Money Supply, Inflation, and Interest Rates

ECON 30020: Intermediate Macroeconomics

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Readings

GLS Ch. 21

Money, Inflation, and Interest Rates

We have now defined money, modeled money demand, and introduced money into the neoclassical business cycle model

In that model, the classical dichotomy holds and money is neutral

Questions we want to address:

1. How is the money supply measured?
2. How is the money supply set?
3. What determines the average inflation rate over the medium/long run?
4. What determines the average level of the nominal interest rate over the medium/long run?
5. Is money really neutral in the short run?

How is the Money Supply Measured?

Recall money serves three functions: medium of exchange, store of value, and unit of account

In the US, unit of account is the dollar. But lots of dollar denominated assets can in principle serve as media of exchange and stores of values – e.g. currency, saving bonds, real estate, etc.

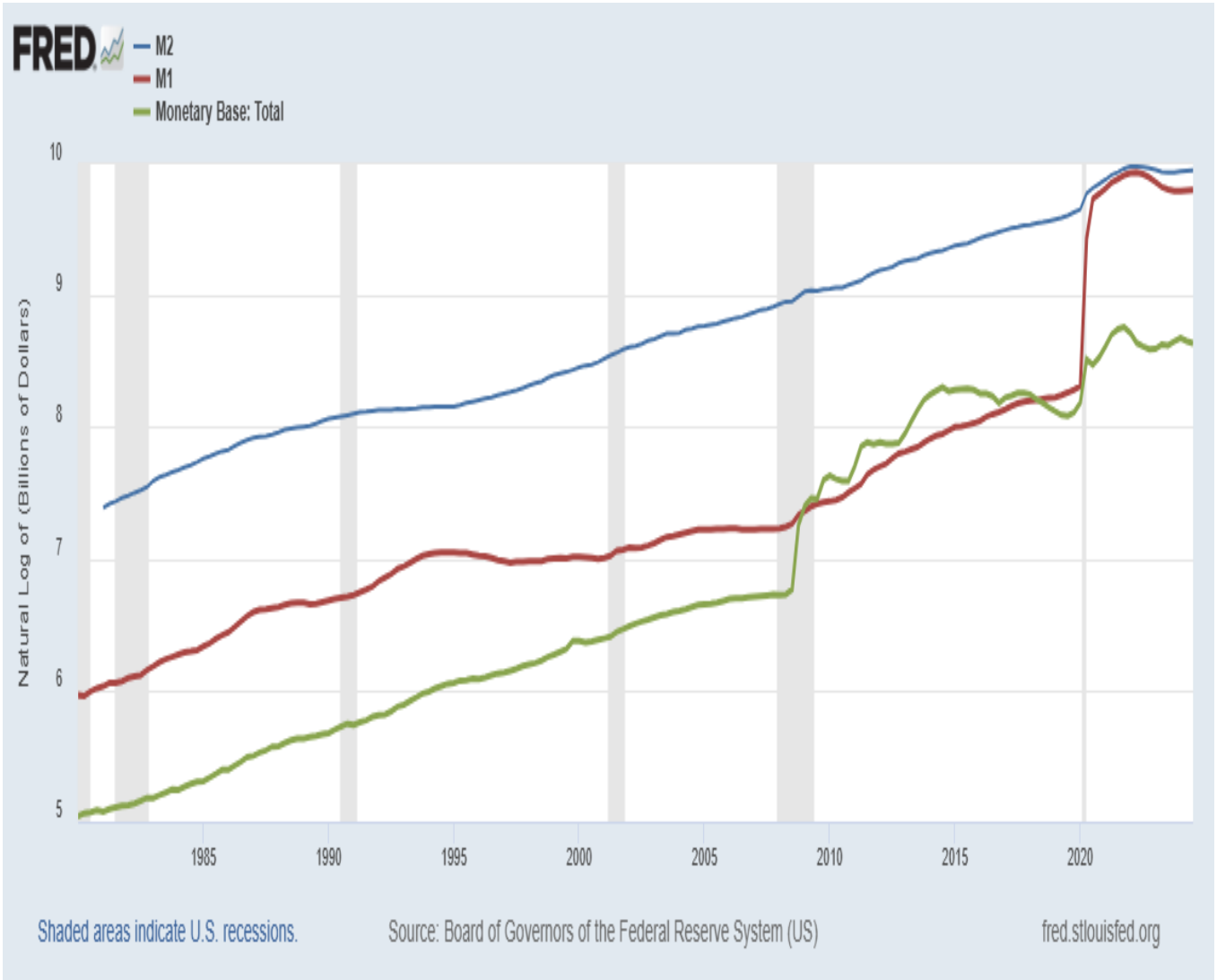
So measuring the money supply is not so trivial

