Asset Pricing and Macro

Spring 2026
Econ 256, College of the Holy Cross
Prof. Josh Abel

Cassidy (2013)

Discounting Future Payments

- Consider a guaranteed ("risk-free") payment of $\$D_1$ you will receive 1 year from now. What is it worth today?

$$D_1$$

- Suppose you saved $P_0 = D_1/(1+i_{0,1})$ today, where $i_{0,1}$ is the risk-free rate between periods 0 and 1. In 1 year, this will turn into:

$$(1+i_{0,1})*D_1/(1+i_{0,1}) = D_1$$

- So D_1 in 1 year is worth $D_1/(1+i_{0,1})$
  - $i_{0,1}$ is the "discount rate"
  - Money in the future is worth less than money today because money today can earn interest between now and then
- If D_1 is risky (e.g. might not be paid, or its value is uncertain), you will typically want to discount it at a higher rate of $\tilde{i} > i_{0,1}$
  - This is of huge importance for many applications, but we will ignore it here

Long-Term Interest Rates

- Consider a guaranteed ("risk-free") payment of $\$D_2$ you will receive 2 years from now. What is it worth today?

$$D_2$$

- *Long-term approach:* Suppose you loaned $P_0 = D_2/(1+i_{0,2})$ for 2 years, where $i_{0,2}$ is the risk-free rate between periods 0 and 2. In 2 year, this will turn into:

$$(1+i_{0,2})*D_2/(1+i_{0,2}) = D_2$$

- *Short-term, rollover approach:* Suppose you loaned $P_0 = D_2/((1+i_{0,1})*(1+i_{1,2}))$ for 1 year, then took the proceeds and loaned them out again for another year. In 1 year, you will have:

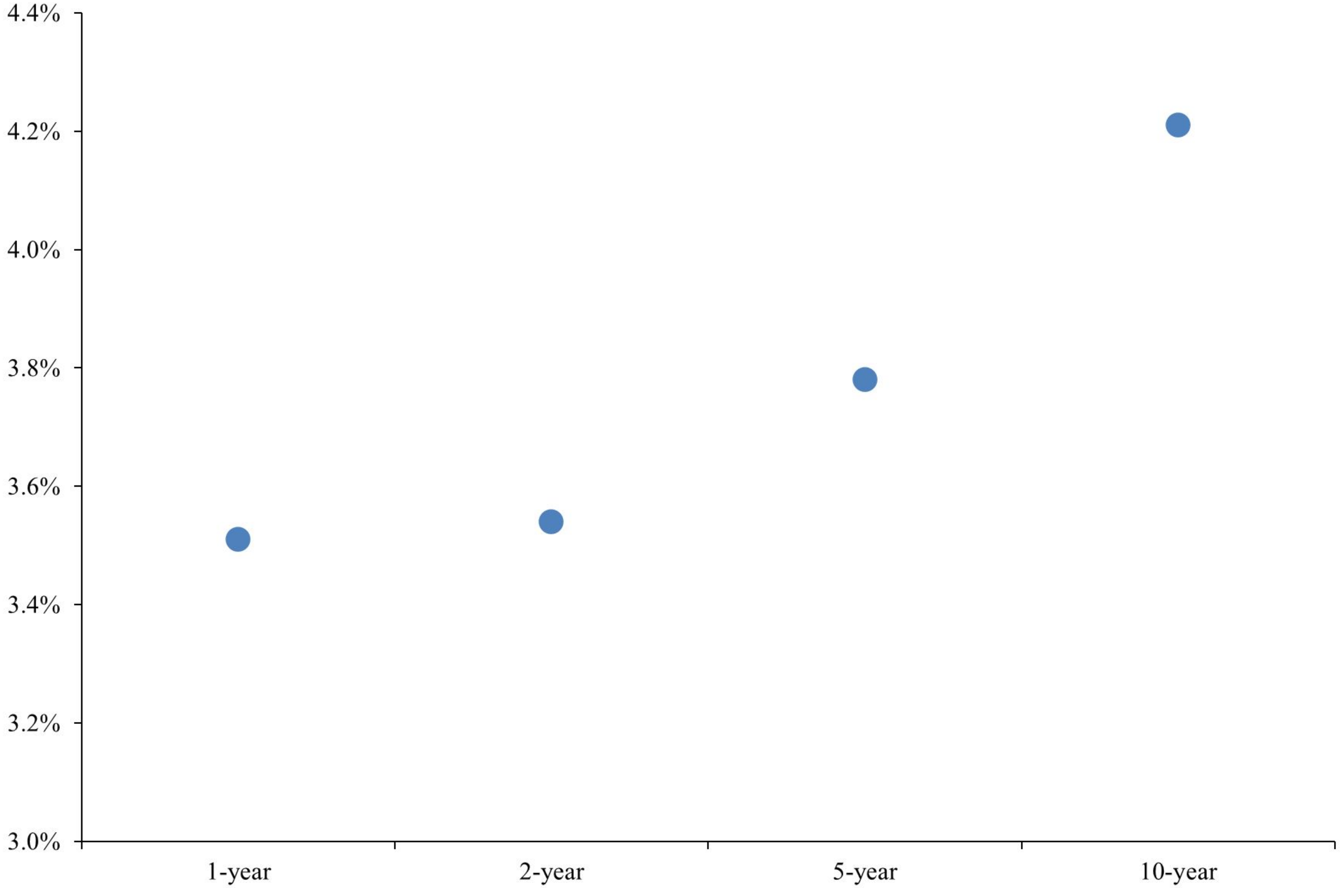
$$(1+i_{0,1})*D_2/((1+i_{0,1})*(1+i_{1,2})) = D_2/(1+i_{1,2})$$

  - Then after the second year, you will have:

$$(1+i_{1,2})*D_2/(1+i_{1,2}) = D_2$$

Yield Curve

Annualized Interest Rates: January 2026



Source: FRED

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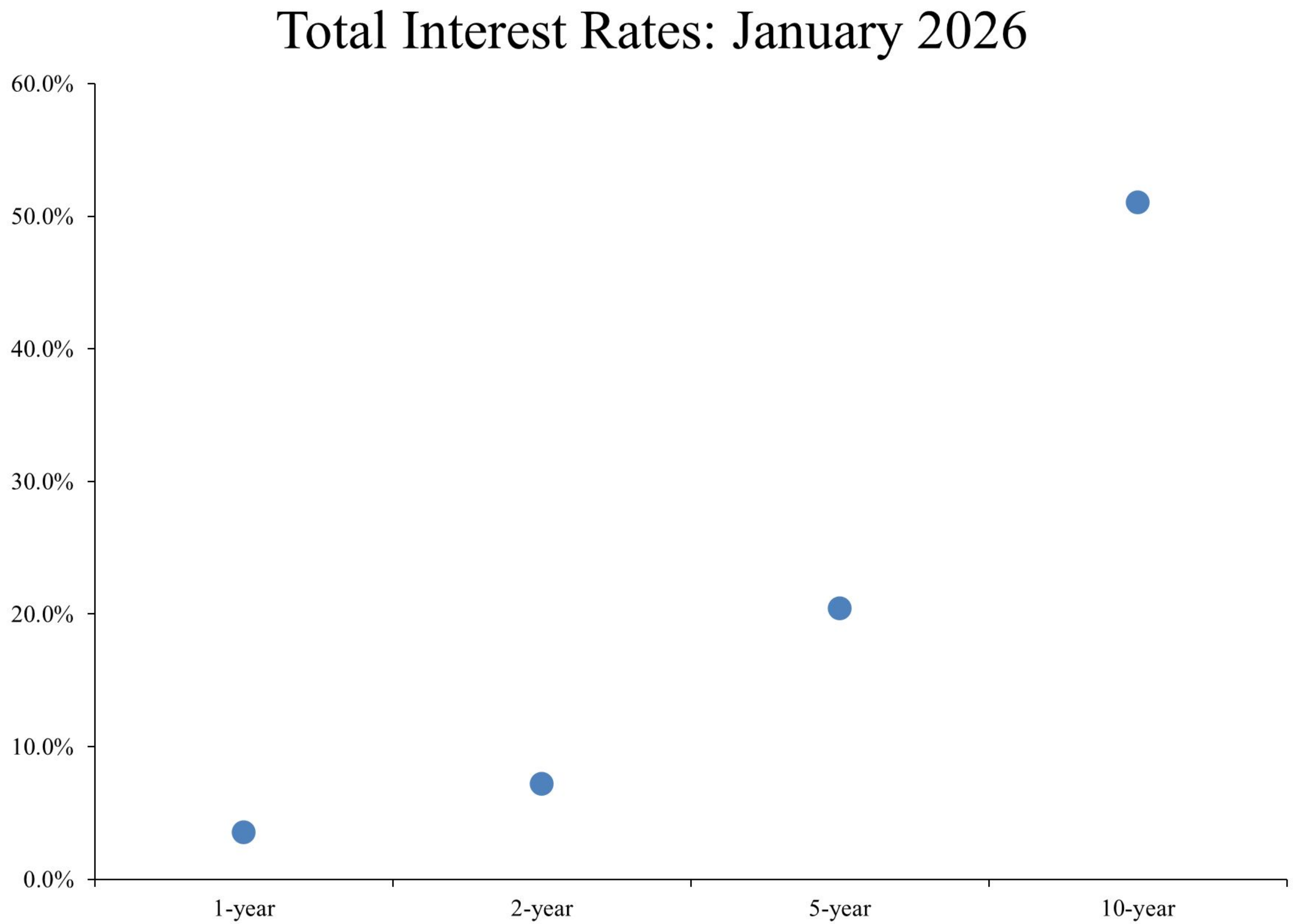

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"The Expectations Hypothesis"

