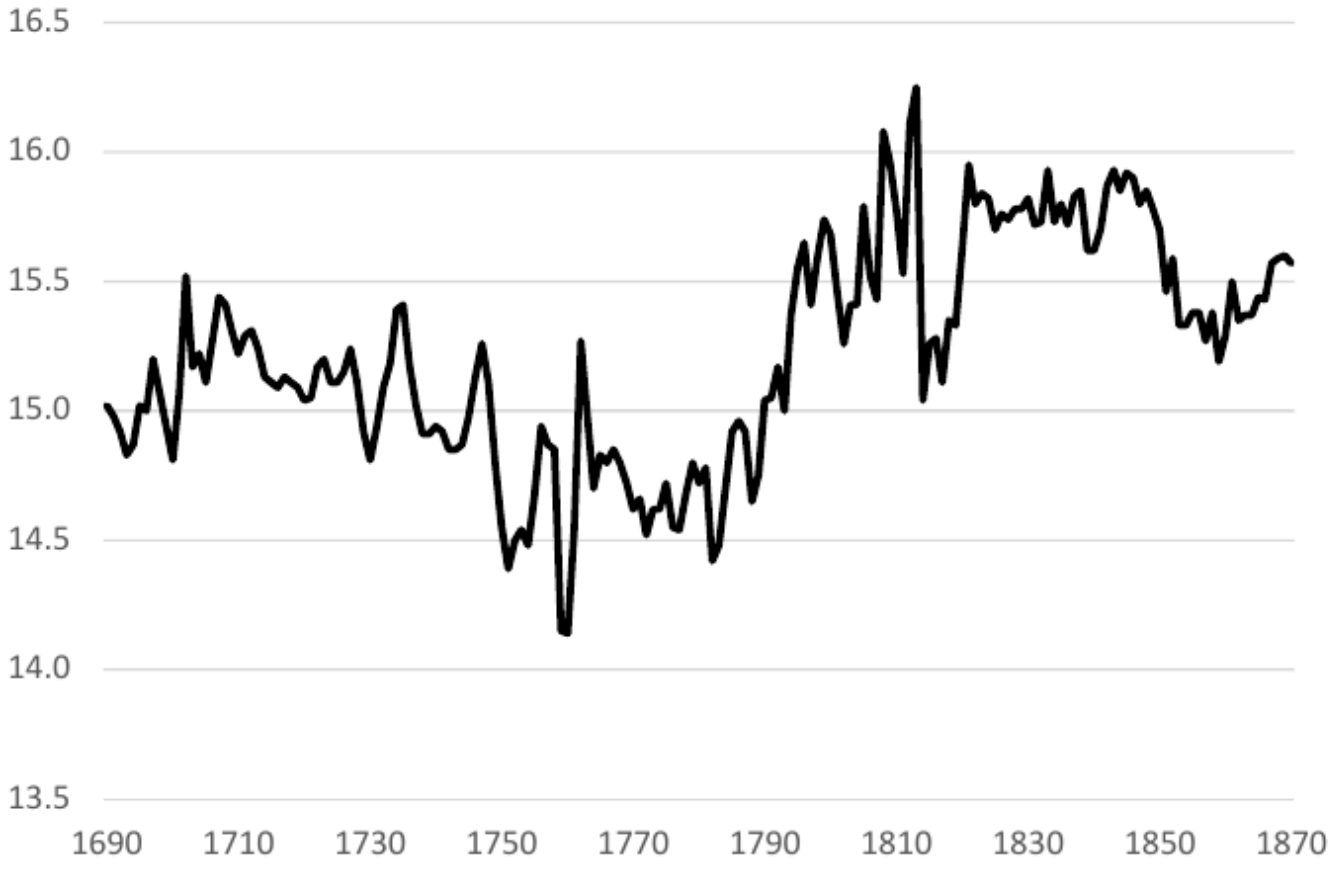


Figure 5: Gold-Silver Price Ratio, 1690-1870

The Civil War

- Enormous government spending on the war
- How to finance this spending?
- U.S. introduced government paper money: “Greenbacks”
  - Paid soldiers and paid for war materials with greenbacks
- Greenbacks had no gold or silver backing
  - No explicit promise of redemption in specie