Measures of Money Supply

Three different measures of the money supply, in descending order of most liquid (liquidity refers to the ease with which an asset can be used in exchange)

1. M0: currency in circulation plus bank reserves (also called monetary base)
2. M1: Currency plus demand deposits (electronic entries in checking accounts)
3. M2: M1 plus money market mutual funds and savings deposits
4. M3: M2 plus institutional money market mutual funds and short term repurchase agreements (discontinued)

Different Measures of the Money Supply



Setting the Money Supply: I

In the model, things are much simpler – there is no ambiguity concerning the definition of money, and we simply assume that the central bank can set it

In reality, it is much more nuanced

The central bank can set the monetary base but most of what qualifies as money is privately created

Setting the Money Supply: II

Monetary base includes currency, CU_t, and reserves, R_t

Reserves, R_t, are like demand deposits which banks hold with the central bank (also includes "vault cash")

In a fractional reserve banking system, the quantity of reserves influences total demand deposits (the other component of M1)

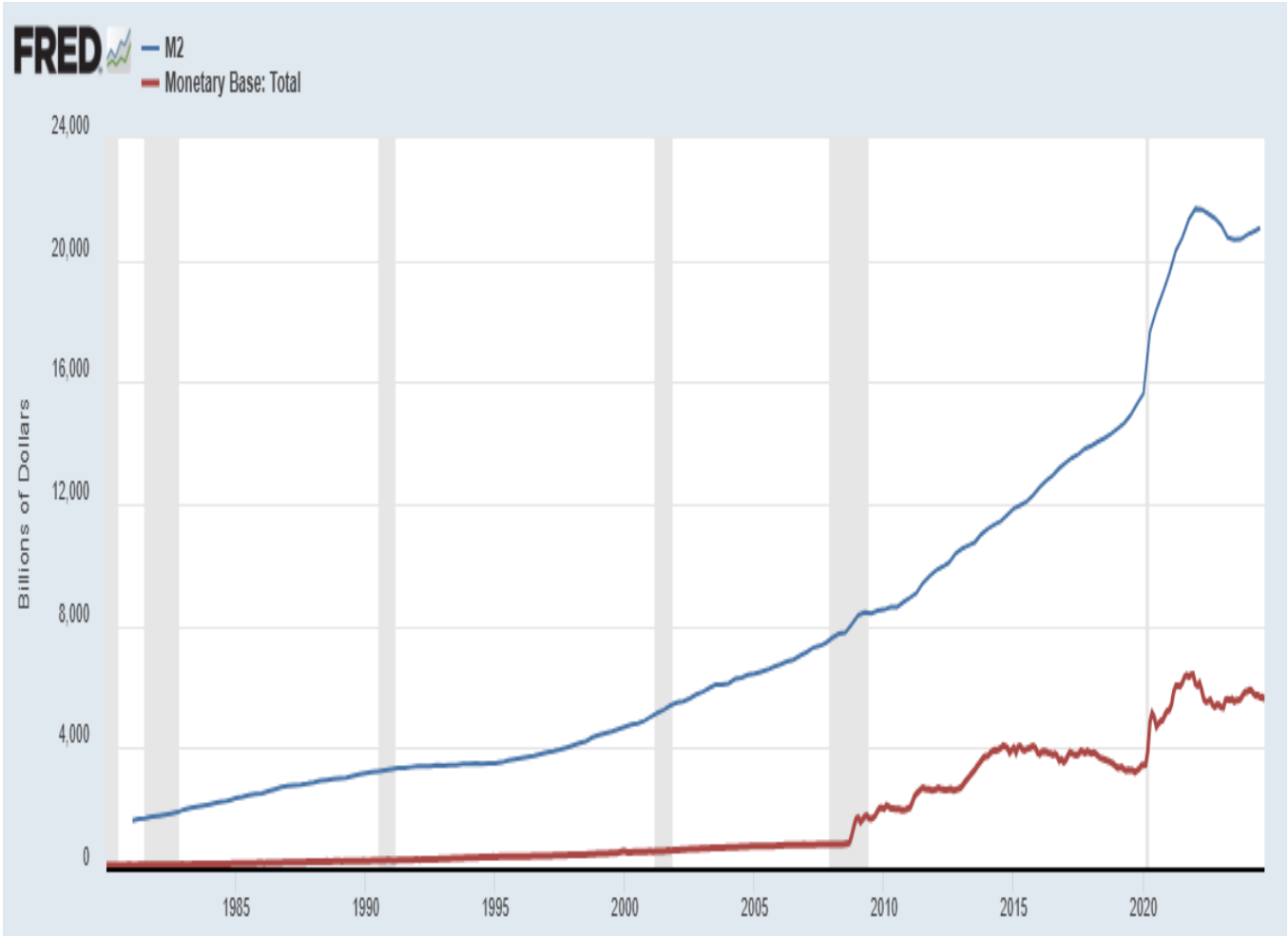
Banks are required to hold a fraction of their deposits in reserves. If they get an increase in reserves, they can make more loans, which entails increasing deposits and therefore the money supply

