FGV EPGE
ESCOLA BRASILEIRA DE ECONOMIA E FINANÇAS

Macroeconomia e Mercados Financeiros

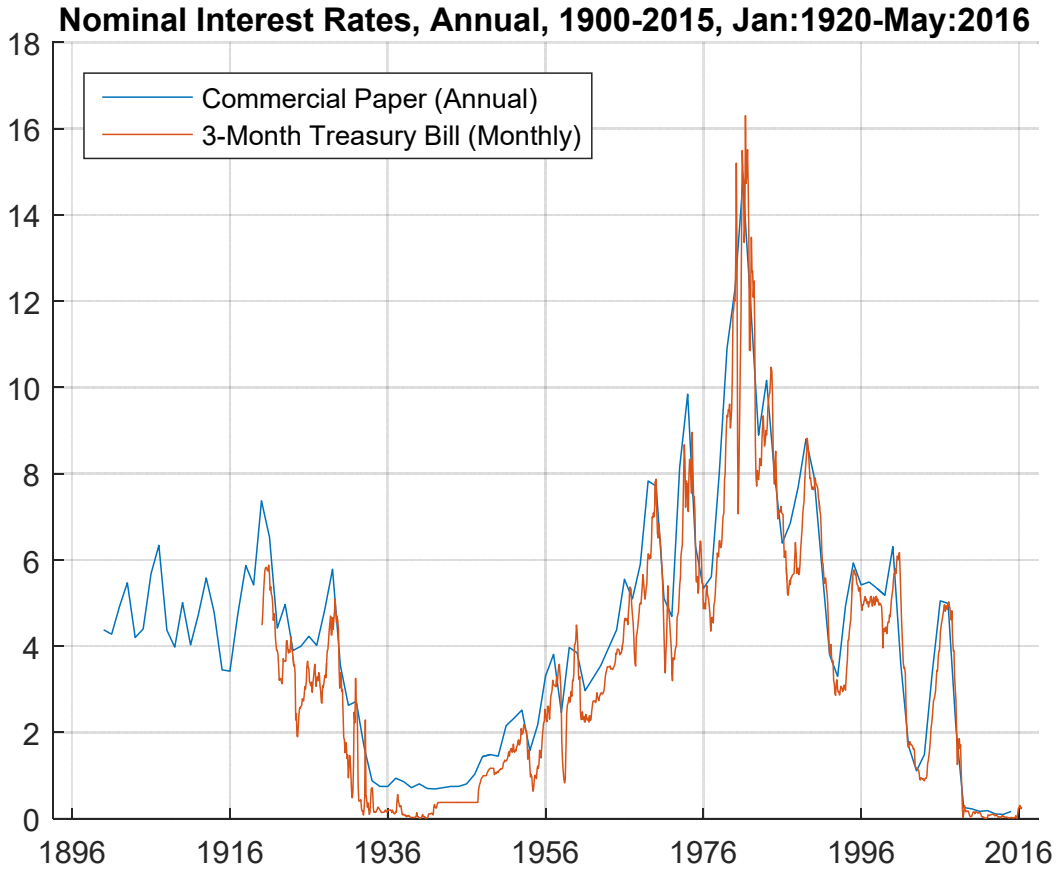
André C. Silva

2016 3º Trimestre

Asset Pricing

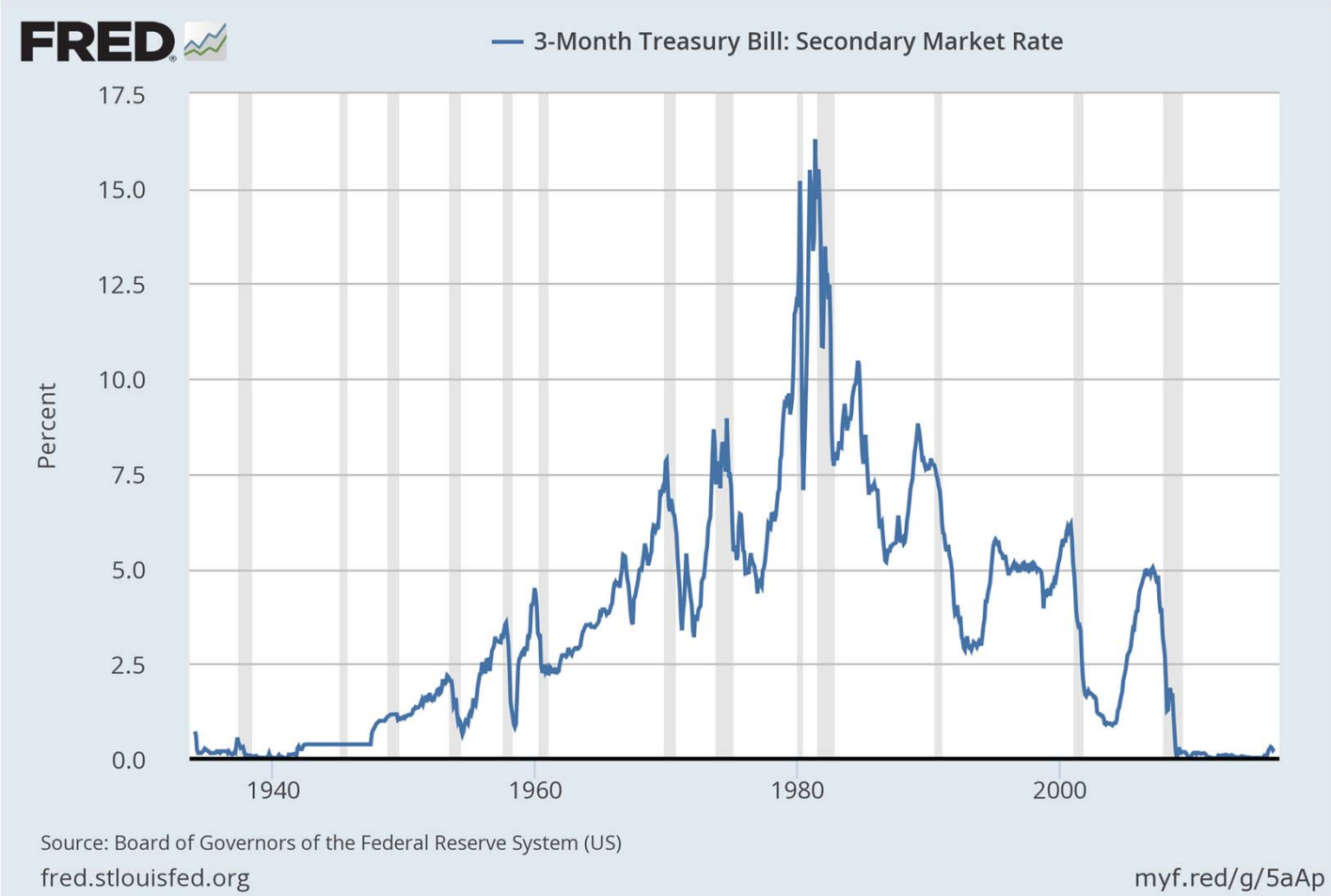
Interest Rates and the Economy

Commercial Paper and 3-Month T Bill



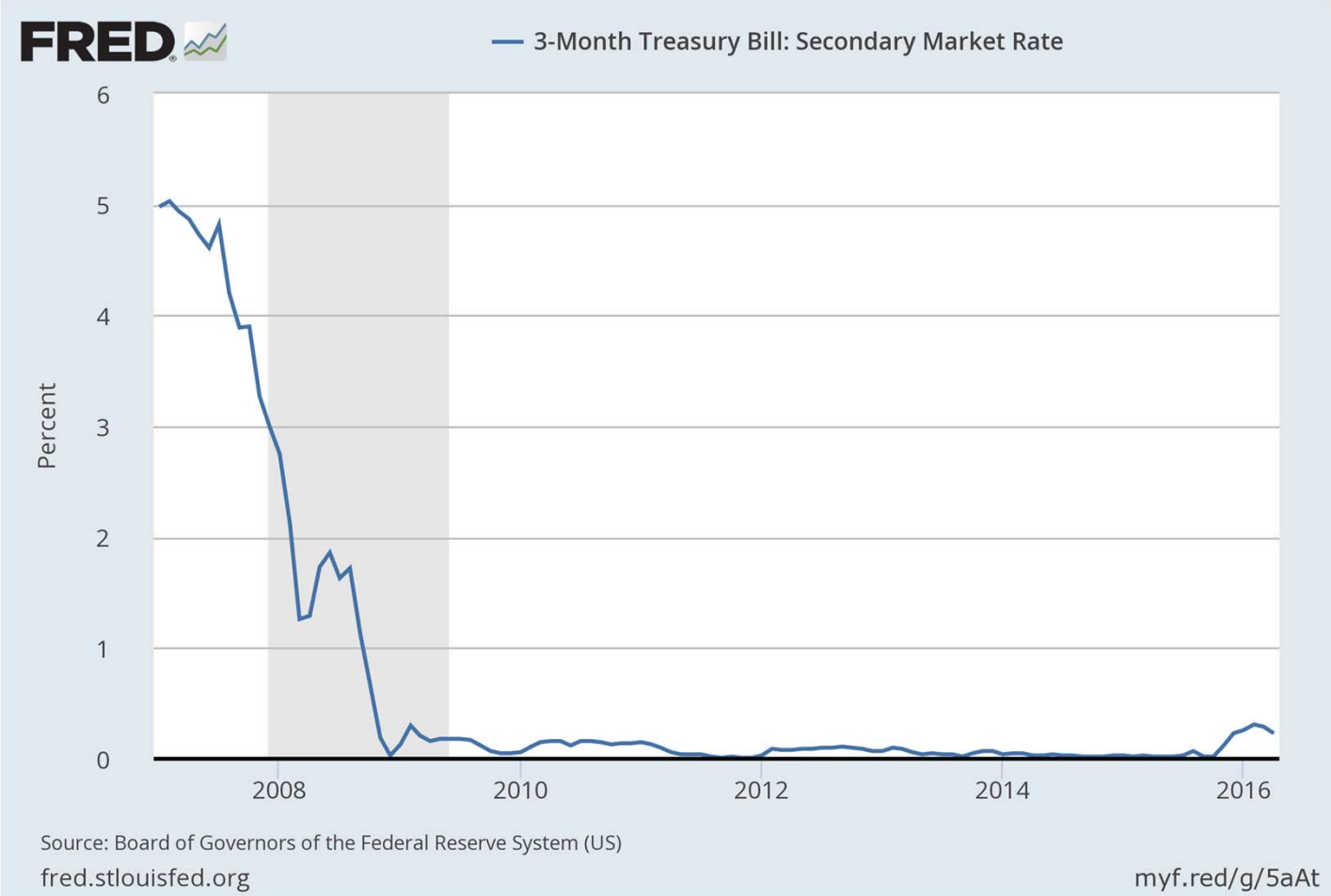
Sources: Friedman-Schwartz, Econ Rep Pres, FED St. Louis