- Just argued that:

$$D_2/(1+i_{0,2}) = D_2/((1+i_{0,1})*(1+i_{1,2})),$$

implying:

$$(1+i_{0,2}) = (1+i_{0,1})*(1+i_{1,2}),$$

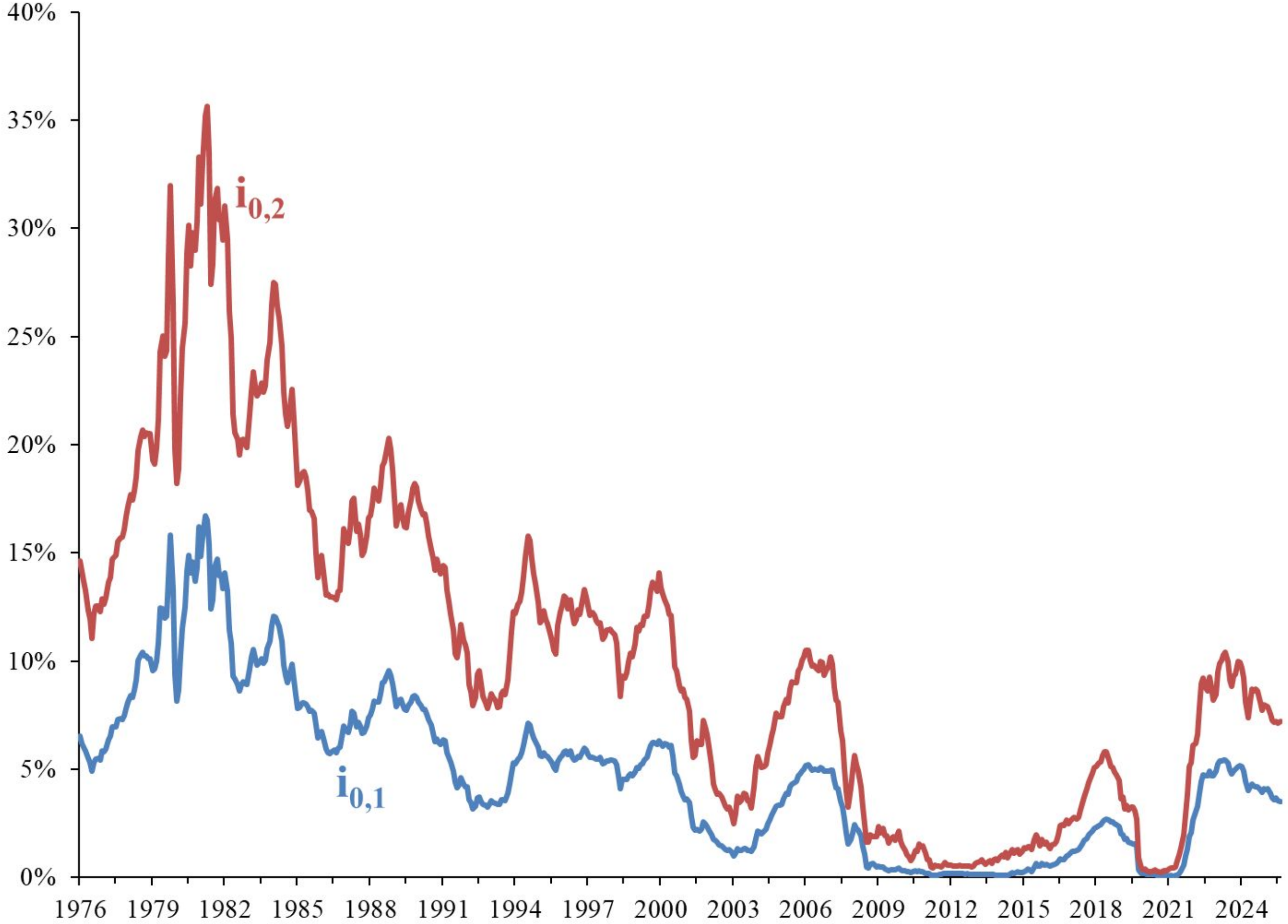
i.e. (because of log approximation):

$$i_{0,2} \cong i_{0,1} + i_{1,2}$$

- In words, long-term rates are the sum of (expected) short-term rates.
- In reality, there's also typically a "term premium" added to long-term rates to compensate lenders for having their money tied up.