The Monetary Base and the Money Supply

Define the monetary base as currency plus reserves (both of which the central bank can directly control)

$$MB_t = CU_t + R_t$$

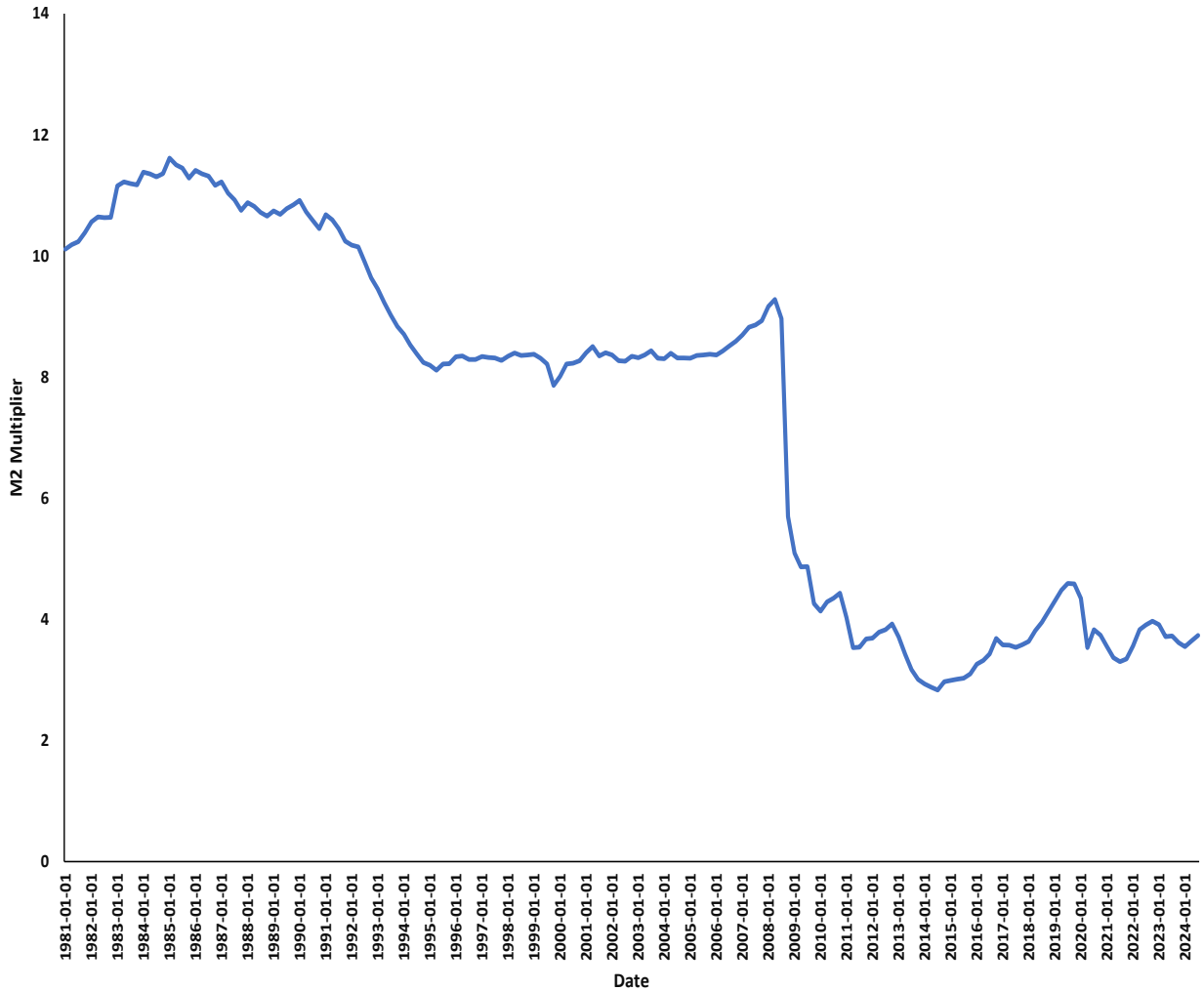
Monetary Base and M2:



Money Multiplier

Money multiplier is ratio of money supply to monetary base

$$mm_t = M_t / MB_t$$



Money and Inflation

Let's now "take the model seriously" and see what the model says about what determines the inflation rate and the nominal interest rate

Suppose a specific functional form for money demand:

$$\frac{M_t}{P_t} = \psi i_t^{-b_1} Y_t, \quad b_1 > 0$$

Take logs and then first difference across time. Define π_t as inflation, g_t^M the growth rate of the money supply, and g_t^Y as the growth rate of output:

$$\pi_t = g_t^M + b_1(\ln i_t - \ln i_{t-1}) - g_t^Y$$

Money and Inflation: the Medium/Long Run

Over sufficiently long periods of time, the nominal interest rate is roughly constant. Hence, we can write:

$$\pi_t = g_t^M - g_t^Y$$

If the nominal rate is constant, then inflation equals the difference between money growth and output growth

Over a sufficiently long period of time, output growth is roughly constant (one of the Solow model stylized facts)

To the extent true, the model would therefore imply that money growth and inflation are perfectly correlated

Monetarism and the Quantity Theory of Money

What is presented on the previous slide is essentially the quantity theory of money

The quantity equation (which is an identity) defines a term called "velocity" as the ratio of nominal GDP to the money supply:

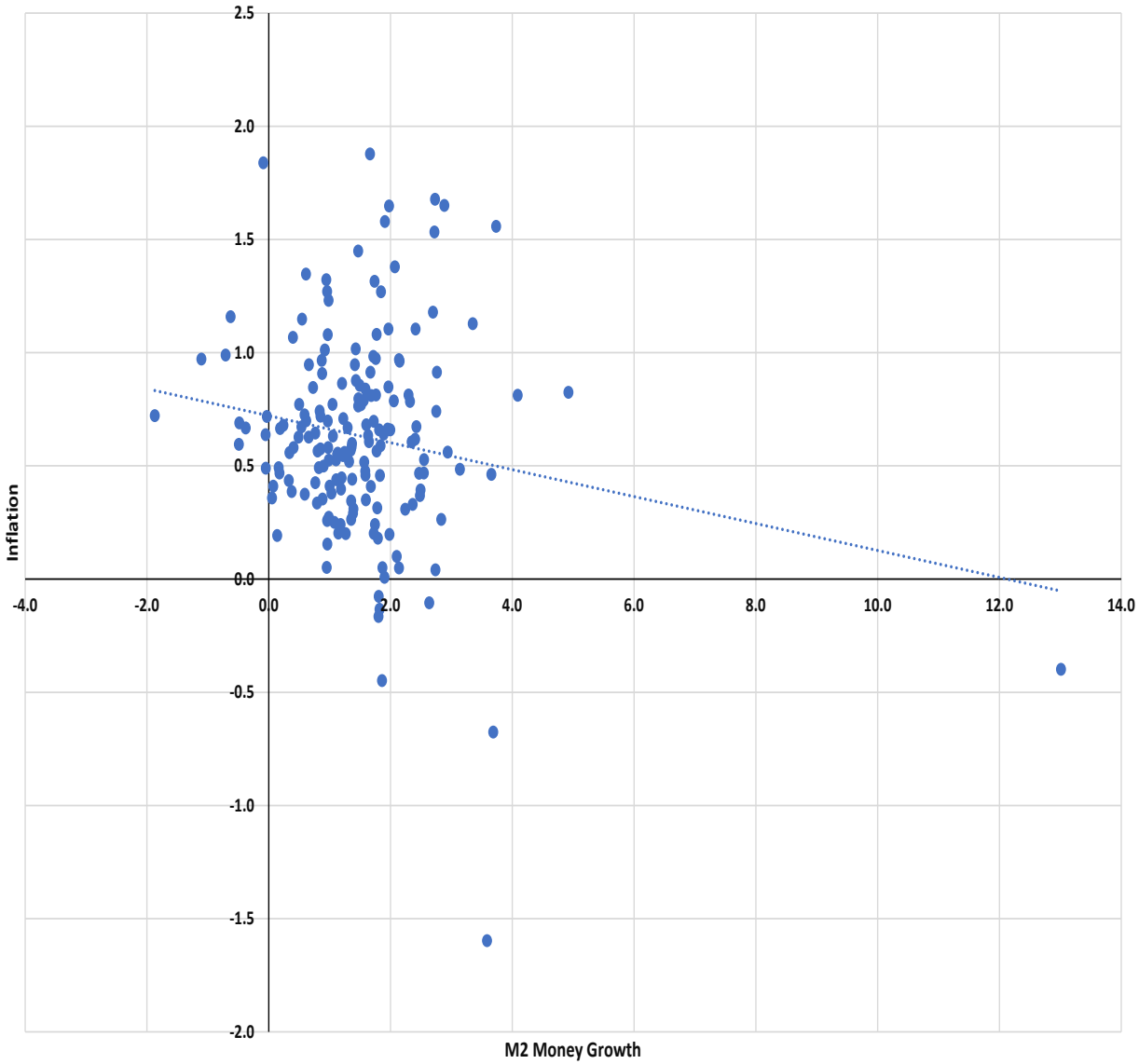
$$M_t V_t = P_t Y_t \Rightarrow$$
$$V_t = \frac{P_t Y_t}{M_t}$$