3-Month T Bill



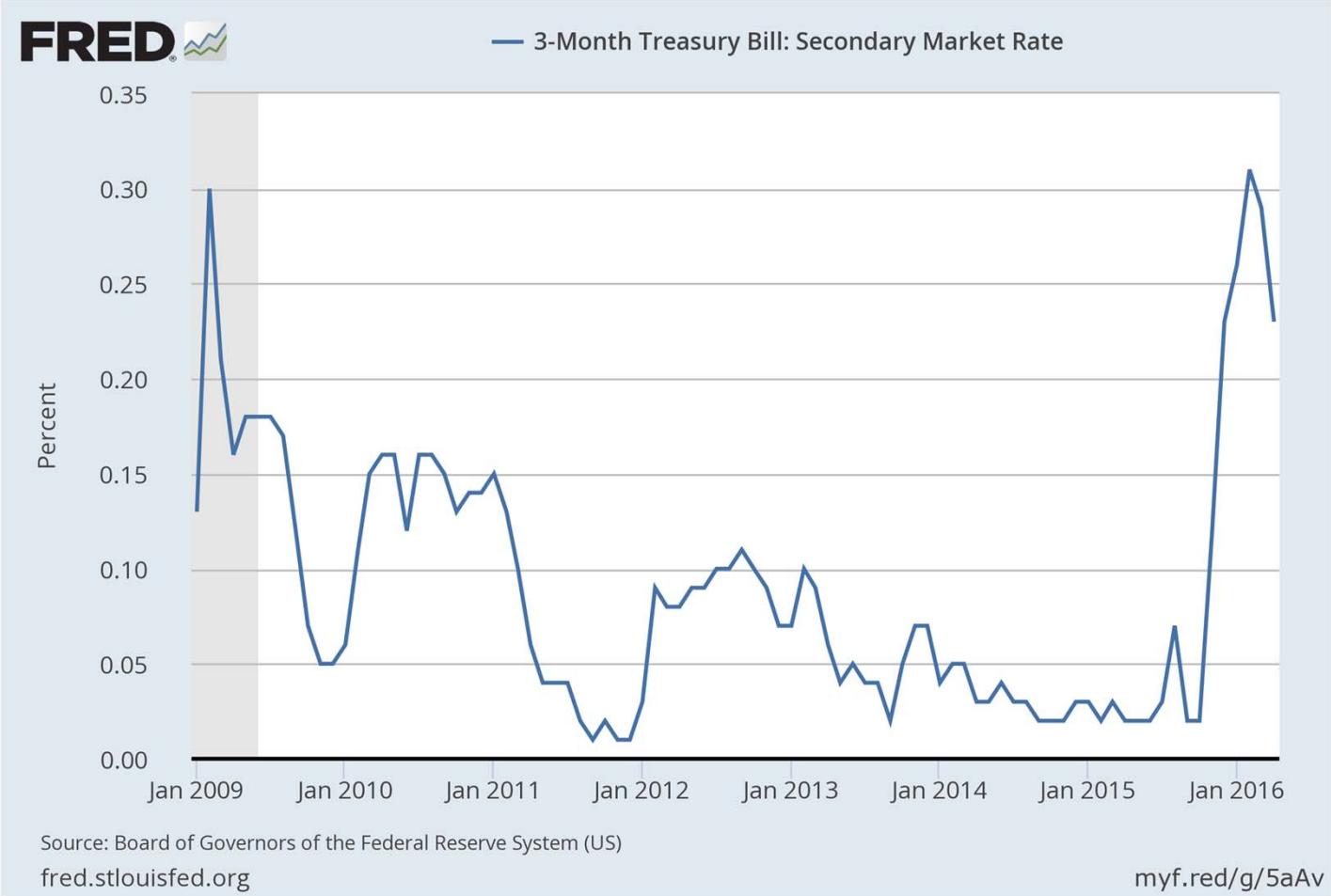
3-Month T Bill

From Jan/2007

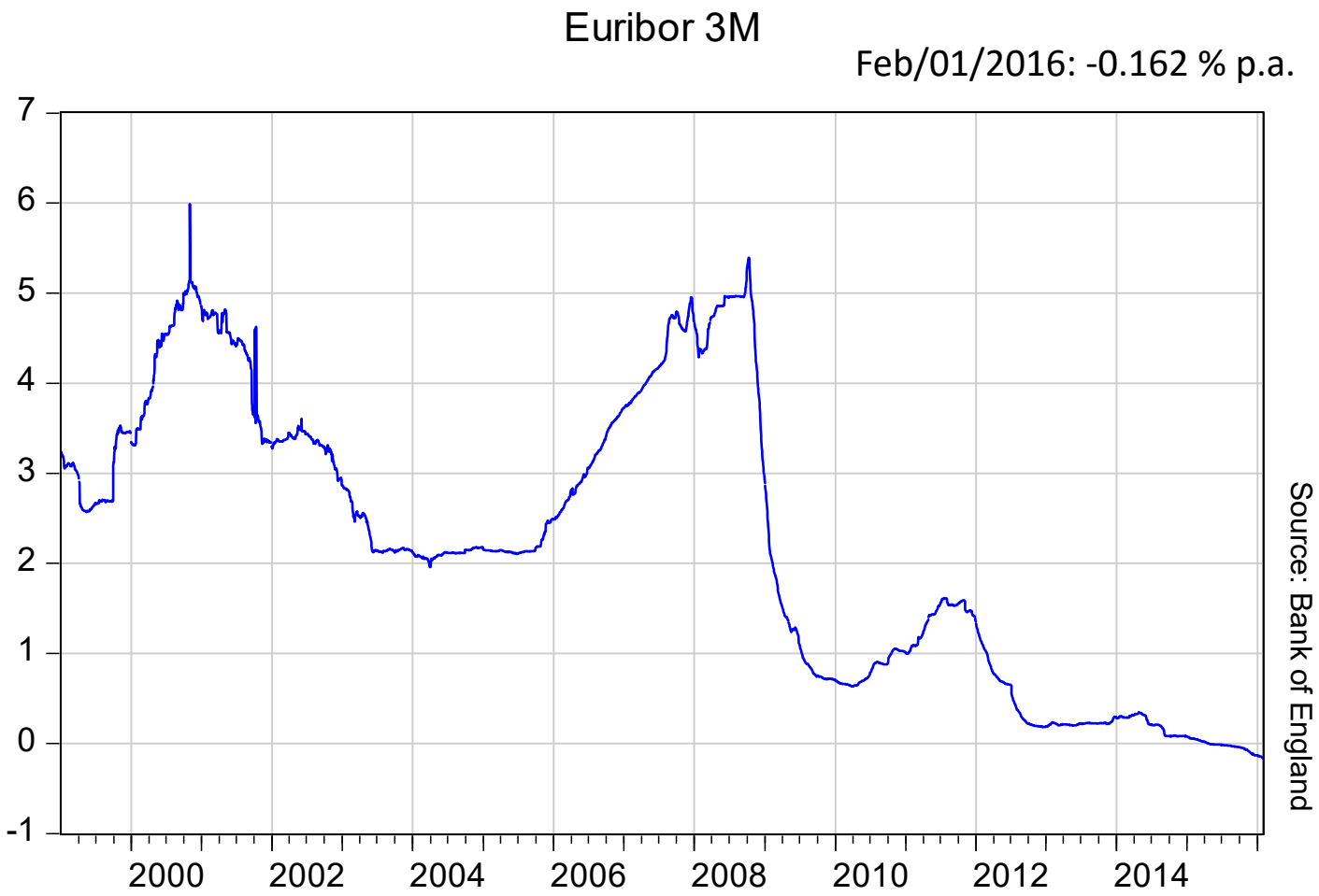


3-Month T Bill

From Jan/2009

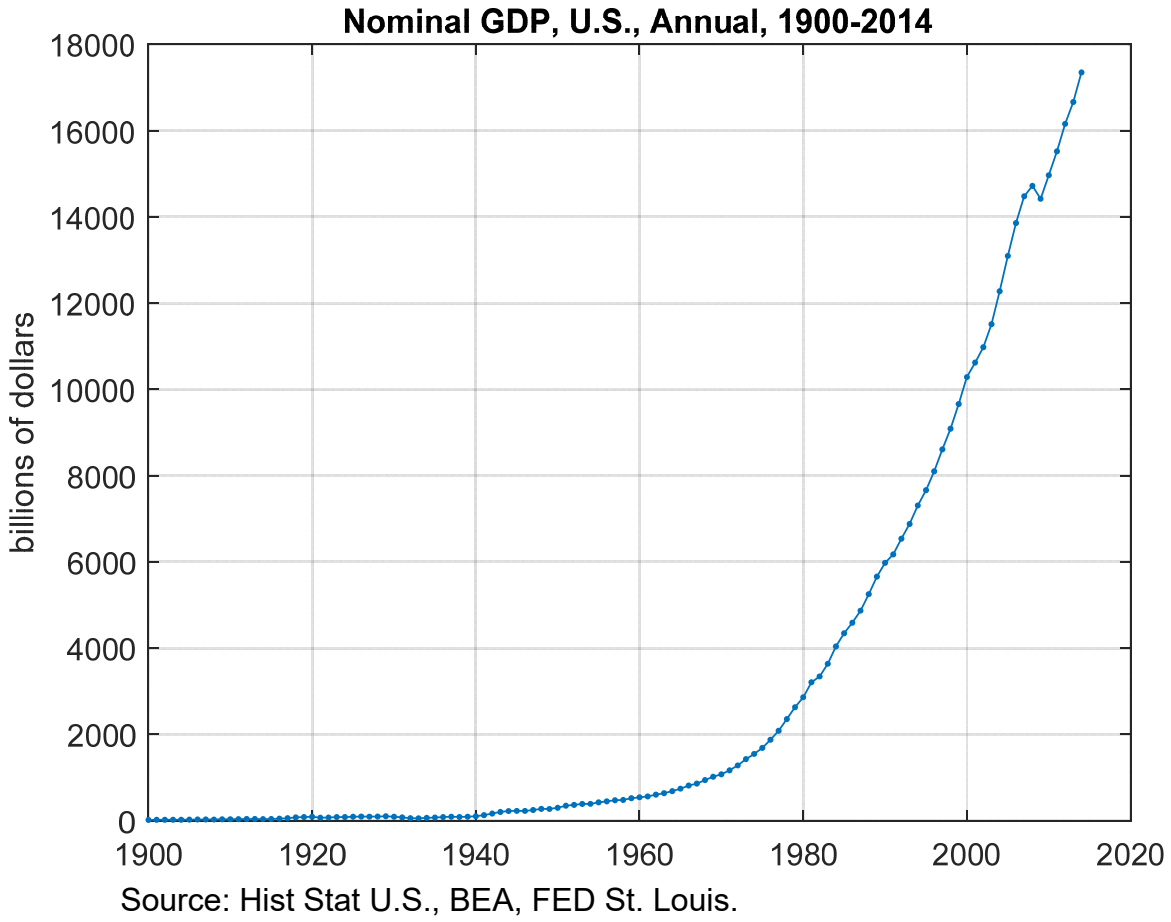


Euribor

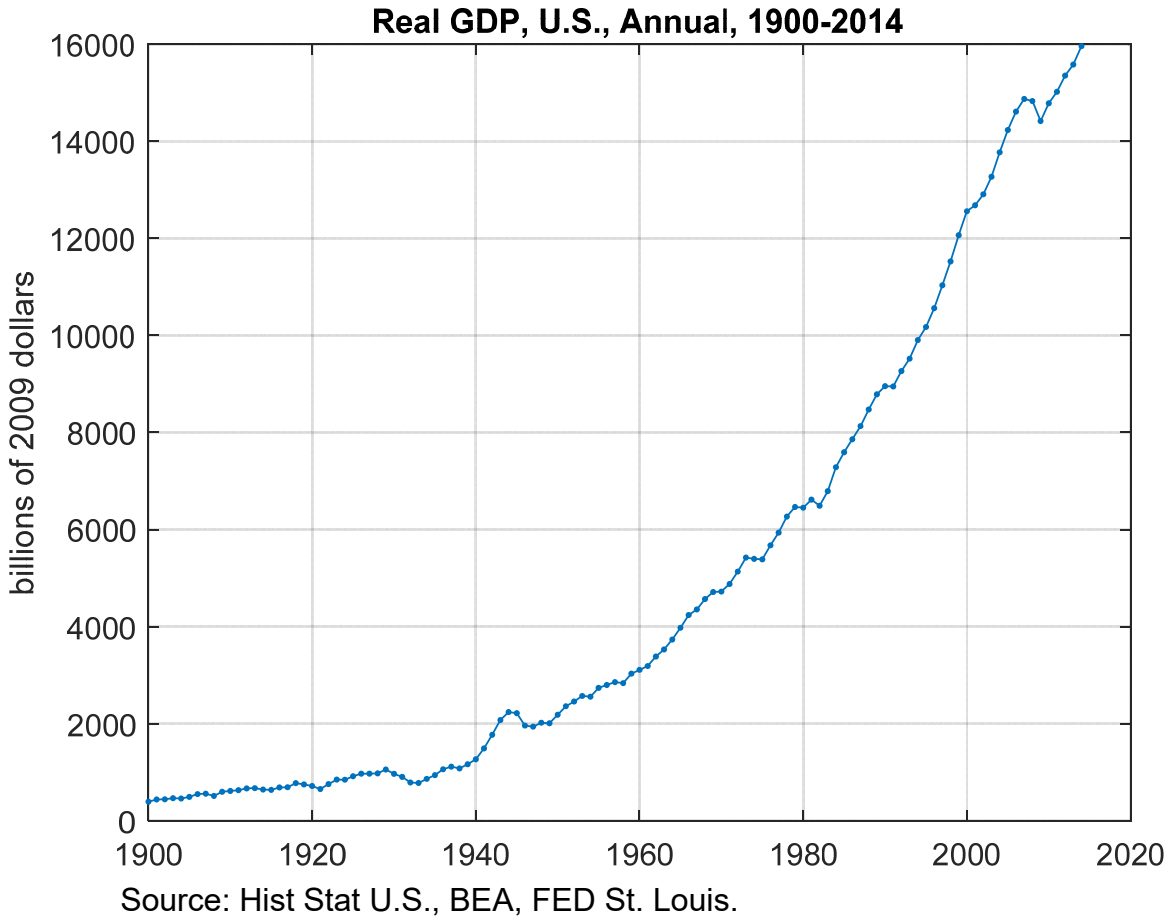