$$i_{0,2} \cong i_{0,1} + i_{1,2} + \boldsymbol{\phi}_{TP}$$

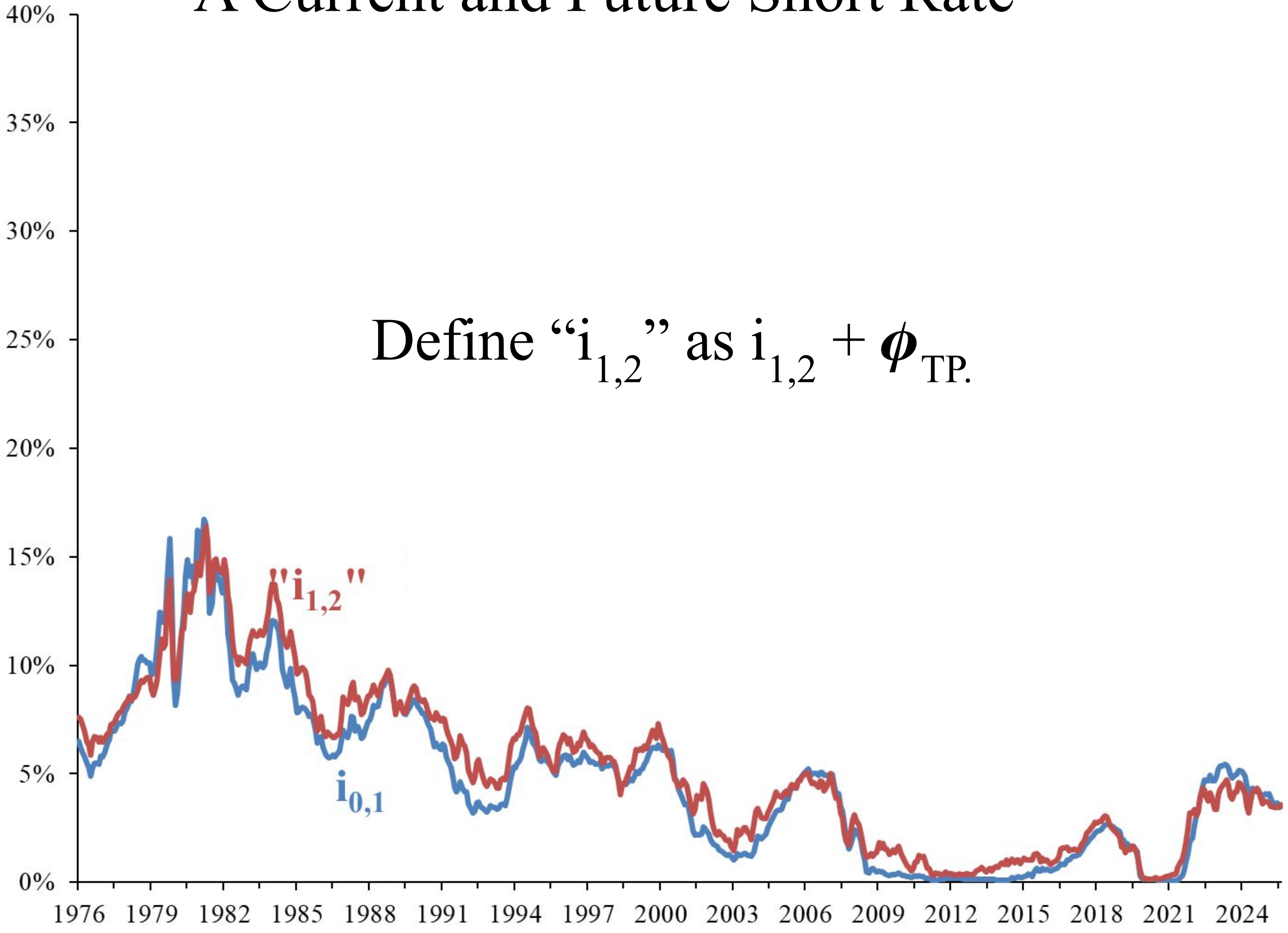
A Short and a Long Rate



Source: FRED

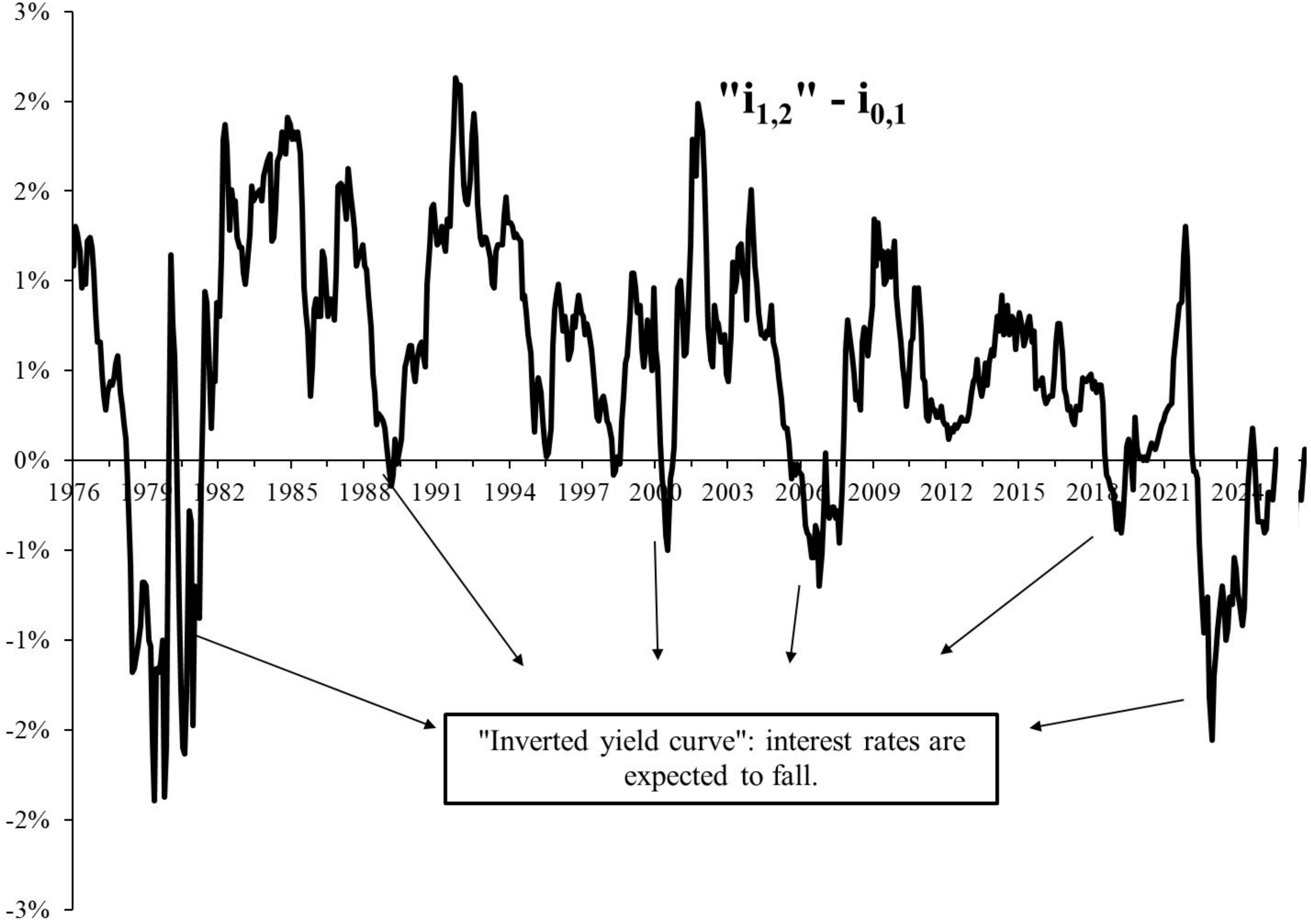
A Current and Future Short Rate

Define "$i_{1,2}$" as $i_{1,2} + \phi_{TP}$.



Source: FRED

Difference Between Future and Current Short Rate



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Interpreting the Yield Curve

$$i_{0,2} \cong i_{0,1} + i_{1,2} + \boldsymbol{\phi}_{TP}$$

- Yield curve is a high-frequency thermometer for the economy (unlike that stock-bond correlation), though interpreting it is subtle.
- First recall the Fisher Equation:

$$i \cong r + \boldsymbol{\pi}^e$$

- There are 3 reasons to get "$i_{1,2}$" < $i_{0,1}$, which is known as an "inverted yield curve:"

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Growth and Interest Rates

- Recall our key condition from the consumption smoothing unit (the "Euler Equation"):

$$u'(C_0) = (1+i_{0,1})\cdot u'(C_1)$$

- Your work in the problem sets has shown that with log utility, this can be rewritten as:

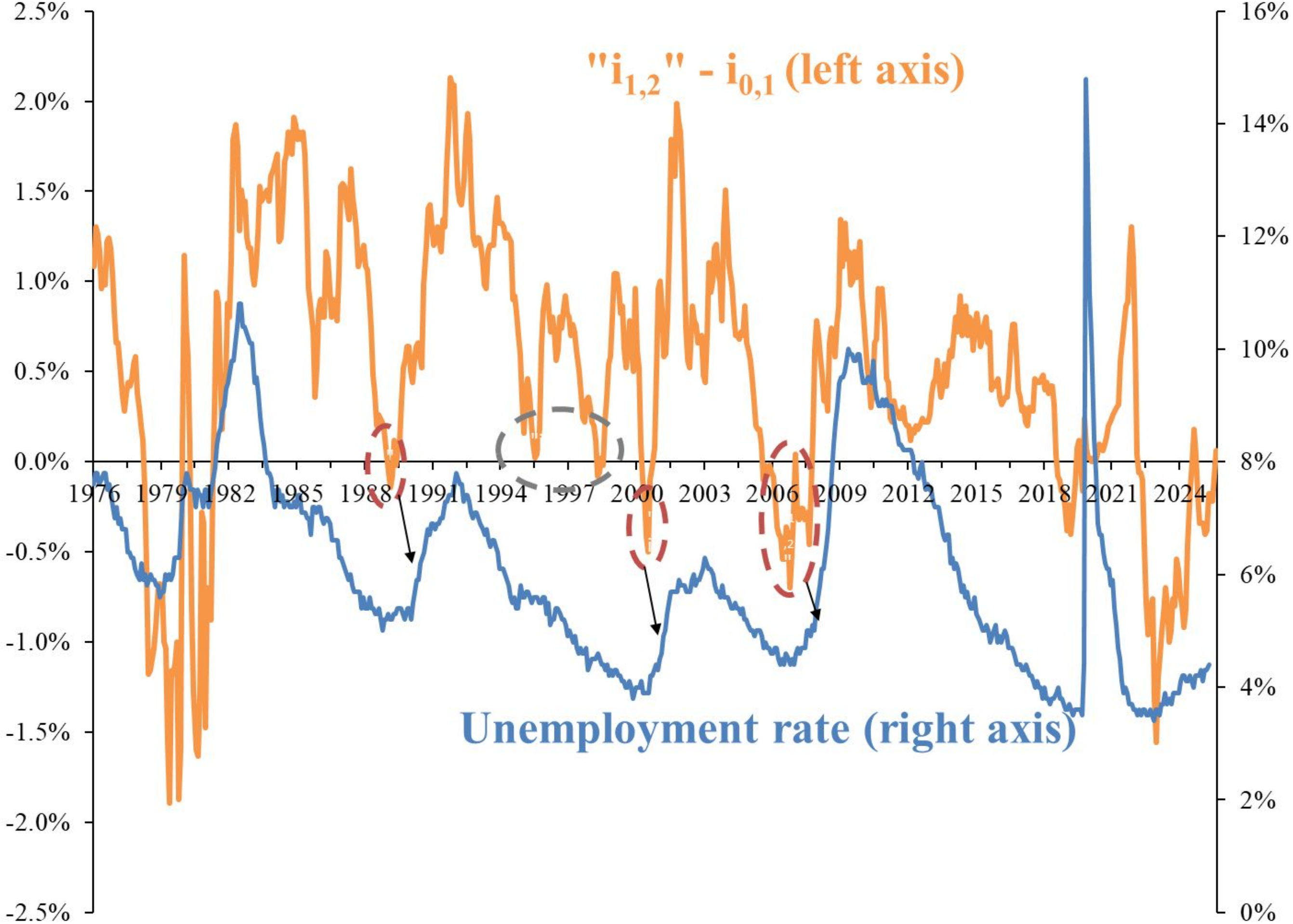
$$1+i_{0,1} = C_1/C_0$$

- In the household model, we took i as exogenous and solved for C_0 and C_1, the endogenous variables
- But in asset pricing, we will take consumption as exogenous and see what it implies for asset prices
- To start, let's focus on the interest rate:

$$1+i_{0,1} = C_1/C_0$$

- Intuition
  - If we expect consumption to grow a lot (C_1/C_0 high), people will not want to save much, so borrowers need to pay a higher interest rate to access funds/incentivize saving ($i_{0,1}$ high)
  - If we expect low consumption growth (C_1/C_0 low), people will want to save a lot, so borrowers do not need to compete as much for funds ($i_{0,1}$ low)

Yield Curve and Unemployment



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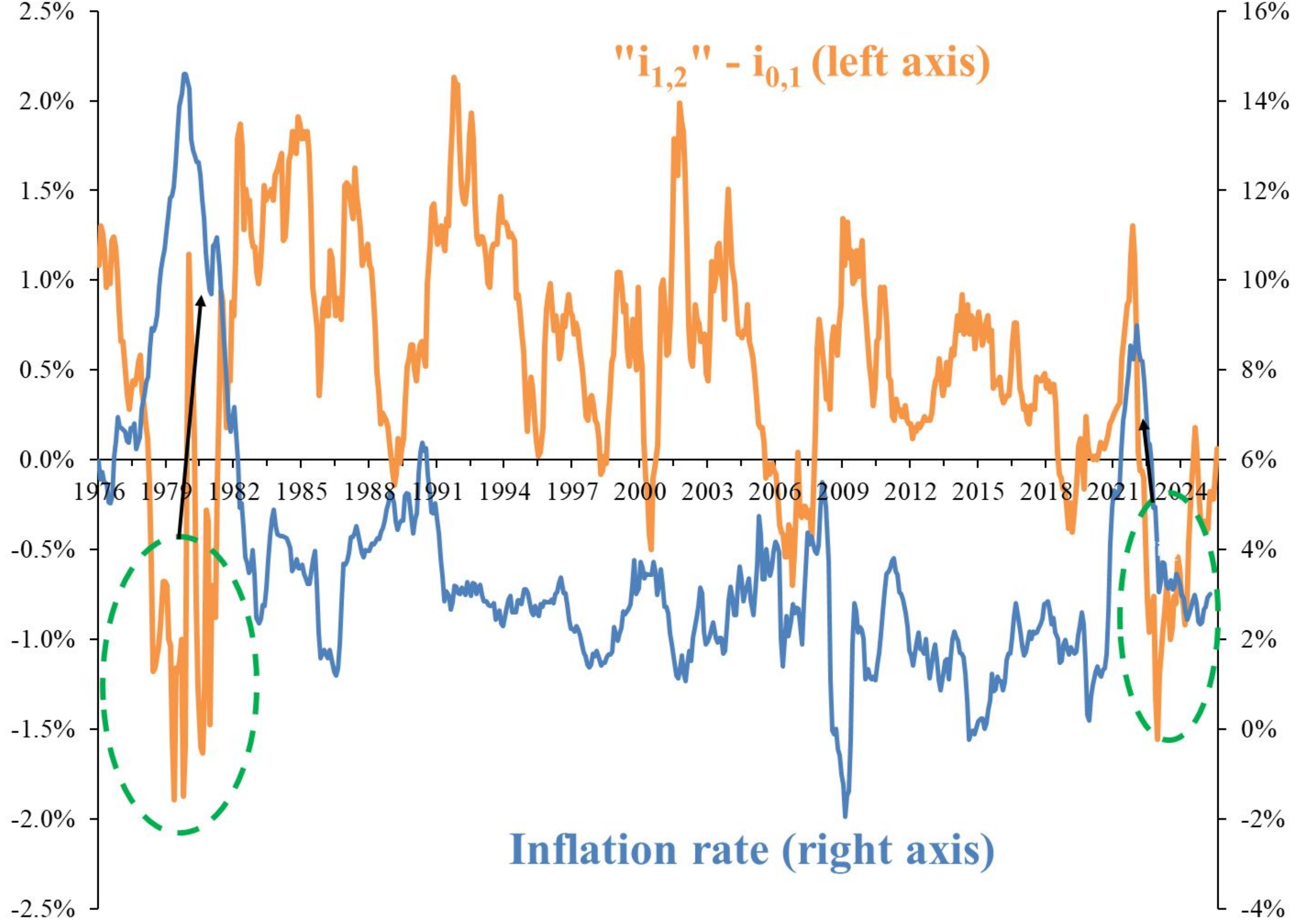
Yield Curve and Inflation