The quantity equation is transformed into a theory by assuming velocity is constant: monetarism

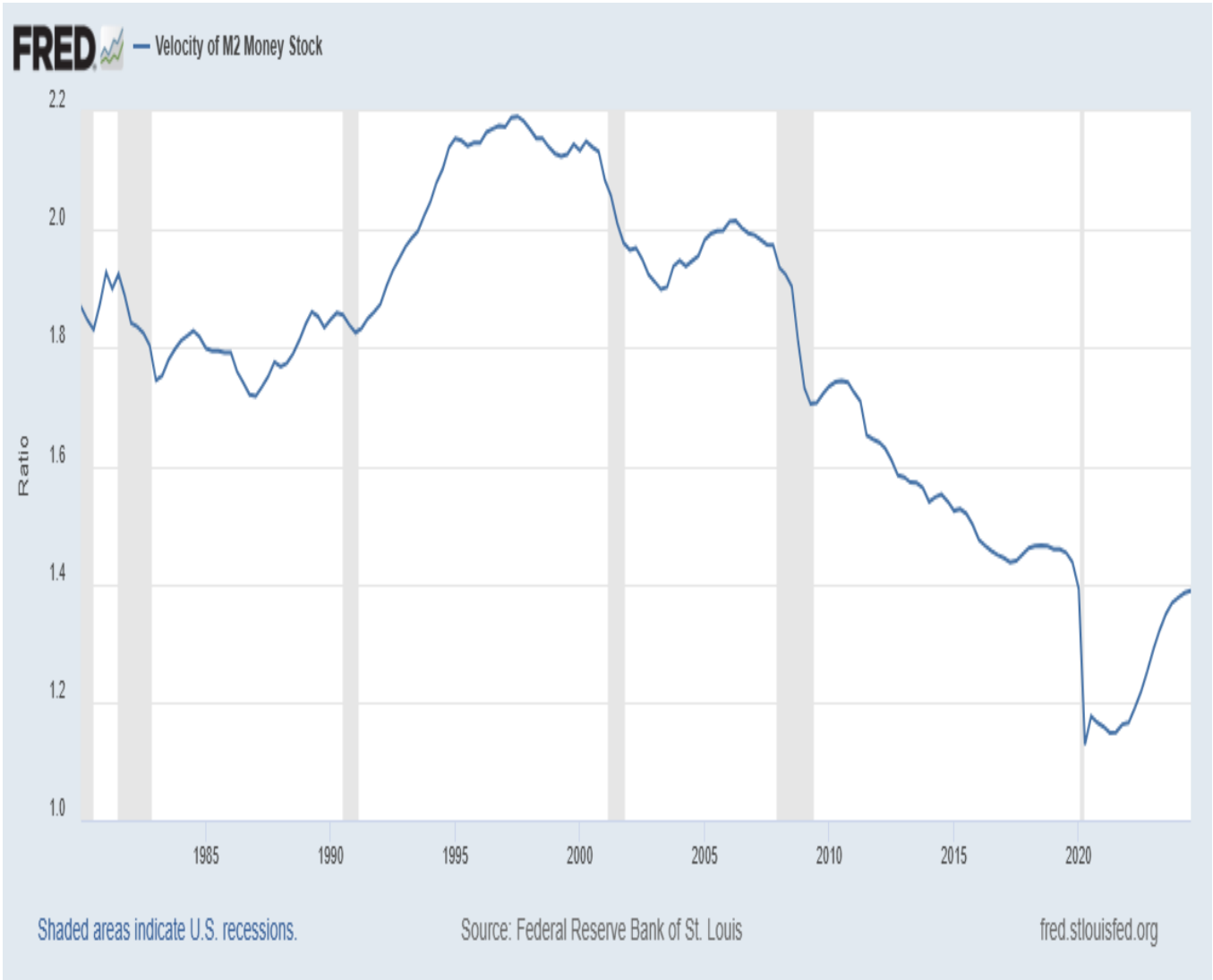
According to demand function we just used, this corresponds to (i) i_t constant and (ii) ψ (preference for holding money) constant as well (i.e. "stable" money demand)