Euribor 3M
Feb/01/2016: -0.162 % p.a.
7
6
5
4
3
2
1
0
-1
2000
2002
2004
2006
2008
2010
2012
2014
Source: Bank of England

GDP Data

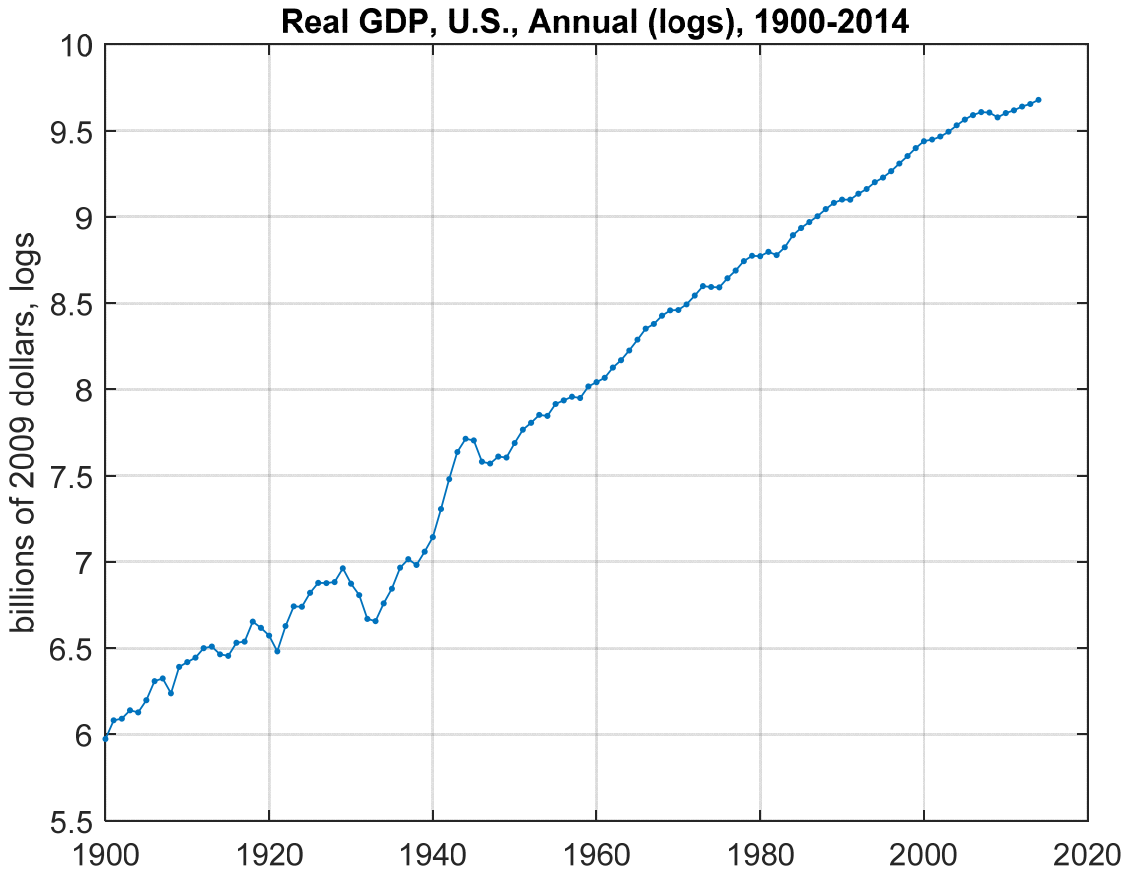
Nominal GDP U.S.



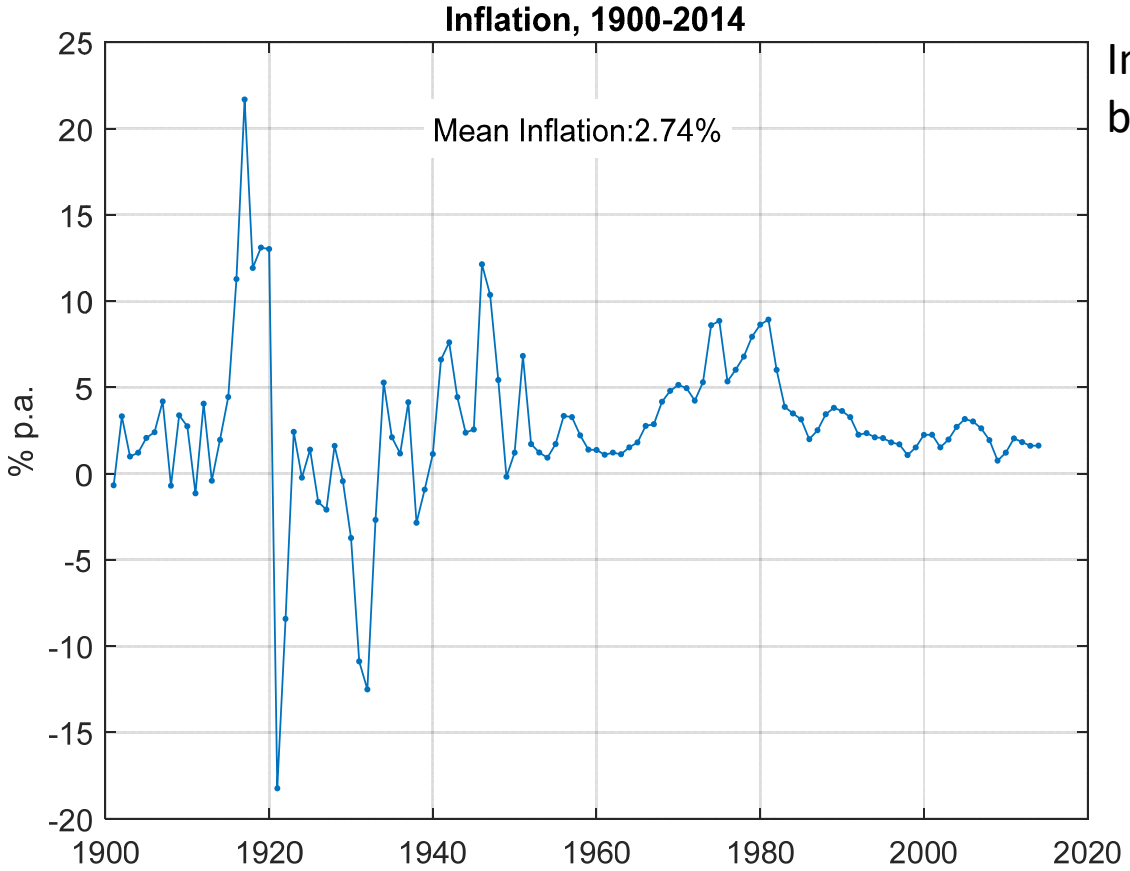
Real GDP U.S.