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  3. Large term premium…
     - The term premium could always be doing something in the background, and we cannot observe it!
       - This means we always have to interpret the yield curve with caution

Stock-Bond Correlation

- Consider a bond that pays out fixed D in period 1. Its price is:

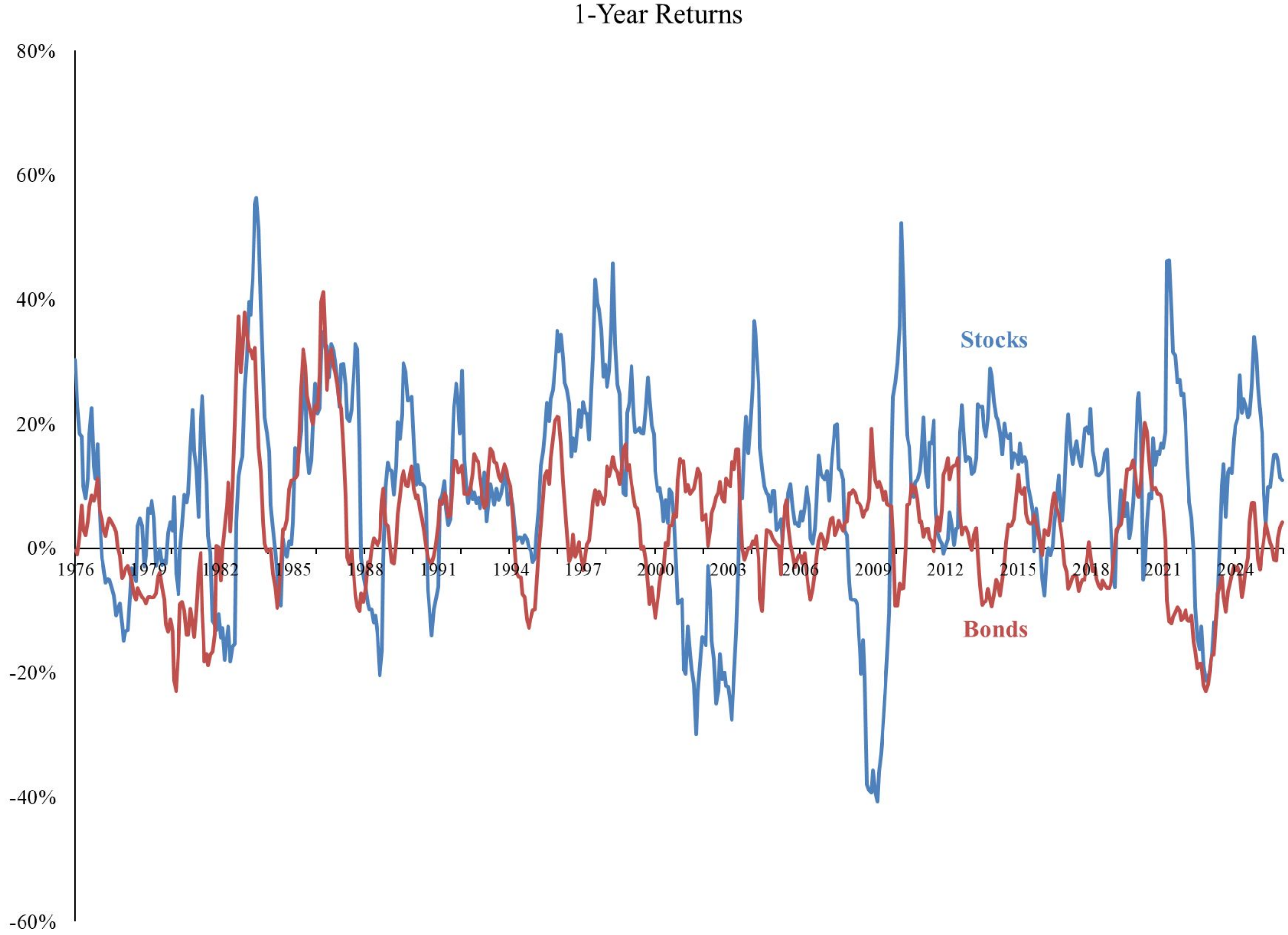
$$P^B{}_0 = D/(1+i_{0,1})$$

- We can think of the stock market as an asset that pays out some share (s) of output. Its price will be:

$$P^S{}_0 = s \cdot Y_1/(1+i_{0,1})$$

- Consider what happens if we get more optimistic about the future, so Y_1 <u>increases</u>:
  - That will make people want to save less, and therefore $i_{0,1}$ increases
    - Therefore, $P_B{}^0$ will <u>fall</u>
  - Simultaneously, the increase in Y_2 raises the stock's dividend
    - You will show in Problem Set 5 that, because the increase in $i_{0,1}$ will put downward pressure on $P^S{}_0$, it's not actually guaranteed that $P^S{}_0$ will rise, but that is the "natural" case.
- This analysis implies that stocks and bonds should move in opposite directions
  - That's nice – it means a portfolio that balances the two can offer "hedging"

Stock and Bond Performance Over Time



Source: Robert Shiller data

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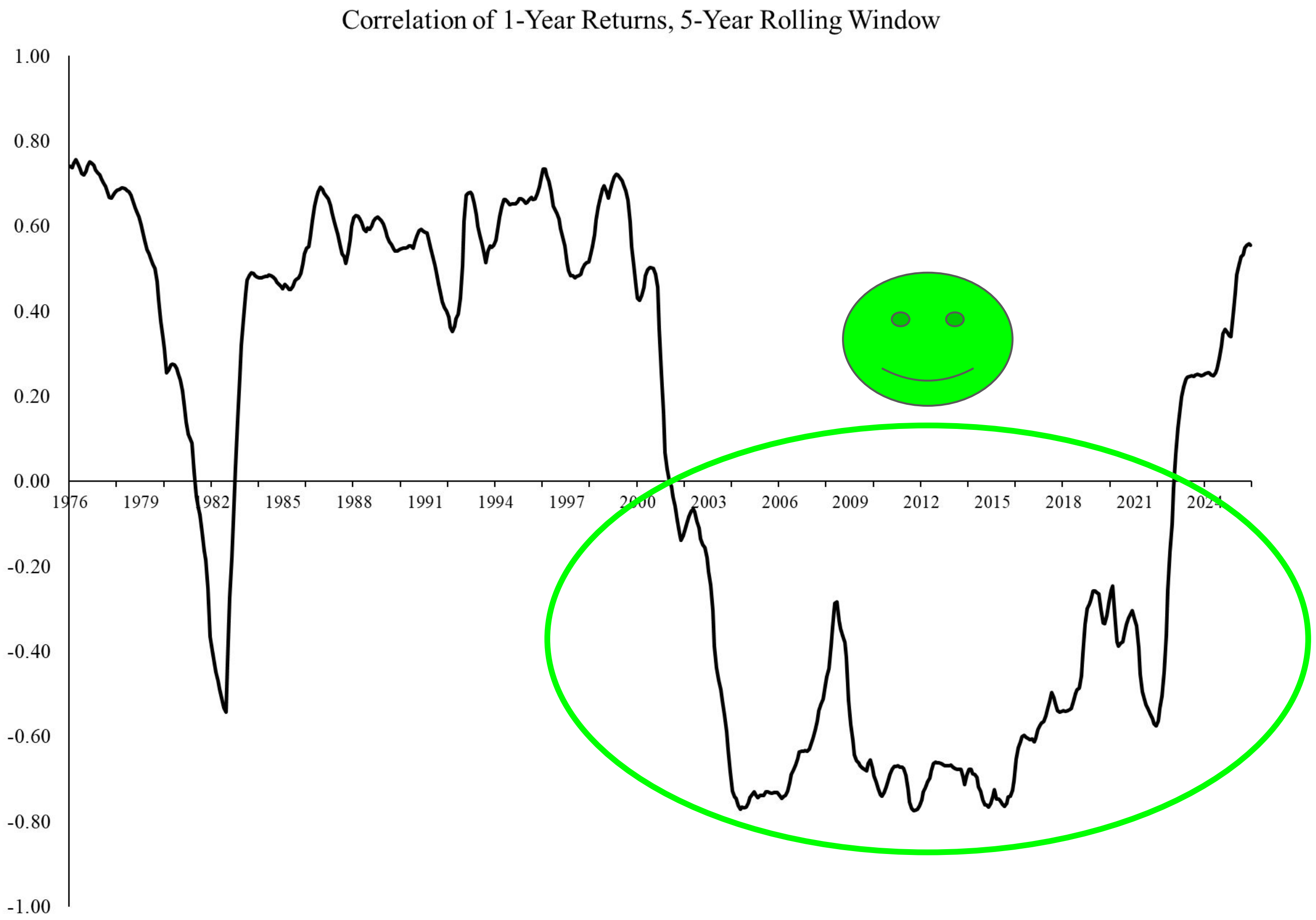