Then "inflation always and everywhere a monetary phenomenon" – Milton Friedman

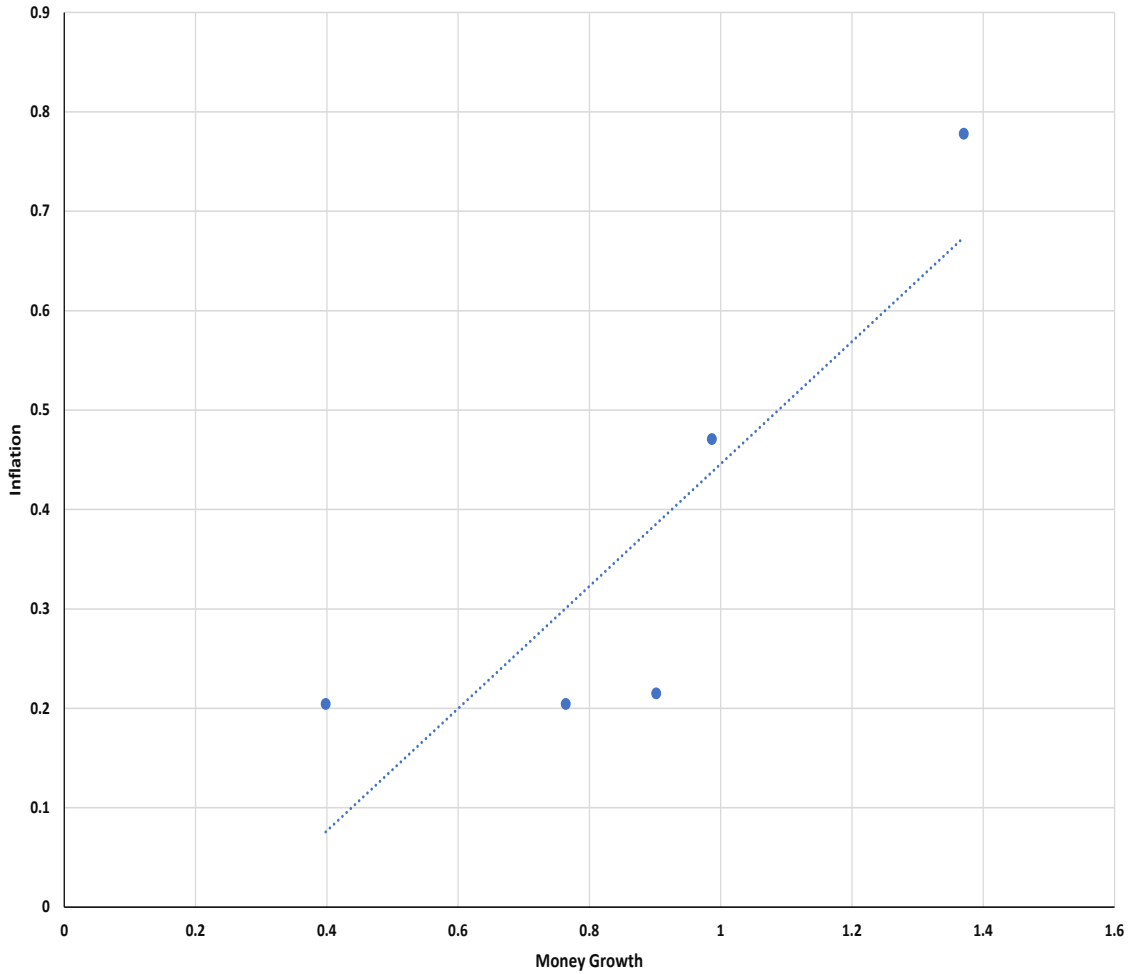
Is Inflation Always and Everywhere a Monetary Phenomenon?