Real GDP, U.S., Annual, 1900-2014
billions of 2009 dollars
16000
14000
12000
10000
8000
6000
4000
2000
0
1900
1920
1940
1960
1980
2000
2020
Source: Hist Stat U.S., BEA, FED St. Louis.

Real GDP U.S.


Real GDP, U.S., Annual (logs), 1900-2014
billions of 2009 dollars, logs
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
1900
1920
1940
1960
1980
2000
2020

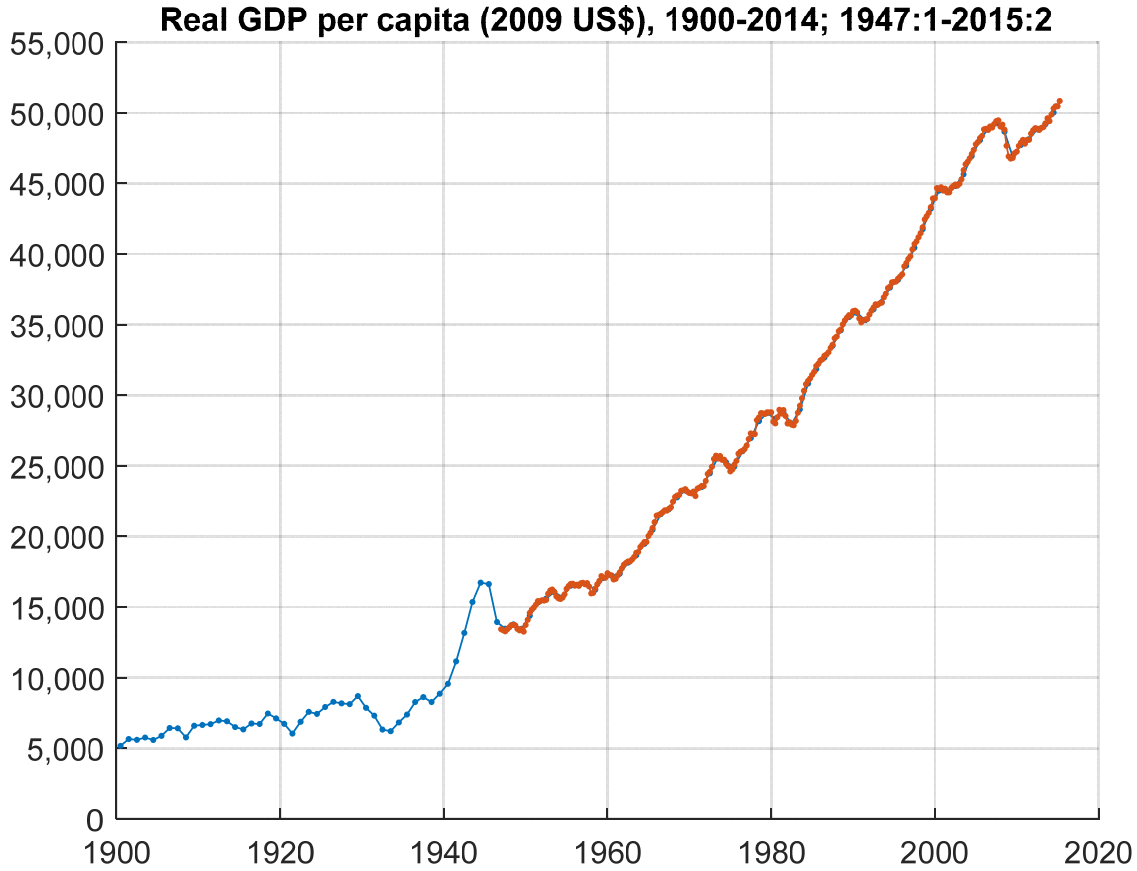
Inflation



Inflation calculated by the price deflator,

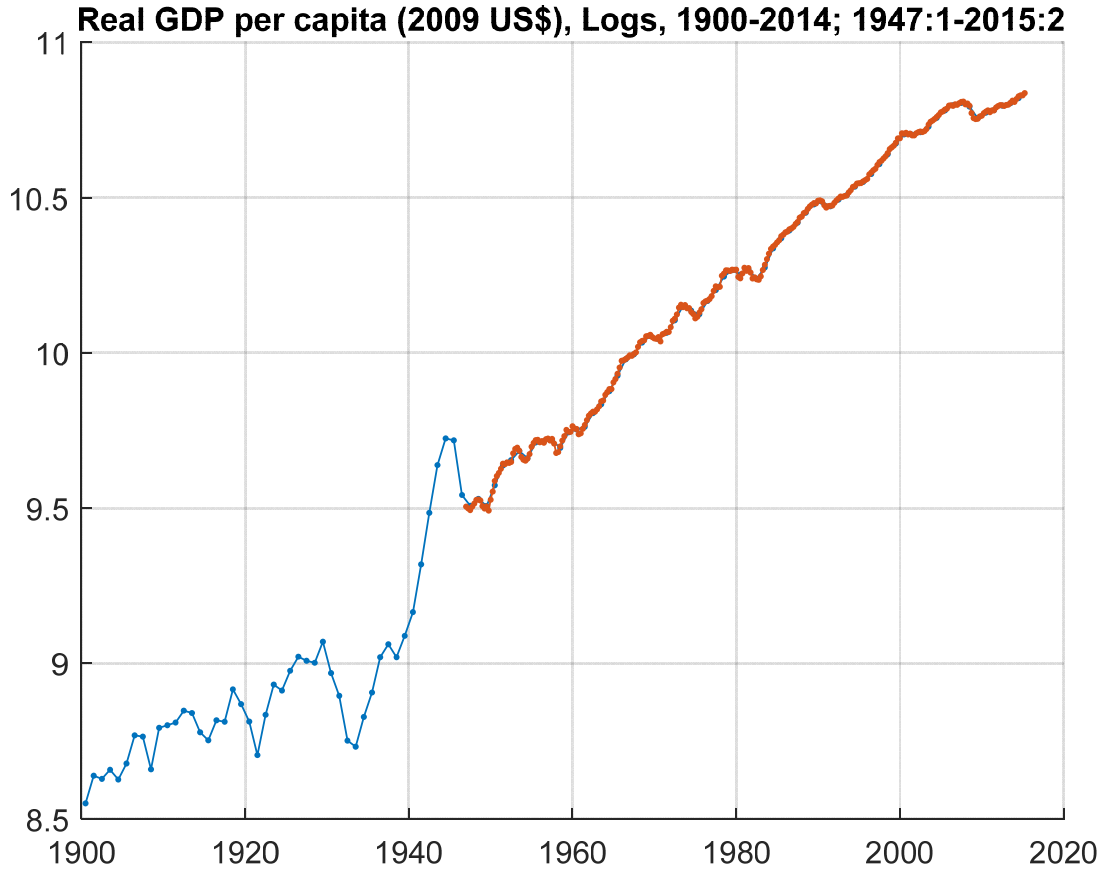
$$PD = \frac{NomGDP}{RealGDP}$$

Real GDP per capita, Annual and Quarterly



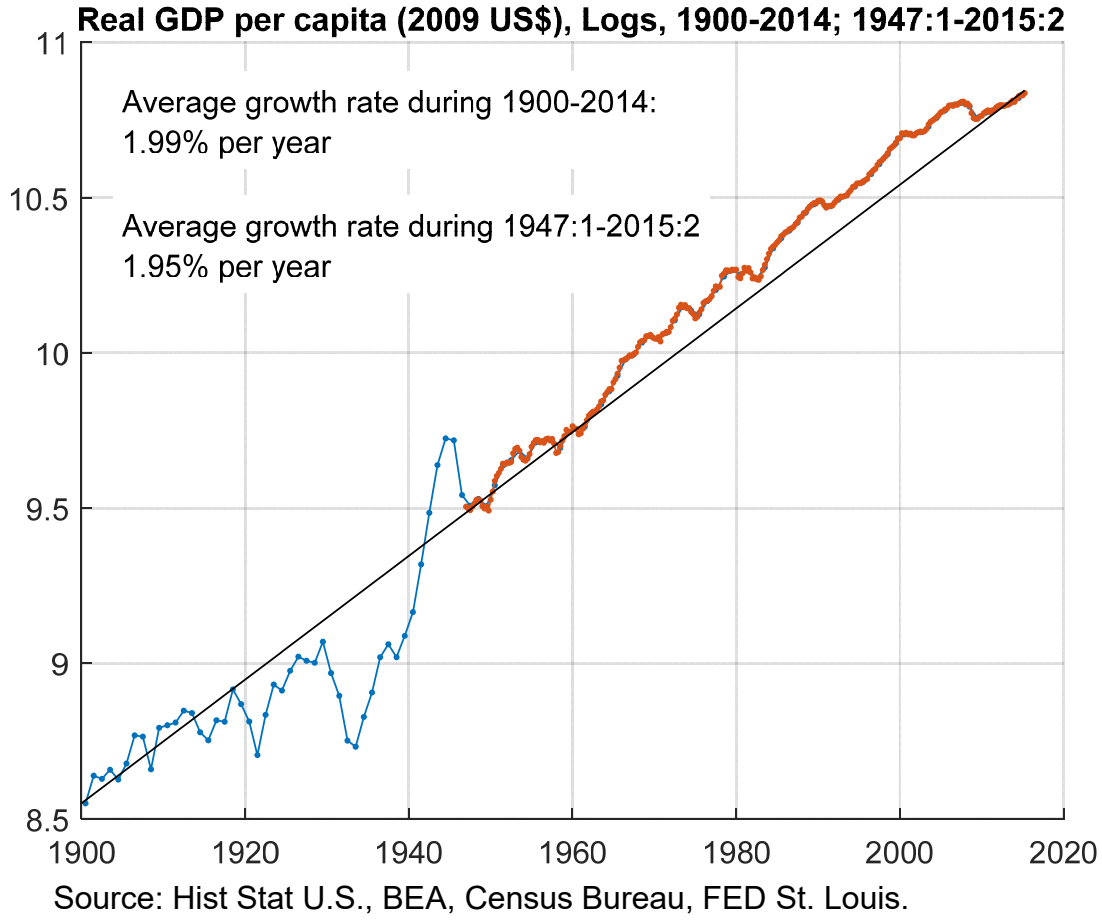
Source: Hist Stat U.S., BEA, Census Bureau, FED St. Louis.