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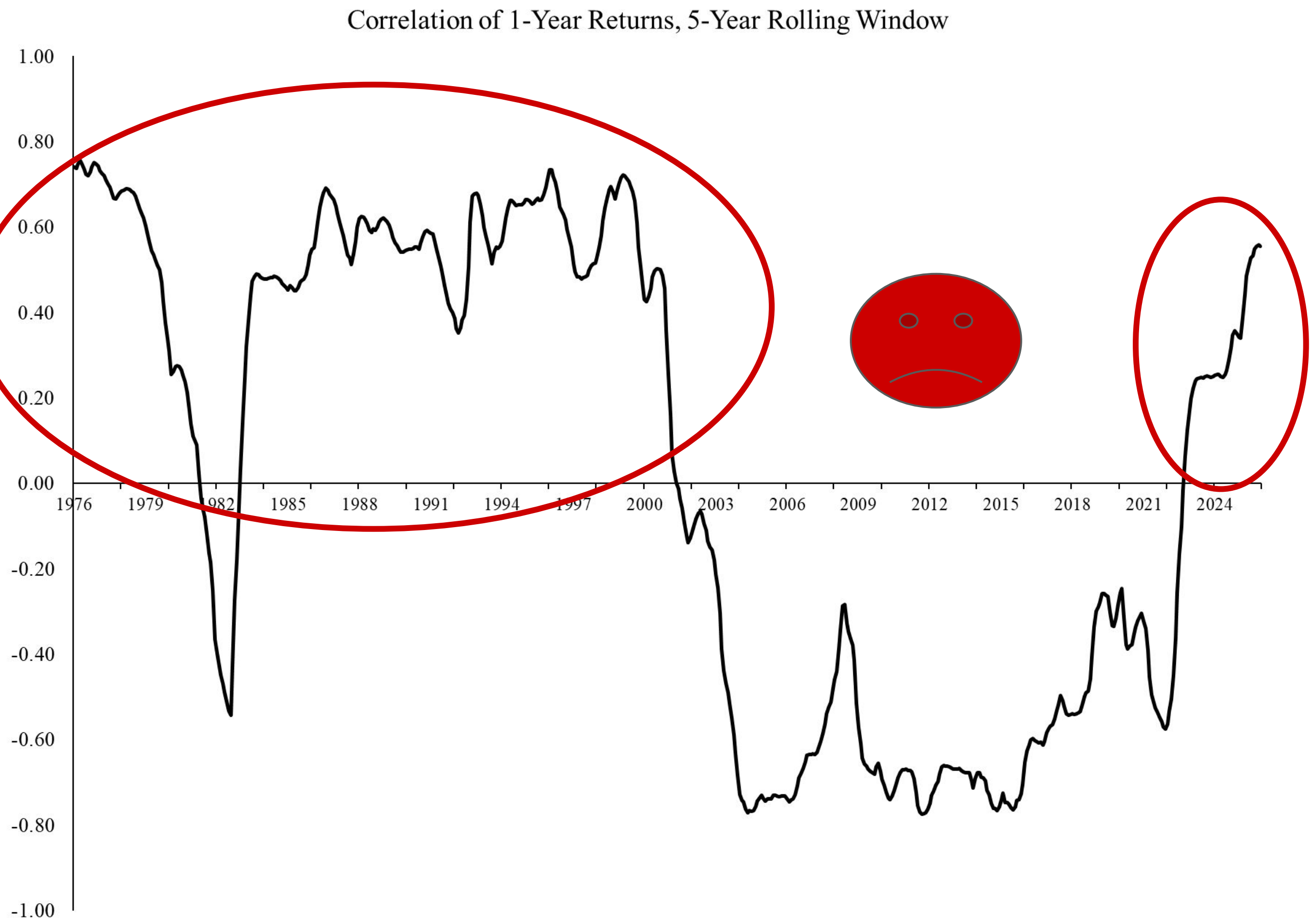

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Interpreting the Stock-Bond Correlation

- For ~2000-2020, stocks and bonds moved against each other like we predicted
- But since COVID – and in the 1970s-early 90s – they moved together, the opposite of what was asserted
    - Why?

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    - Why?
- For ~2000-2020, inflation was stable and so the main thing affecting the economy was GDP
    - Remember, our analysis focused on changes in Y_1, which moved opposite of $i_{0,1}$
    - So it makes sense that our analysis worked for the ~2000-2020 period

$$P^B_0 = D/(1+i_{0,1})$$

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  - Remember, our analysis focused on changes in Y_1, which moved opposite of $i_{0,1}$
  - So it makes sense that our analysis worked for the ~2000-2020 period
- But following COVID – and during the 1970/80s – the main policy objective was fighting inflation. This meant the main thing affecting asset prices was not Y_1 but rather the Fed moving the real interest rate
  - Recall the Fisher Equation: $i_{0,1} = r_{0,1} + \pi^e_{0,1}$
  - So as the Fed cranks up the real – and by extension, nominal – interest rate, both stock and prices fall
  - Then, when the Fed eases up after inflation is defeated, both types do well

$$P^B_0 = D/(1+i_{0,1}) \qquad\qquad P^S_0 = s \cdot Y_1/(1+i_{0,1})$$

Valuing Long-lived Assets

- Consider a stock, which entitles you to a claim on a company's dividends forever. To value this, we just need to apply our notion of discounting (for simplicity, I'm assuming i is constant):

$$P_0^S = \frac{D_1}{1+i} + \frac{D_2}{(1+i)^2} + \frac{D_3}{(1+i)^3} + \frac{D_4}{(1+i)^4} + \ldots$$

  - The stock price should be the "net present value" of all future dividends.
- Can rewrite as:

$$P_0^S = \frac{D_1}{1+i} + \frac{1}{1+i} \cdot \underbrace{\left(\frac{D_2}{1+i} + \frac{D_3}{(1+i)^2} + \frac{D_4}{(1+i)^3} + \ldots \right)}_{P_1^S}$$

$$= \frac{D_1 + P_1^S}{1+i}$$

  - The stock price should be the (discounted) dividend tomorrow and its remaining value tomorrow.

Dividend Yield and Capital Gain

$$P_0^S = \frac{D_1 + P_1^S}{1+i} \Rightarrow i = \frac{D_1}{P_0^S} + \frac{P_1^S - P_0^S}{P_0^S}$$

- Assets have to give a (risk-adjusted) return of the market interest rate. The return has two components:
  1. $\frac{D_1}{P_0^S}$: (Expected) "dividend yield." For every dollar you invest, how much does it pay out next period?
  2. $\frac{P_1^S - P_0^S}{P_0^S}$: (Expected) "capital gain." Growth in future value.
- Some assets are valued because they pay good dividends, i.e. their return comes from <u>dividend yield</u>
  - Think of a company like Toyota. These are often referred to as "value stocks."
- Some assets are valued because they are expected to grow rapidly in the future.
  - Think of a company like Nvidia. These are often referred to as "growth stocks."
  - Companies like these might have high stock prices and low dividends: this is justified if people believe they will have very high dividends in the future. So D_1 may be low, but expected price growth makes up for it – i.e. their value comes from expected <u>capital gains</u>.

The P/E Ratio

$$P_0^S = \frac{D_1 + P_1^S}{1+i} \Rightarrow i = \frac{D_1}{P_0^S} + \frac{P_1^S - P_0^S}{P_0^S}$$

- We cannot evaluate this directly because we don’t observe expected dividends and prices in the future
- Common to look at the Price-Earnings ratio (or P/E)
  - Price divided by recent earnings
  - High P/E is like low dividend yield
    - People are paying a lot to own companies that are not earning much
- 2 interpretations:
  1. Earnings are expected to grow a lot in the future, leading to capital gains
  2. Bubble, i.e. price is irrationally high
     - There’s actually an important but less interesting 3rd one – low interest rates. We’ll return to that.