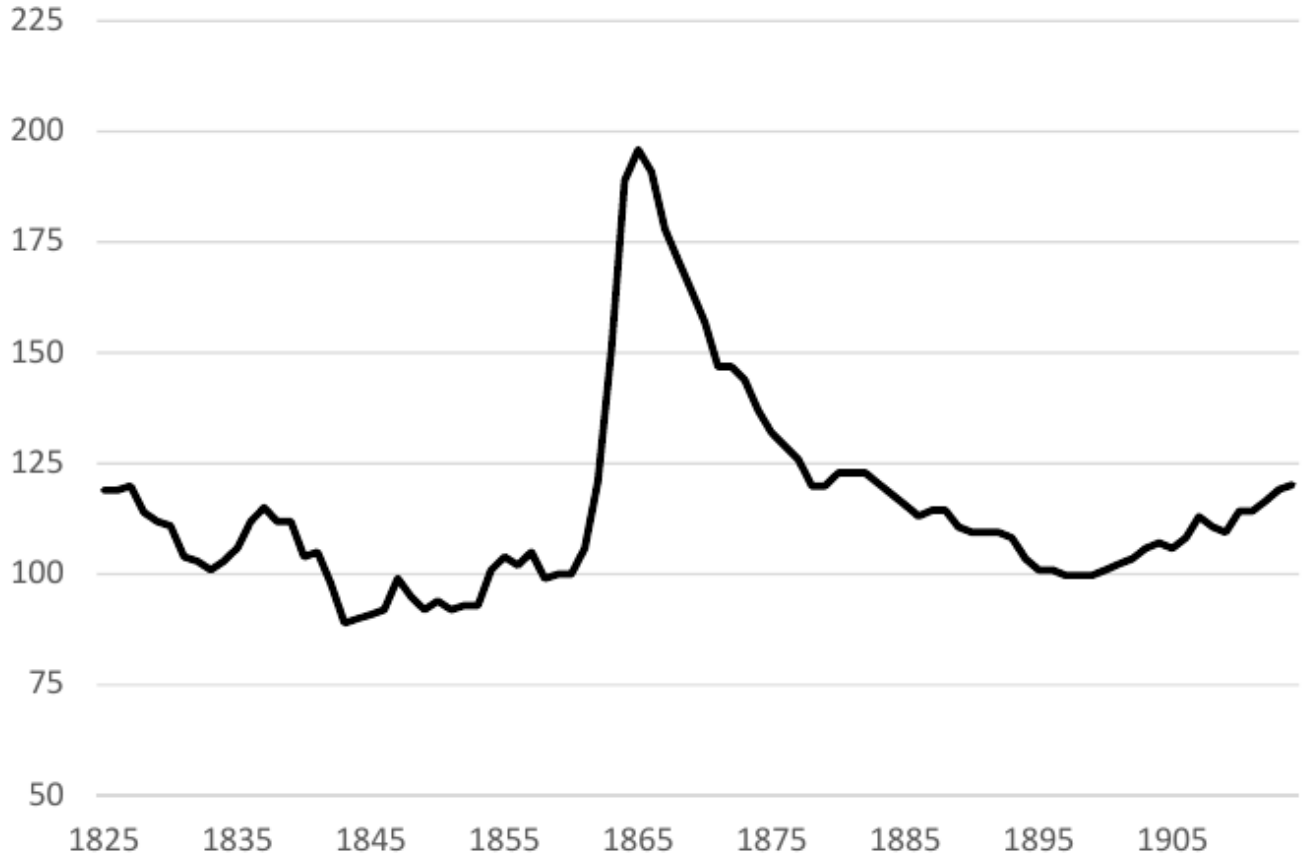


Figure 6: An Estimate of the Consumer Price Index in the U.S., 1825-1914

Back to a Gold Standard

- Wartime inflation doubled price level (in Greenbacks)
- After war: Widespread desire to return to a commodity standard ("sound money")
- Many people think:
  - We went off the gold standard and we had a lot of inflation. So, being off gold standard causes inflation.
  - Is this a sound argument?

Back to Gold Standard

- Resumption Act of 1875:
  - Full convertibility of paper money into gold and vice-versa (at pre-war rate)
  - Should take place Jan 1, 1879
- Many other countries adopted gold at similar time
  - Britain (de facto 1717)
  - France (1865), Germany (1873)
- 1870s-1914: International Gold Standard

U.S. Experience on the Gold Standard

- U.S. goes back on the gold standard in 1879
- Does this yield price stability
- Actually, huge deflation!
- Why?