Real GDP per capita, Annual and Quarterly



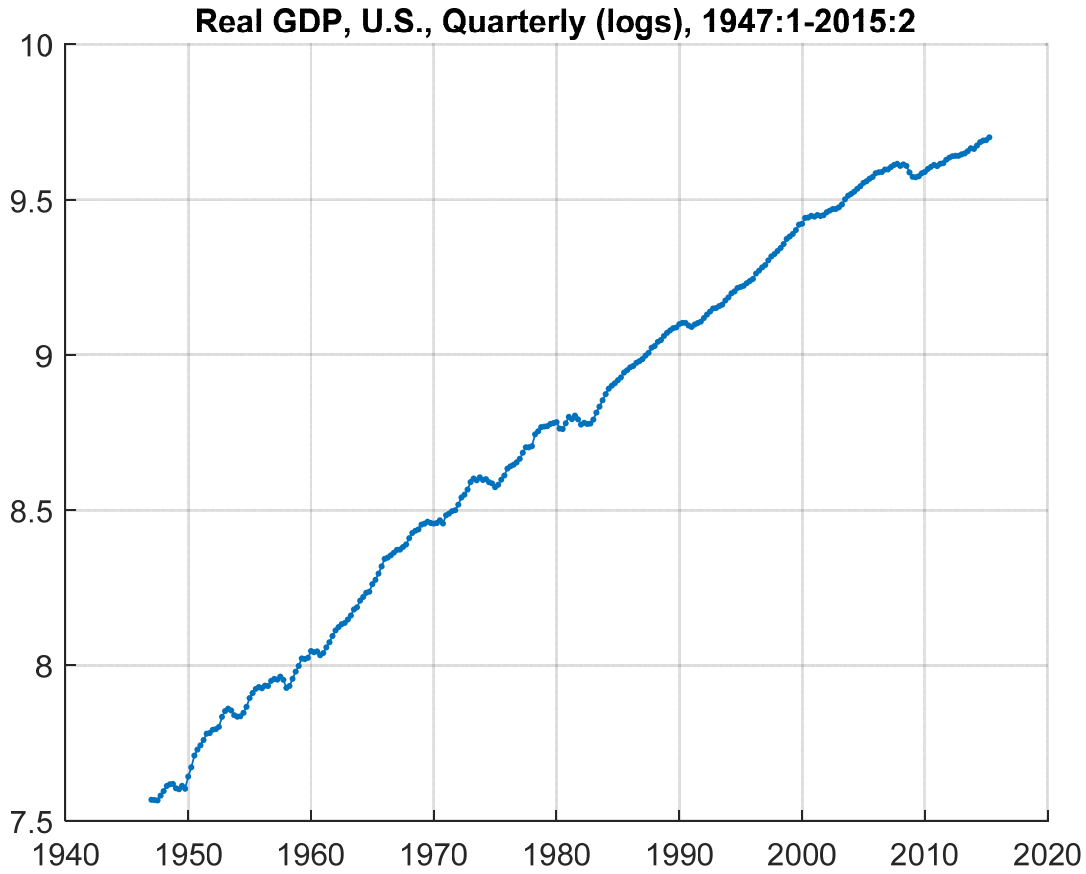
Source: Hist Stat U.S., BEA, Census Bureau, FED St. Louis.

Real GDP per capita, Annual and Quarterly

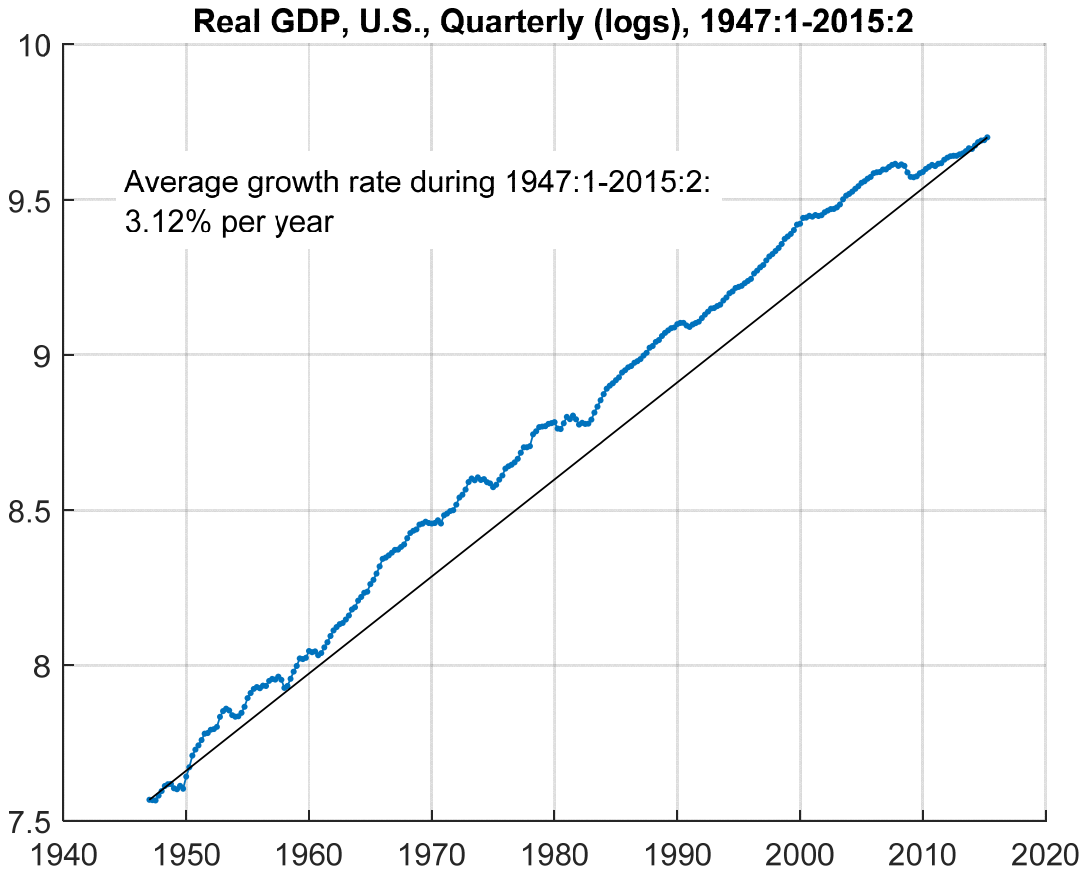


Source: Hist Stat U.S., BEA, Census Bureau, FED St. Louis.