Velocity


FRED
Velocity of M2 Money Stock
Ratio
2.2
2.0
1.8
1.6
1.4
1.2
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Shaded areas indicate U.S. recessions.
Source: Federal Reserve Bank of St. Louis
fred.stlouisfed.org

Money and Inflation: Decades



Interest Rates

What determines the nominal interest rate?

First, what determines the real interest rate? Euler equation with log utility:

$$\frac{C_{t+1}}{C_t} = \beta(1 + r_t)$$

Take logs, and suppose growth rate of consumption over long period of time is equal to the growth rate of output (true in data):

$$r_t = g^Y_{t+1} - \ln \beta$$

So real interest rate depends positively on (expected) output growth, and negatively on discount factor

"Natural rate" or "r-star"

Inflation and the Fisher Relationship

Call the natural rate $r^* = g^y - \ln \beta$

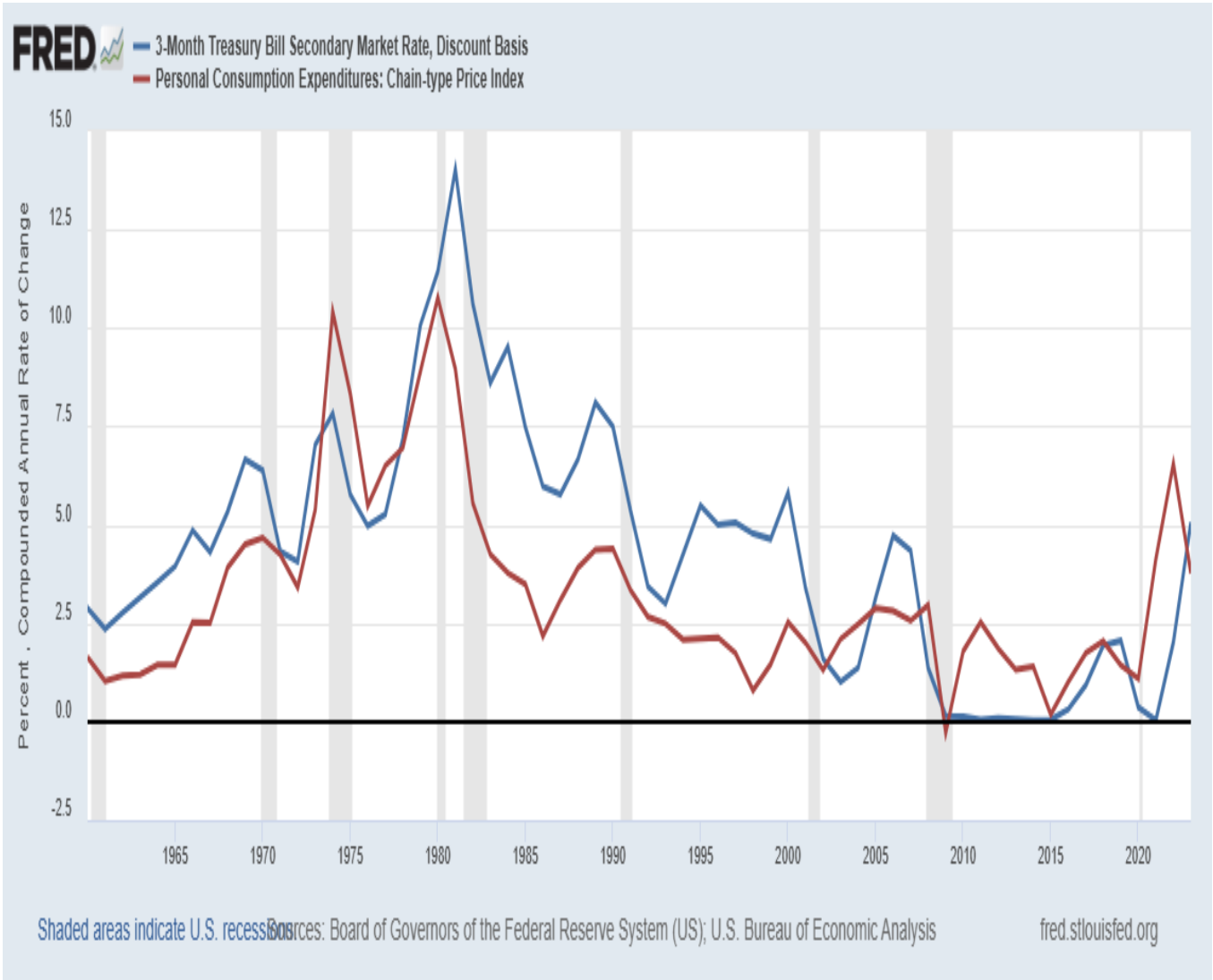
Fisher relationship says $i_t = r_t + \pi^e_{t+1}$