For 100 years, P/E had a strong tendency to revert towards 15

Source: Robert Shiller data

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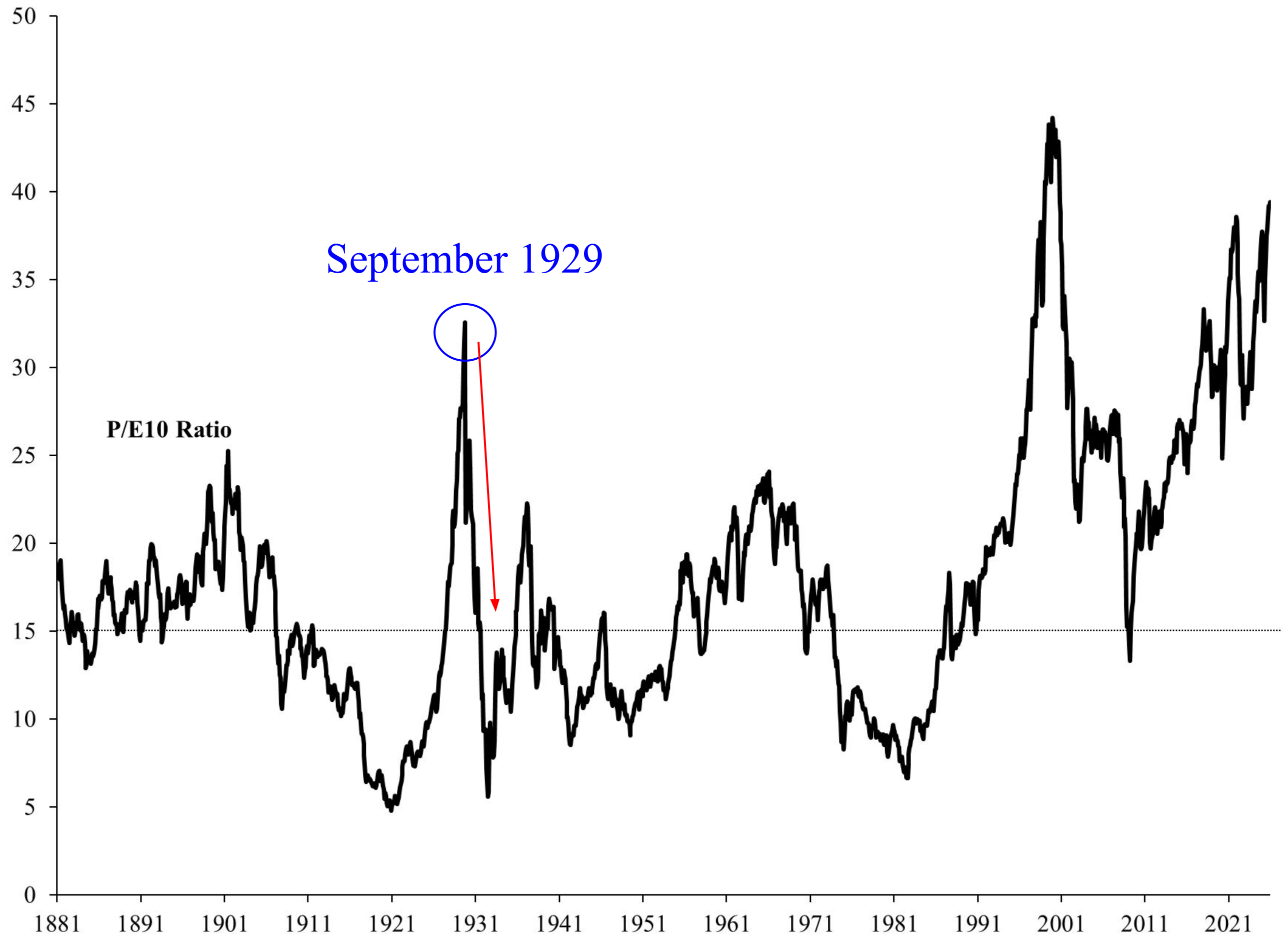
- As a matter of arithmetic, there are 2 ways that a high P/E can fall back to "normal:"
    1. Earnings rise
        - Interpretation: those optimistic expectations were right
    2. Price falls:
        - Interpretation: those optimistic expectations get crushed/bubble bursts

The run-up during the great 1920s boom was resolved by…



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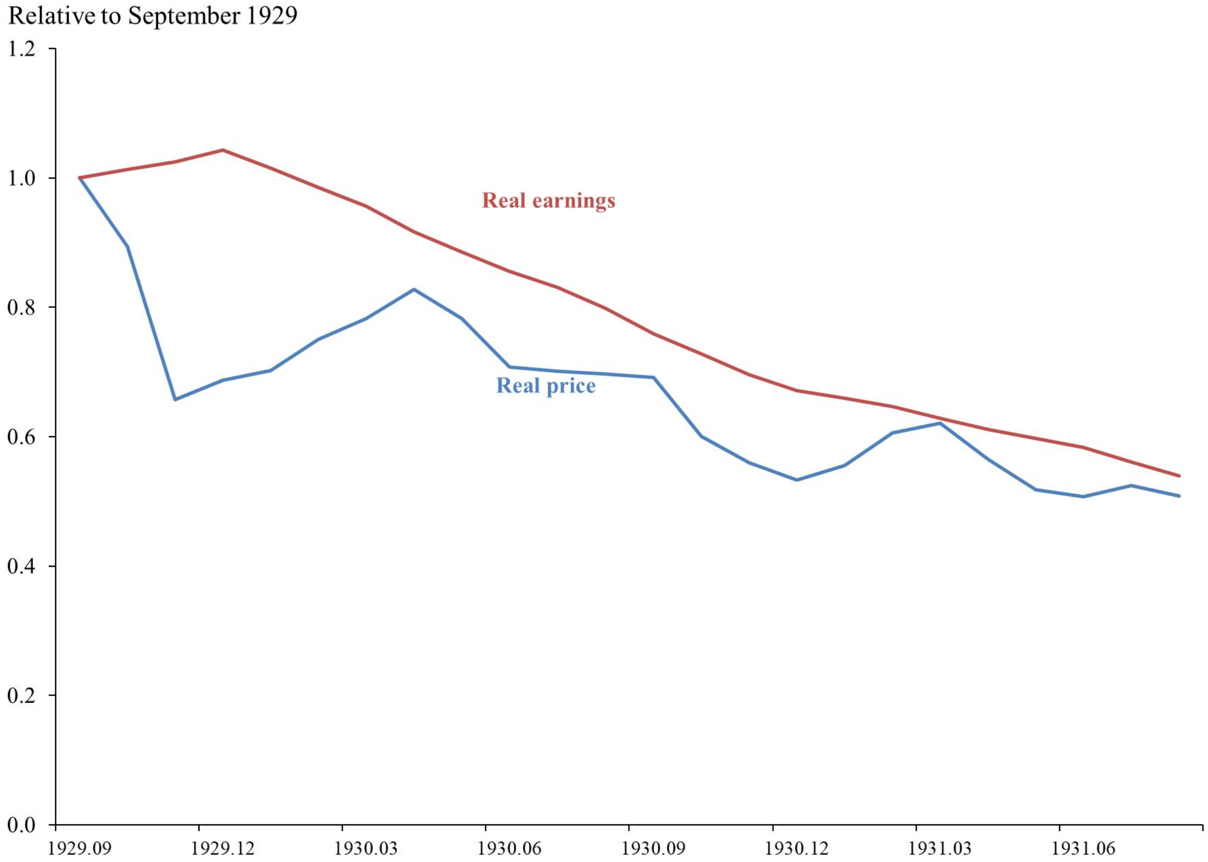

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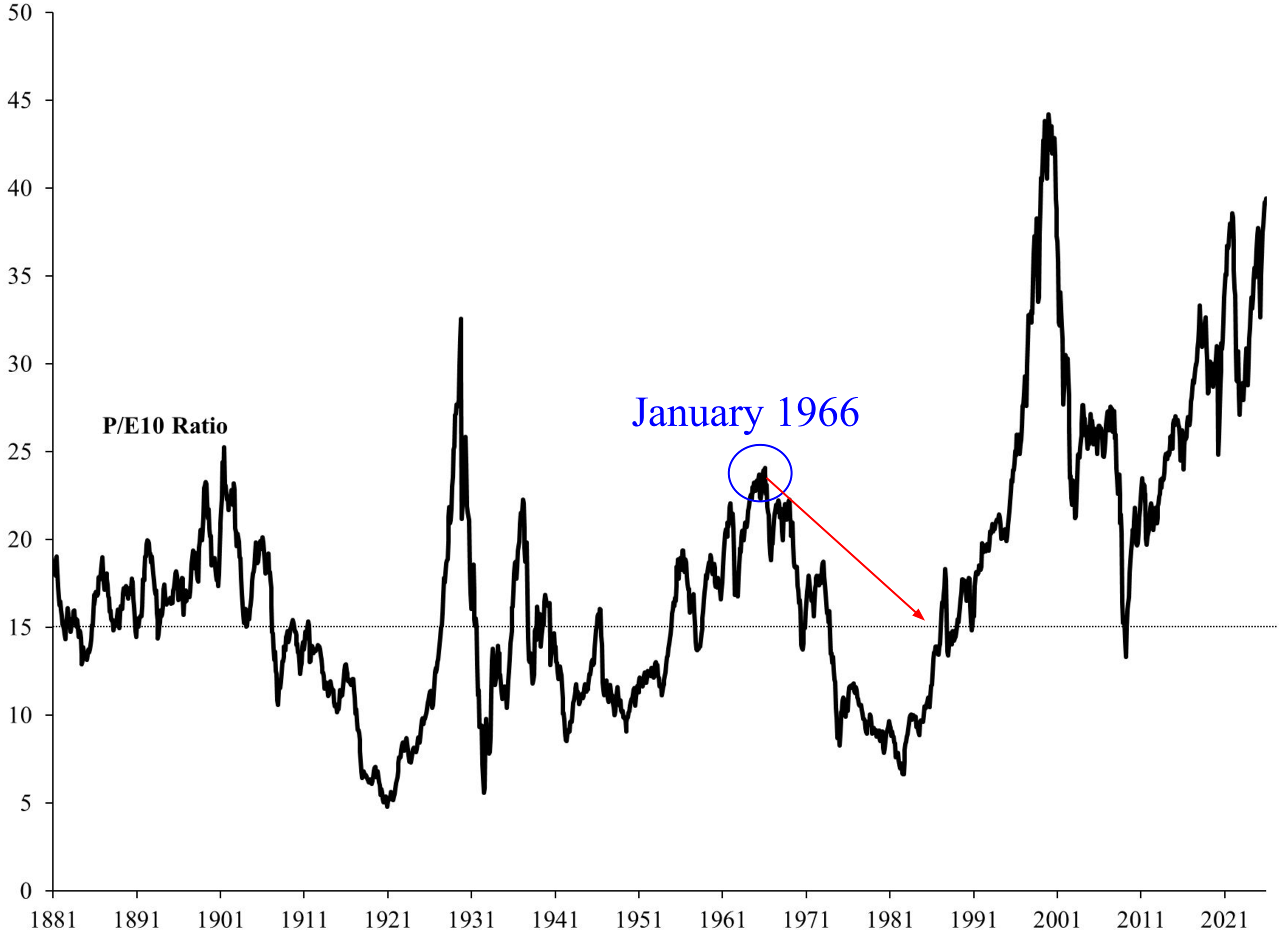
The post-WW2 run-up was resolved by…