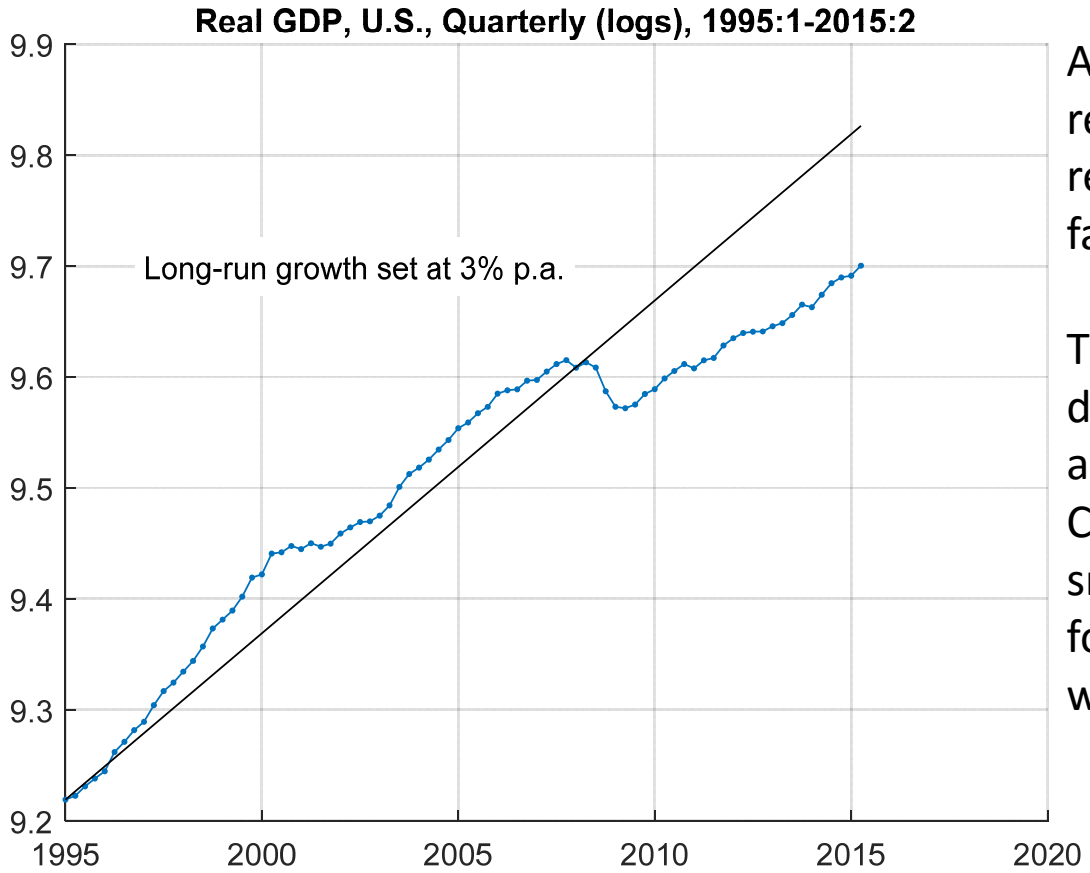
Real GDP, Quarterly



Real GDP, Quarterly



Real GDP, Quarterly

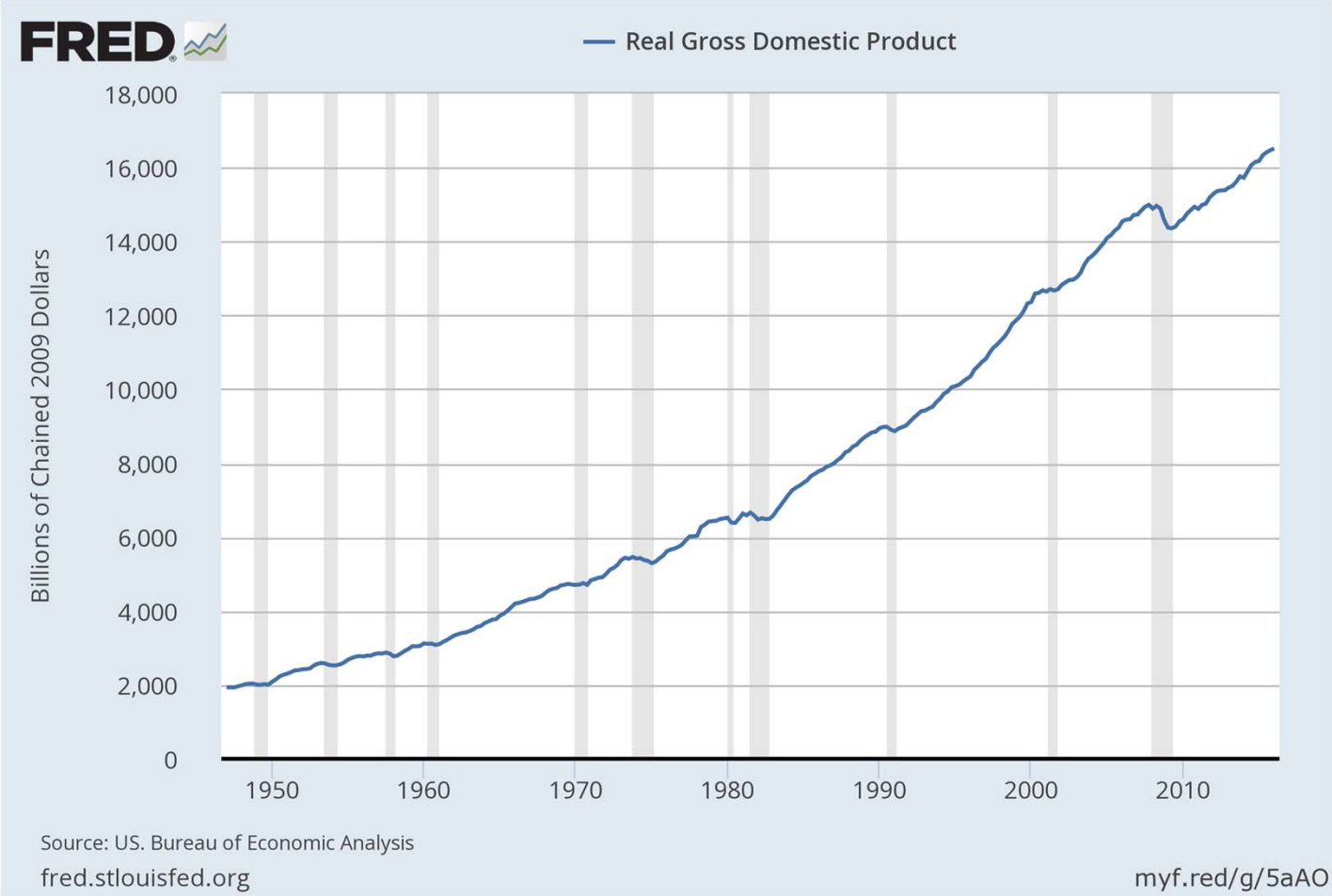


Aside: in other recessions, Real GDP returned to its trend faster.

There are lots of data and comments about this in the Cooley-Rupert snapshot (see a link for it on the course webpage).

Aggregate Real GDP

1947:Q1 to 2016:Q1



A Model

Relate interest rates with economic fluctuations

Each person decides how much to buy of consumption goods at each time

It is possible to use today's wealth to buy goods in the future through savings

Therefore, each person has a budget constraint in the form

$$c_t + Investment_t = A_t$$

Financial Markets

The variable for investments can take many forms

One of the forms is in bonds

Each bond has a promise of payment at a future date

The payment promised is called face value. Let's say 1$

The bonds are negotiated today. The negotiation implies a bond market price

Financial Markets

Let q_t be the price of the bond

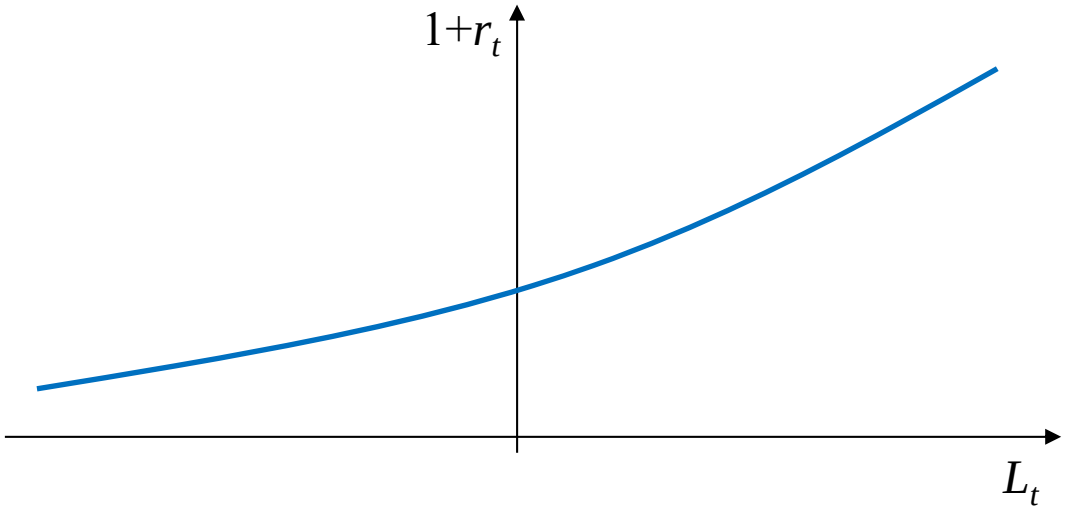
As bonds pay 1$ in the future, we expect $q_t < 1$

The interest rate between today and the period in which the bonds are redeemed is then

$$1 + r_t = \frac{1}{q_t}$$

Interest Rates and the Demand for Bonds

The demand for bonds tends to increase if the interest rate increases

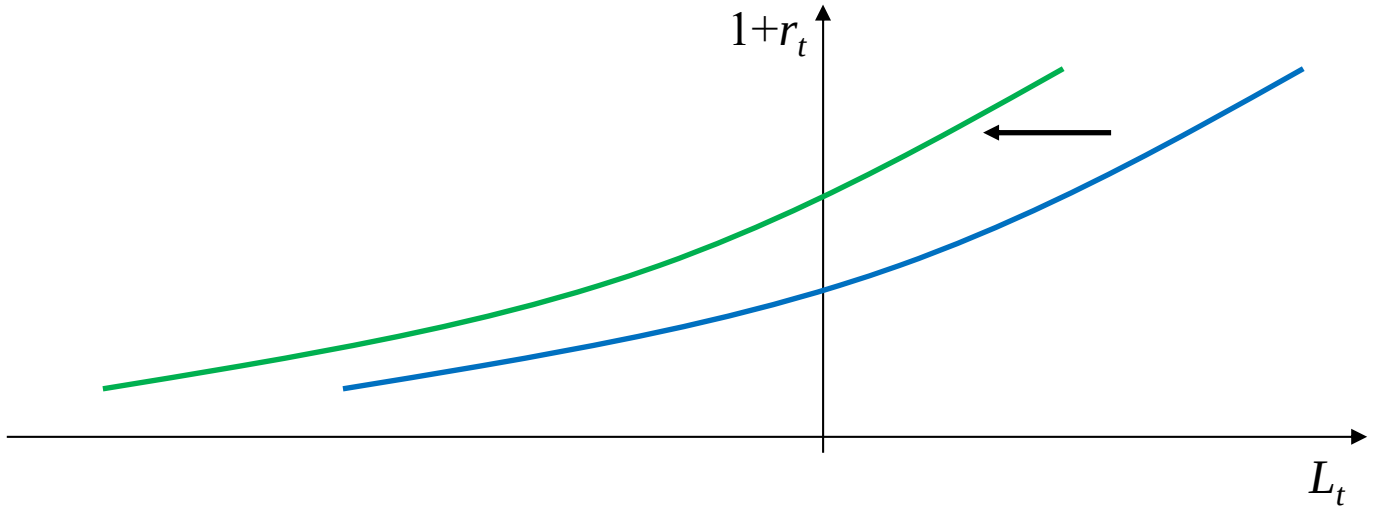


L_t: Demand for bonds

r_t: Real riskfree interest rate

The Demand for Bonds May Fluctuate

For example:



Different factors can affect the demand for bonds

Interest Rates

The interest rates must be compatible with the decisions of each person

As income and expectations change, these changes will make interest rates fluctuate over time

The fluctuations of interest rates can even help us to predict future changes

Decisions and Interest Rates

The decisions and interest rates are related by

$$E_t\left[(1+r_t)\beta\,\frac{u'(c_{t+1})}{u'(c_t)}\right]=1$$

Later, we will see how to obtain this result

Simplifying

Simplify the formula to

$$(1 + r_t)\beta \frac{u'(c_{t+1})}{u'(c_t)} = 1$$

To Apply the Formula

Use a form for the utility function $u(c_t)$, such as $u(c_t) = \log c_t$.