Assume that expected inflation equals actual inflation over long periods of time: $\pi^e = \pi$

$$i = \pi + g^Y - \ln \beta$$

The primary determinant of nominal interest rate is the inflation rate

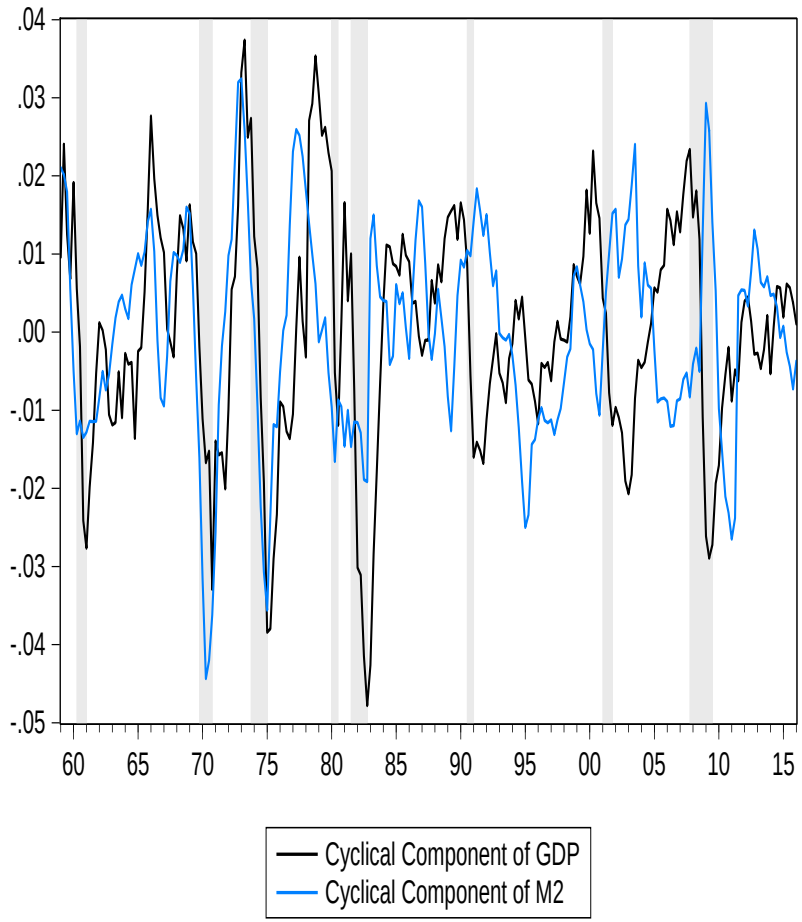
Inflation and Interest Rates



Money and Real Variables

Neoclassical model predicts that money is neutral with respect to output

Is that true? Even in the short run? Correlation between cyclical components of M2 and output 0.2



Dynamic Correlations

Positive correlations do not imply causality running from money to output

What about dynamic correlations?

Variable	Correlation with $\ln M_t$
$\ln Y_t$	0.22
$\ln Y_{t+1}$	0.32
$\ln Y_{t+2}$	0.37
$\ln Y_{t+3}$	0.37
$\ln Y_{t+4}$	0.33
$\ln Y_{t+5}$	0.26
$\ln Y_{t+6}$	0.19
$\ln Y_{t+7}$	0.10
$\ln Y_{t+8}$	0.03

Money leads output for a couple of years; suggestive that changes in money cause changes in output in the short run. Also emerges in more sophisticated econometric work