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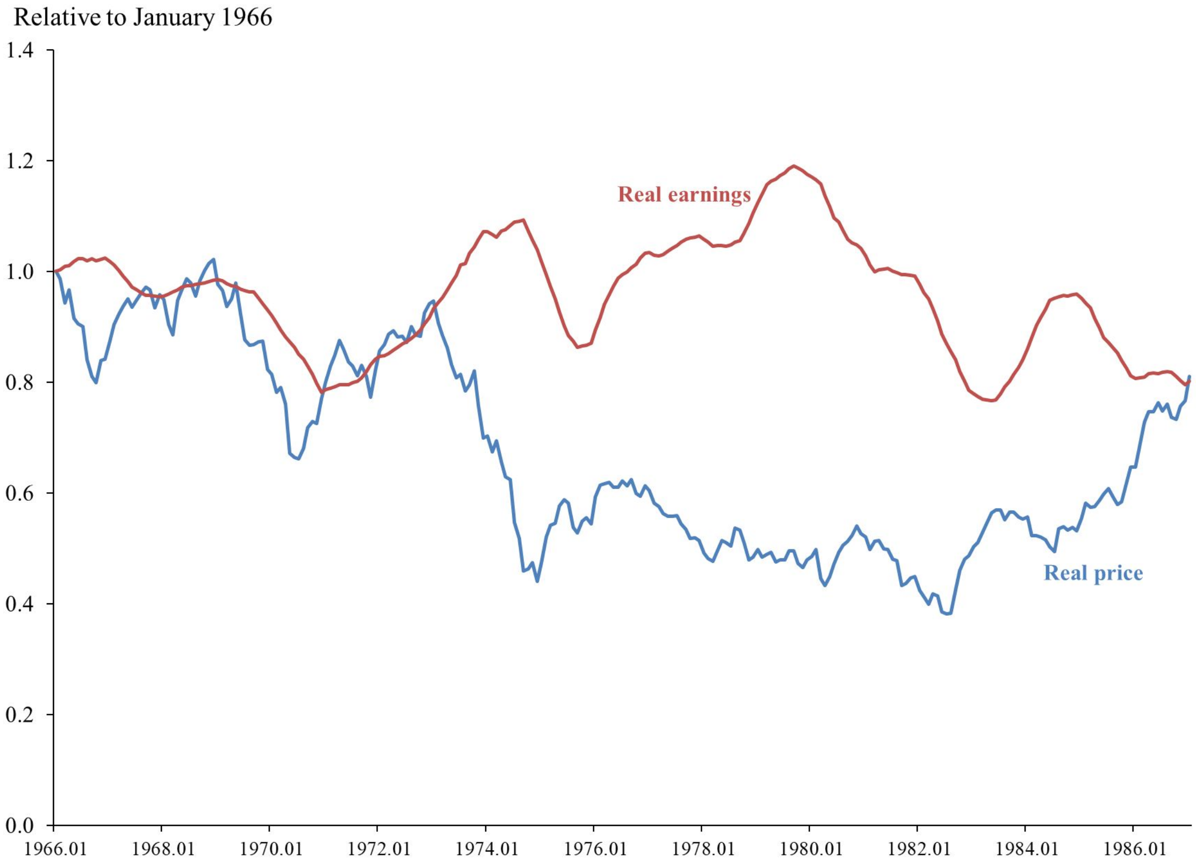

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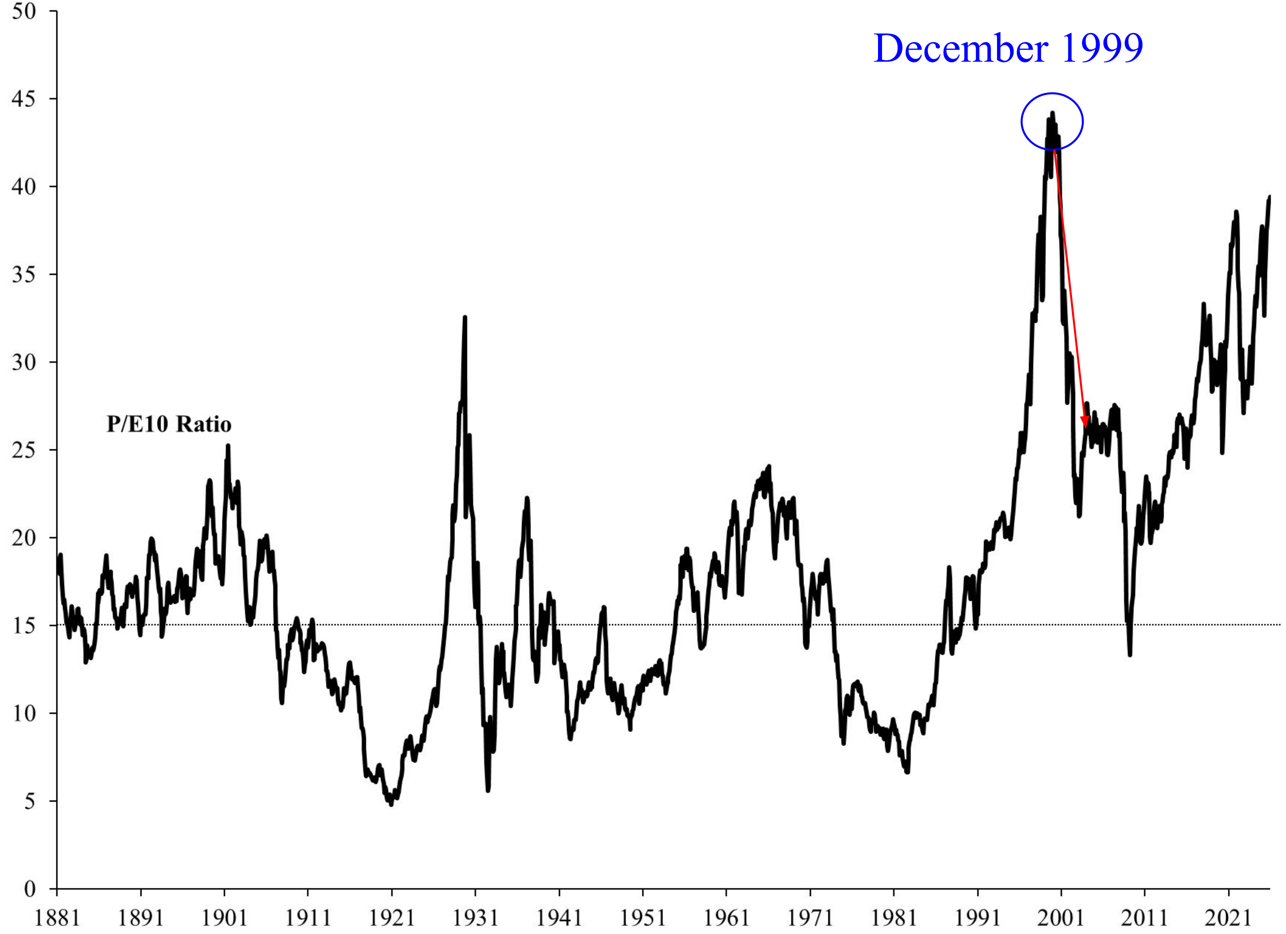
The run-up during the dot-com boom was resolved by…



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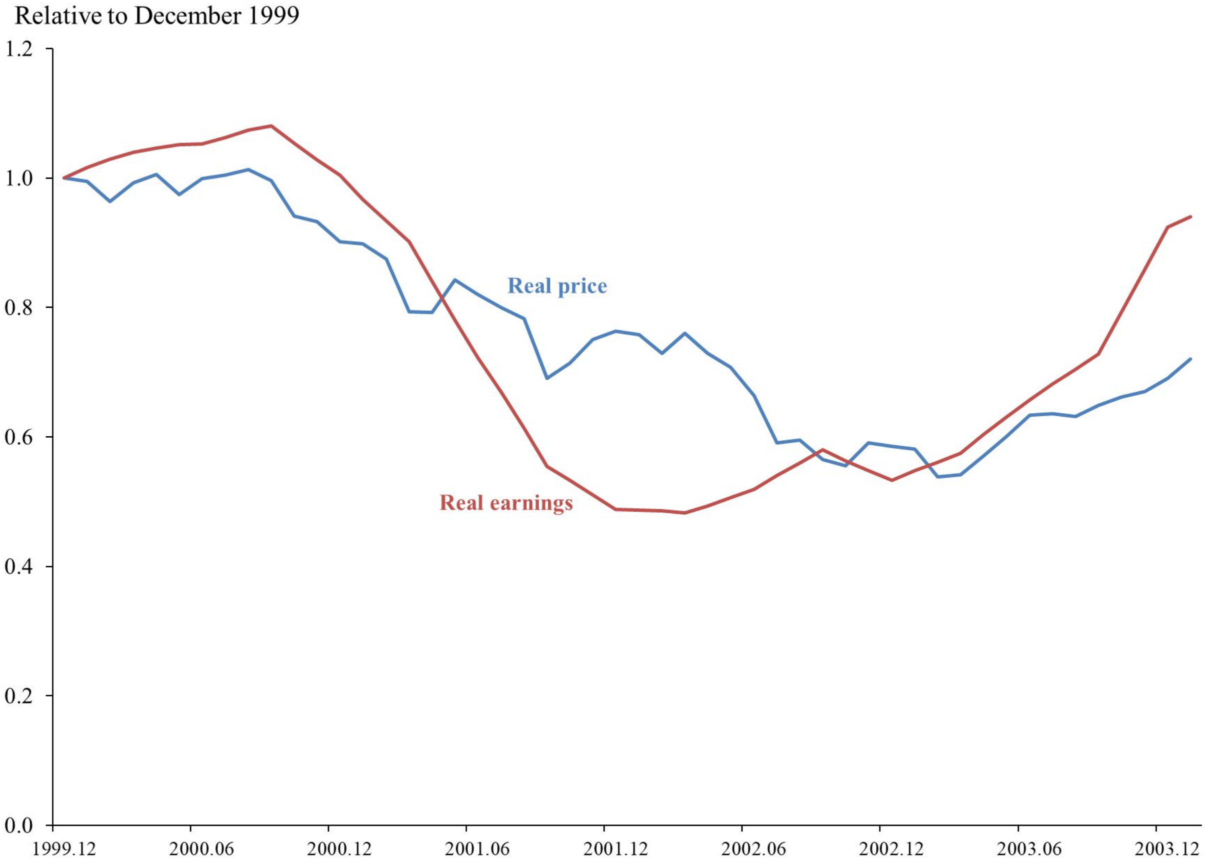