We obtain

$$(1 + r_t)\beta \left(\frac{c_{t+1}}{c_t} \right)^{-1} = 1$$

Applications

Rewriting,

$$1 + r_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t}$$

Applications

The formula,

$$1 + r_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t}$$

Means that interest rates should correlate positively with consumption growth

We could also relate to output growth, as consumption and output are strongly correlated

Data on Interest rates and Consumption Growth

From Our Discussion

Interest rates and the decisions of investors are related through the expression

$$E_t\left[(1+r_t)\frac{\beta u'(c_{t+1})}{u'(c_t)}\right]=1$$

We Obtained

$$1 + r_t = \frac{1}{\beta}\frac{c_{t+1}}{c_t}$$

This equation implies that we should expect a positive correlation between real interest rates and consumption growth

Let us see if we can find this positive correlation in the data

Writing as a Regression Equation

$$1 + r_t = \frac{1}{\beta}\frac{c_{t+1}}{c_t}$$

Implies

$$\log(1 + r_t) = log\frac{1}{\beta} + log\frac{c_{t+1}}{c_t}$$

Let $y_t \equiv \log(1 + r_t)$ and $x_t \equiv \log(c_{t+1}/c_t)$

Writing as a Regression Equation

$y_t \equiv \log(1 + r_t)$ and $x_t \equiv \log(c_{t+1}/c_t)$

The regression equation

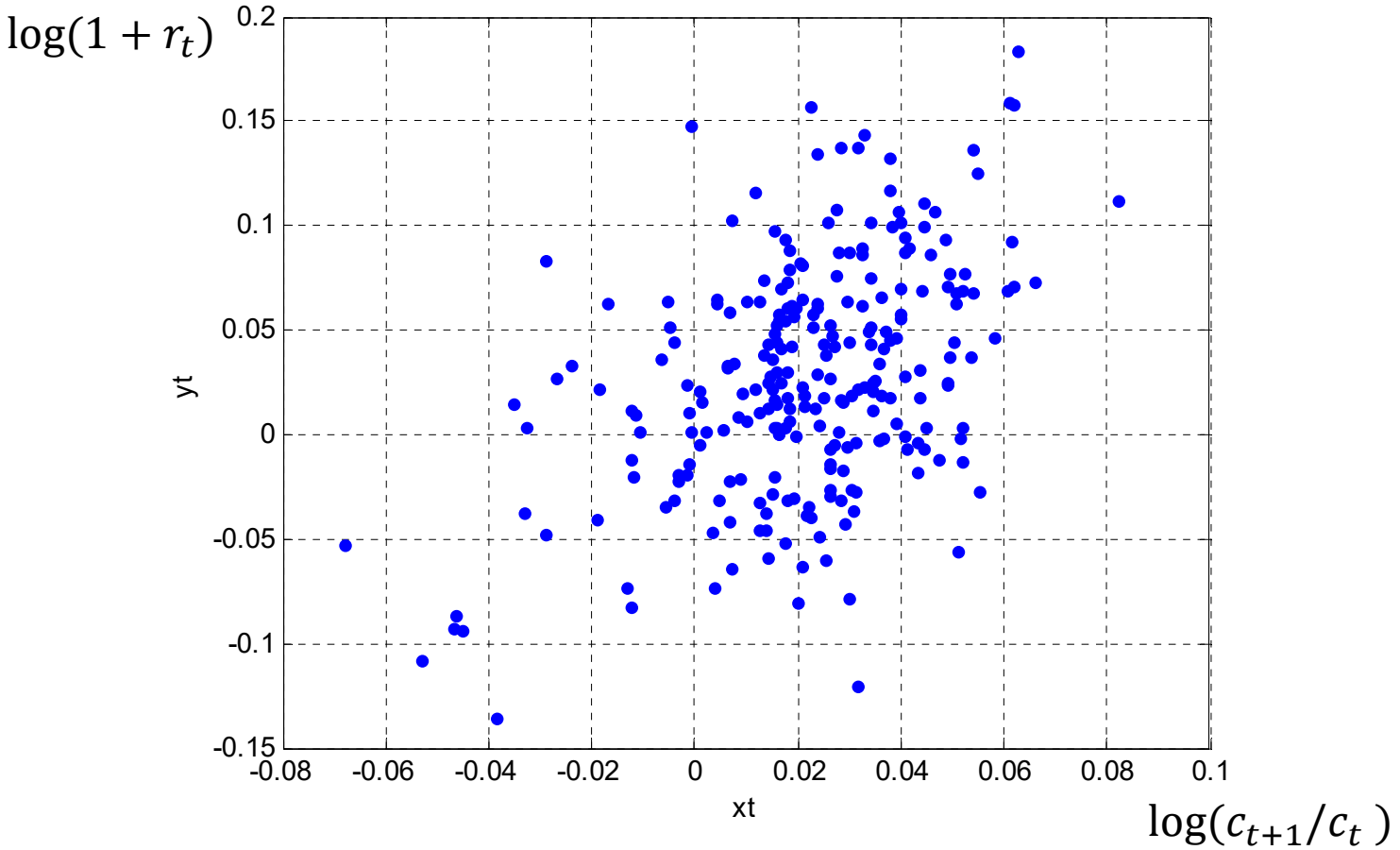
$$y_t = a + bx_t + \varepsilon_t$$

Implies

$$a = \log\frac{1}{\beta} > 0 \text{ and } b = 1 > 0$$

We Expect

$$y_t = a + bx_t + \varepsilon_t, \quad a > 0, b > 0$$



Data

Nominal Interest Rates, Annual

- Commercial Paper: 1900-
  - 1900-1975: Friedman-Schwartz (1982)
  - 1976-1997: The Economic Report of the President
  - 1998-: FED St. Louis
- 3-Month Treasury Bills: 1934-
  - FED St. Louis

Nominal Interest Rates, Quarterly

- 3-Month Treasury Bills: 1934:1-
  - FED St. Louis

Data

GDP

- 1900-1928: Historical Statistics U.S.
- 1929-: BEA-Nat Income and Prod Accts (NIPA)
- 1947:1-: BEA-NIPA

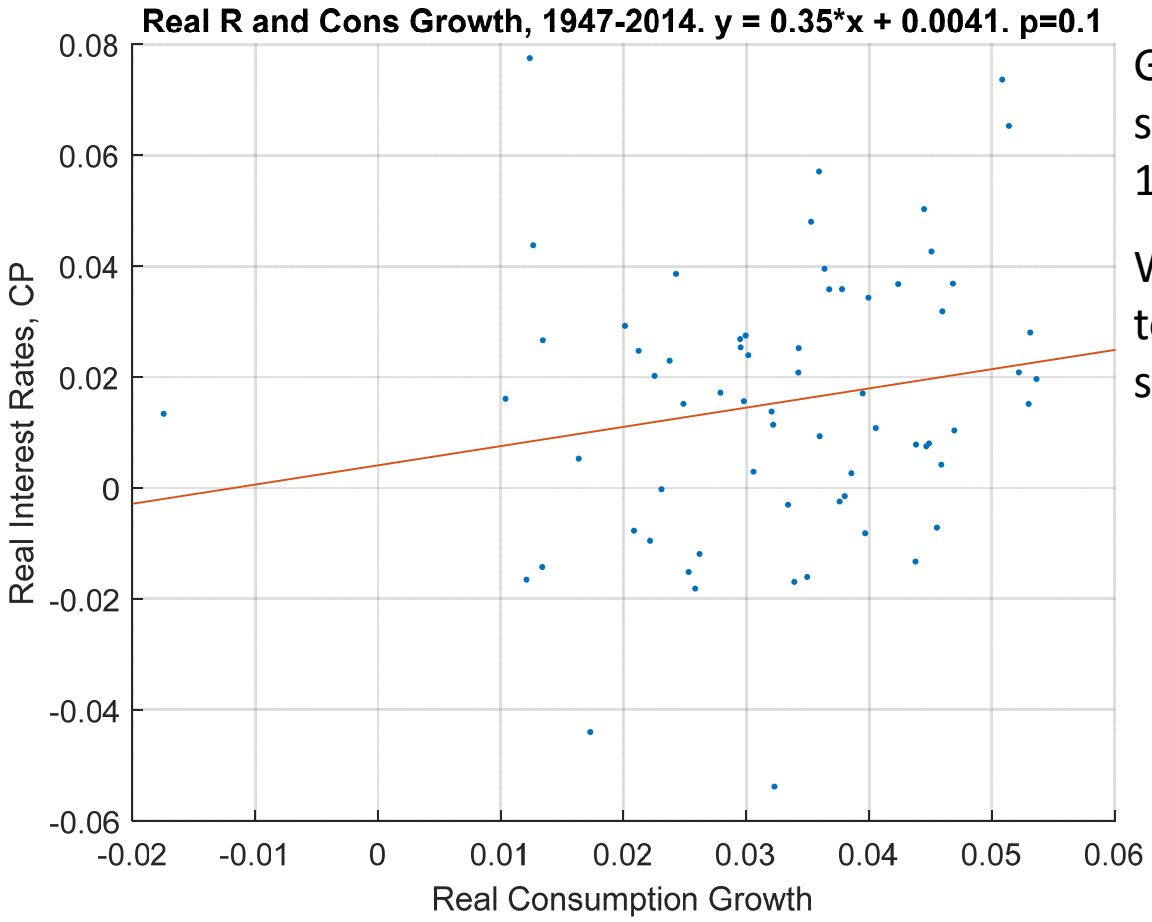
Consumption: Non-Durable Consumption and Services