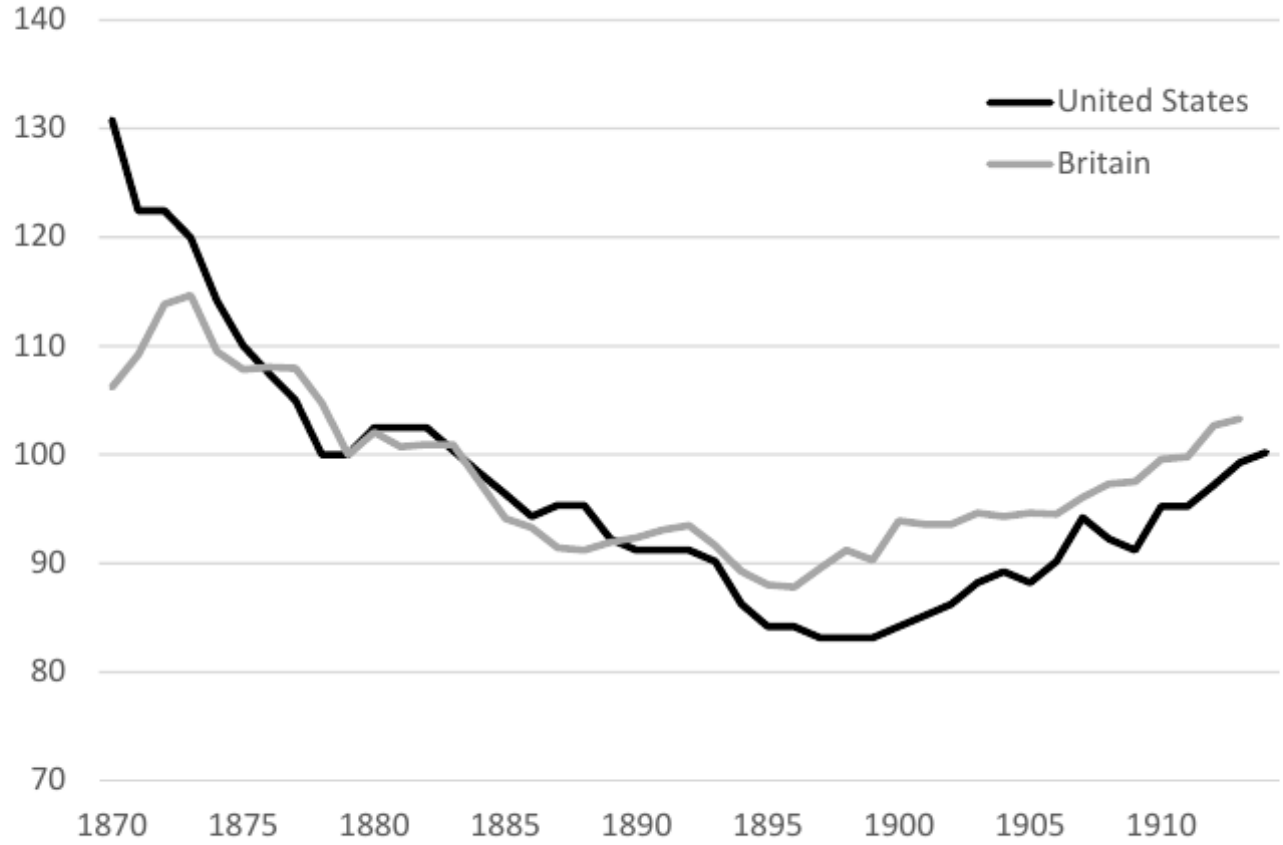


Figure 8: An Estimate of the Consumer Price Index in the U.S. and Britain, 1870-1914

U.S. Experience with Gold Standard

- Two reasons:
  1. Started off with a price level that was high because of war time inflation (i.e., doubt about value of Greenbacks). Resumption raise value of Greenbacks.

  2. Period of high economic growth. Production of gold didn't keep up with increase in demand for gold

$$\Delta \log P_t = \Delta \log M_t - \Delta \log Y_t$$

Politics of U.S. Gold Standard

- Persistent deflation. Largely unanticipated.
- How did this matter? Who gains and looses?
- “Crime” of 1873:
  - Demonetization of silver
- Value of silver fell dramatically in 1880s

Figure 7: Gold-Silver Price Ratio, 1800-1914

Crime of 1873

- What difference did this make?
- U.S. likely would have switched to a silver standard if not for "crime" of 1873
- This would have reduced/eliminated deflation
- Perhaps even lead to substantial inflation
  - Although this is not clear since U.S. being on silver standard would have changes demand for silver and raised its price relative to what happened

Politics of U.S. Gold Standard

- Deflation implied that monetary policy was the major election issue in the presidential election of 1896
- William Jennings Bryan:

  "You shall not crucify mankind upon a cross of gold"
- Bryan lost. Lost by bigger margin in 1900.
  - Movement petered out
- What solved the "problem"?

From Deflation to Inflation

1. Large discoveries of gold in South Africa
2. Invention of cyanide process for extracting gold from low-grade ore

- William Jennings Bryan's presidential hopes were undone by Scottish chemists and S. African miners

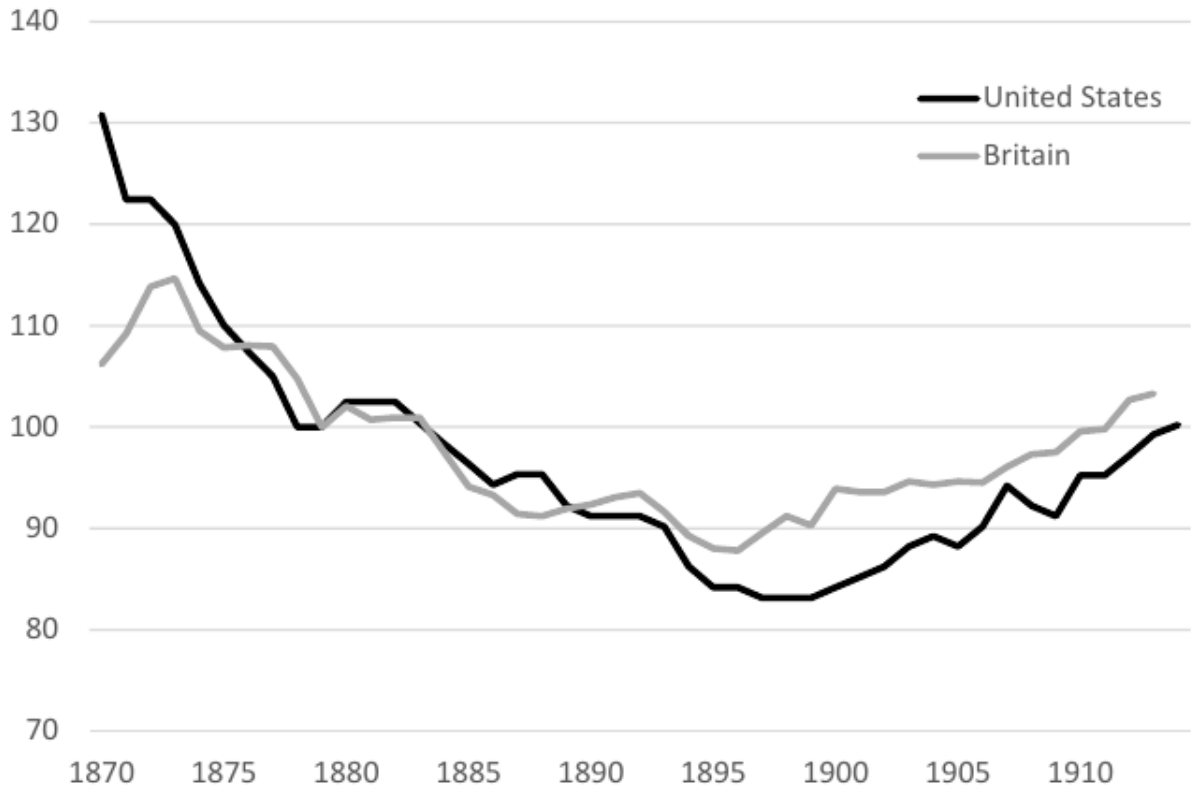


Figure 8: An Estimate of the Consumer Price Index in the U.S. and Britain, 1870-1914

Lesson About Gold Standard

- Under the gold standard, inflation is dictated by world production of gold (supply of gold) relative growth in world economy (demand for gold as money) and other demand for gold

$$\Delta \log P_t = \Delta \log M_t - \Delta \log Y_t$$

- This will not necessarily result in price stability
- Not clear why we want supply of gold to dictate inflation