- 1929-: BEA-NIPA
- 1947:1-: BEA-NIPA

Population

- 1900-: U.S. Census Bureau, FED St. Louis

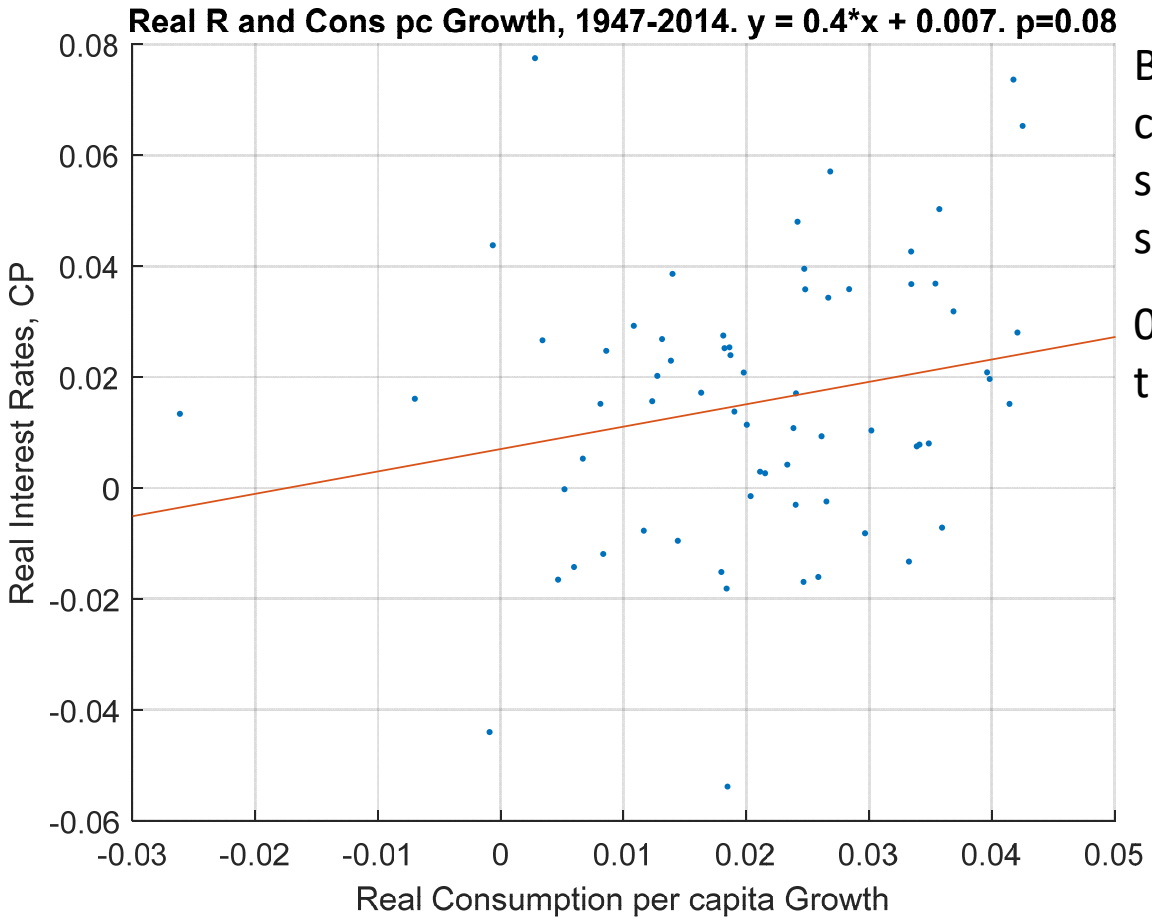
With Consumption Growth



Great! But 0.35 is significant at the 10% level.

With data from 1947 to 2013, it is not significant.

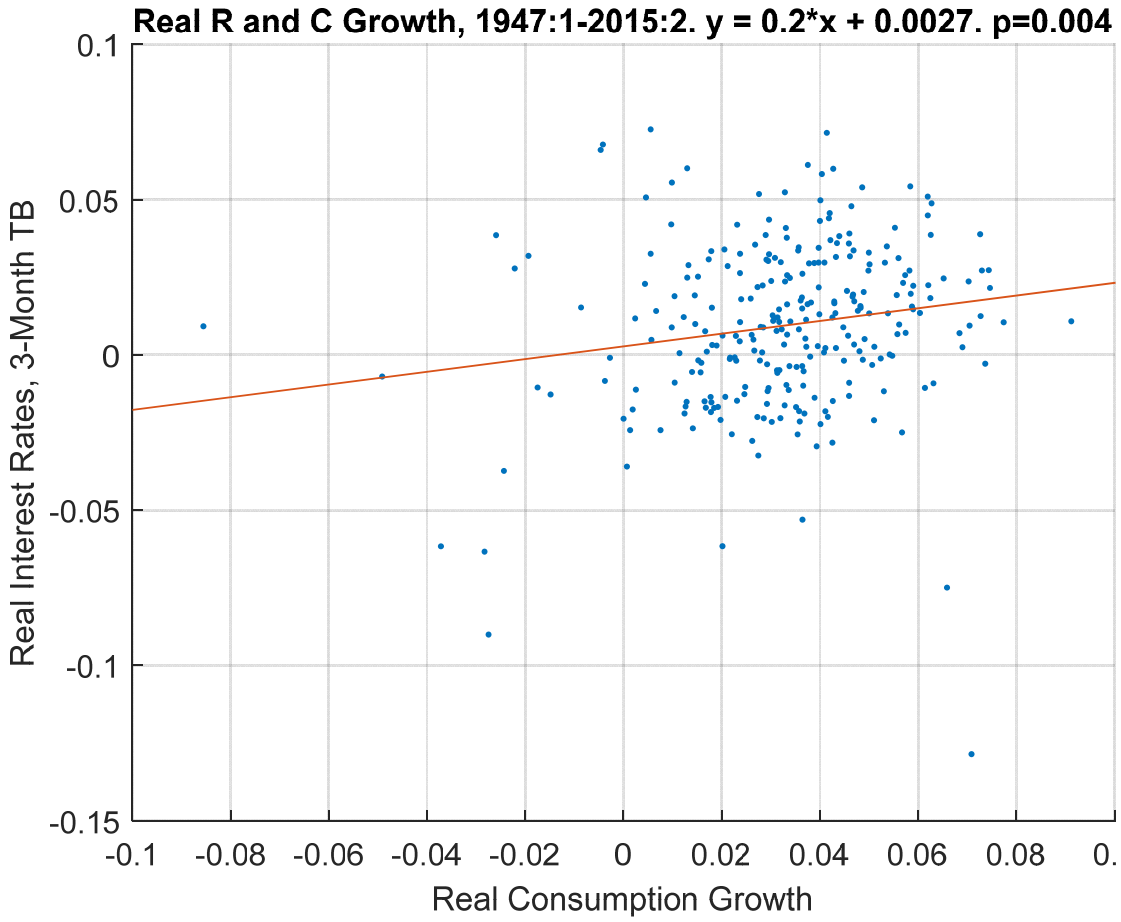
With per capita Consumption



Better, higher coefficient and more statistical significance.

0.4 is significant at the 10% level.

With Consumption, Quarterly



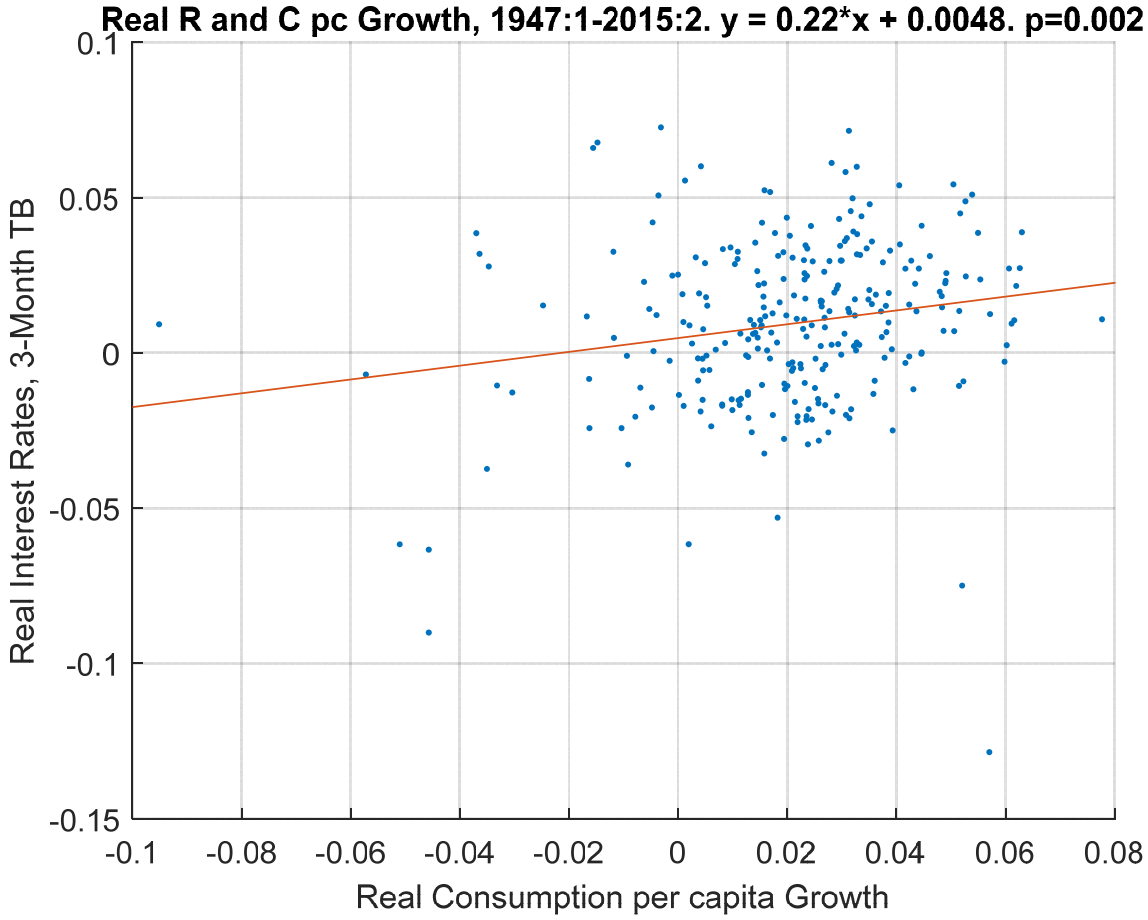
Quarterly data yields more data and more variation.

We obtain a positive coefficient on x, as expected.

Moreover, the coefficient is significant at the 1% level.

Remember that x stands for consumption growth.

With Consumption per capita



The results are even better with consumption per capita.

The coefficient on x increases and the p-value decreases (becomes more significant).

Conclusions

We test the relation $1 + r_t = \frac{1}{\beta} x_t$, where x_t stands for output growth or consumption growth

The relation works well with consumption growth

Works better with per capita consumption growth

This is evidence that interest rates are related to consumption growth