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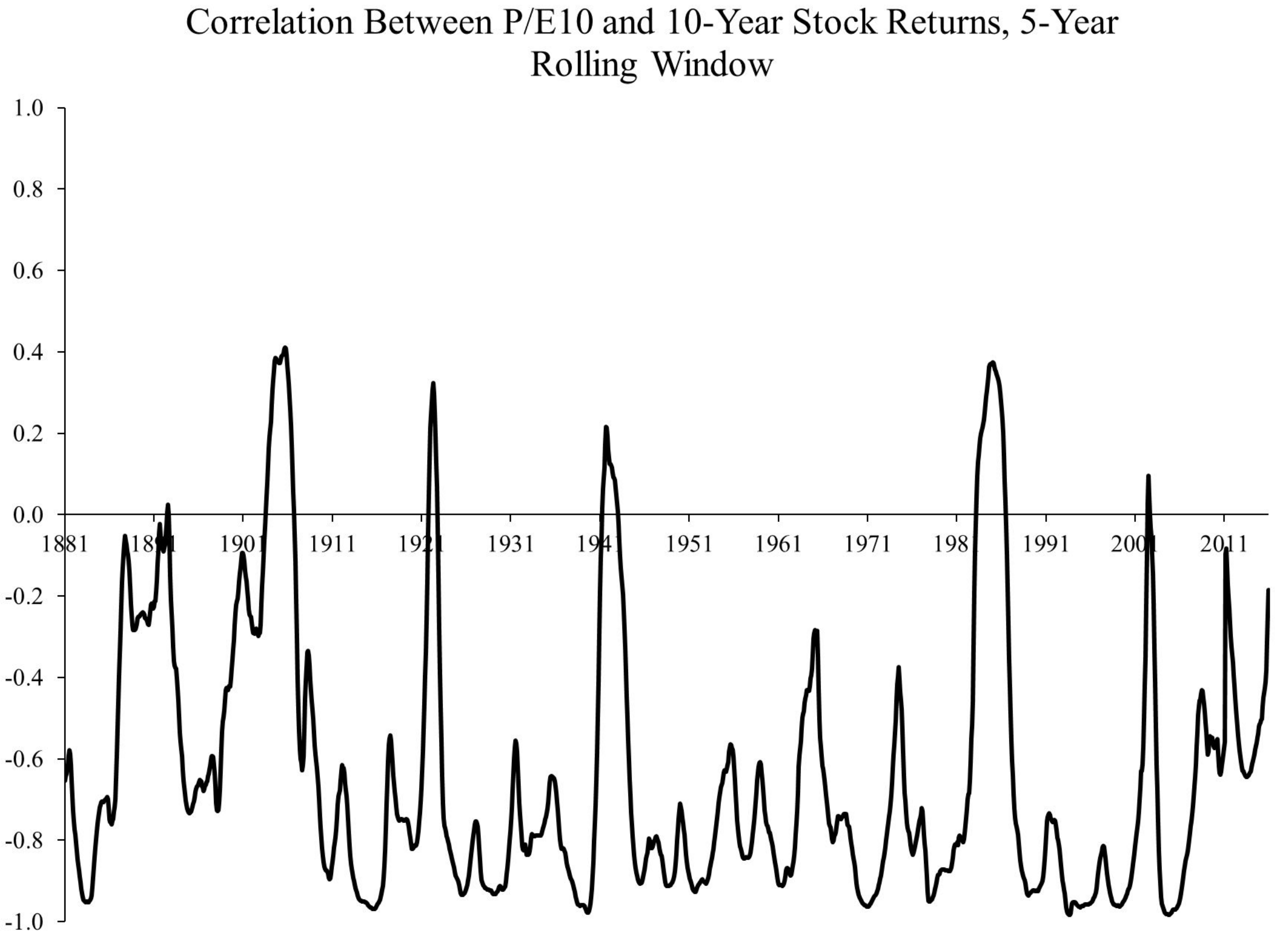
High P/E Ratio is probably the most reliable predictor of bubbles



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Should we be scared by the high PE Ratio right now?

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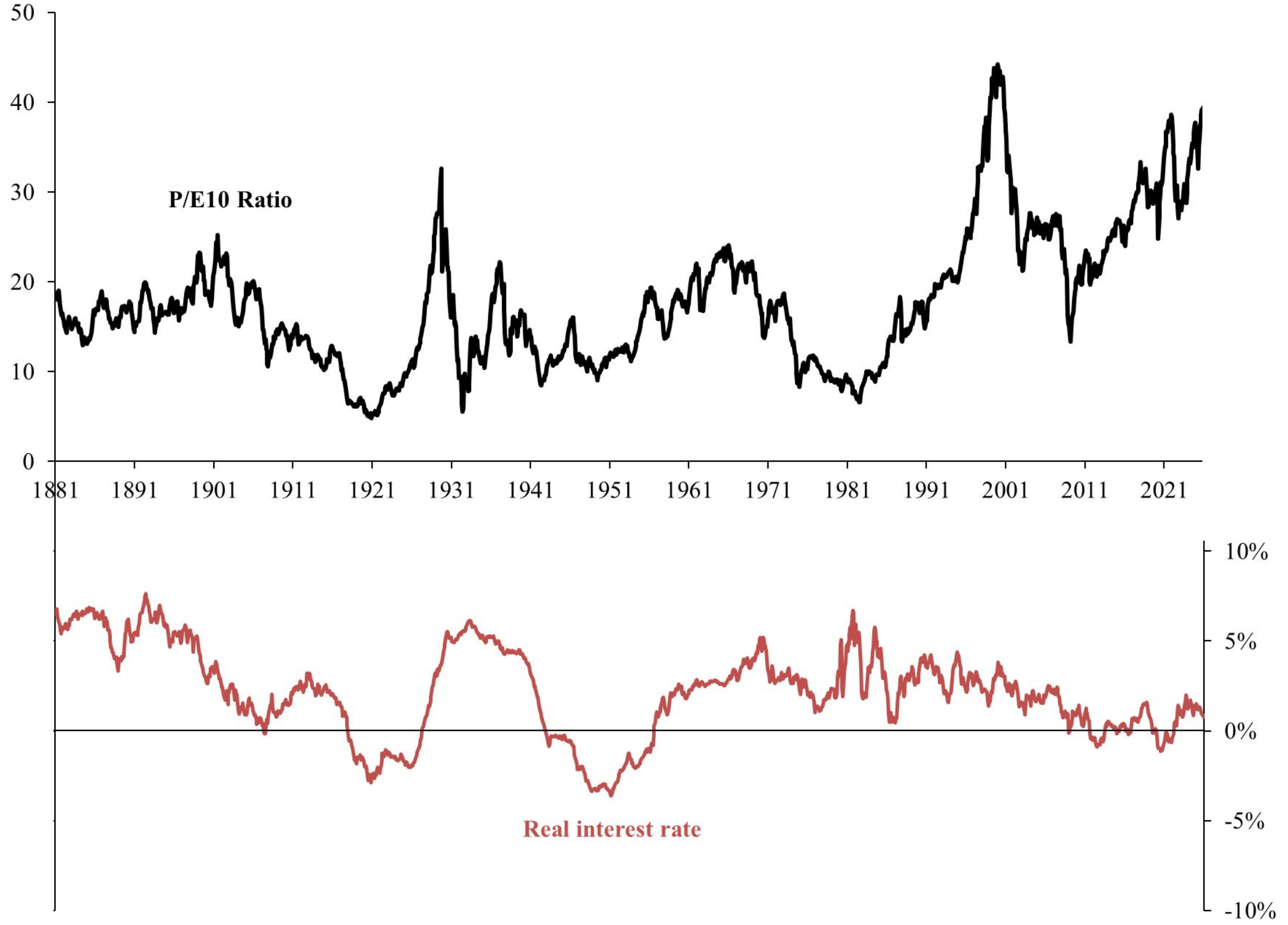
Should we be scared by the high PE Ratio right now?

- Probably.
- However, keep in mind that high PE Ratios can be justified by low interest rates:

$$\uparrow P_0^S = \frac{D_1 + P_1^S}{1+i\downarrow} \Rightarrow i\downarrow = \frac{D_1}{P_0^S\uparrow} + \frac{P_1^S - P_0^S}{P_0^S}$$

  - Intuition: Low interest rates mean we care relatively more about the future, so it makes sense to pay more for a long-lived asset, even if its dividends or earnings stay the same.
- We are currently in the midst of the an usually-sustained period of low interest rates, so a PE Ratio of 15 may not be the appropriate baseline right now.

PE Ratio and Real Interest Rate



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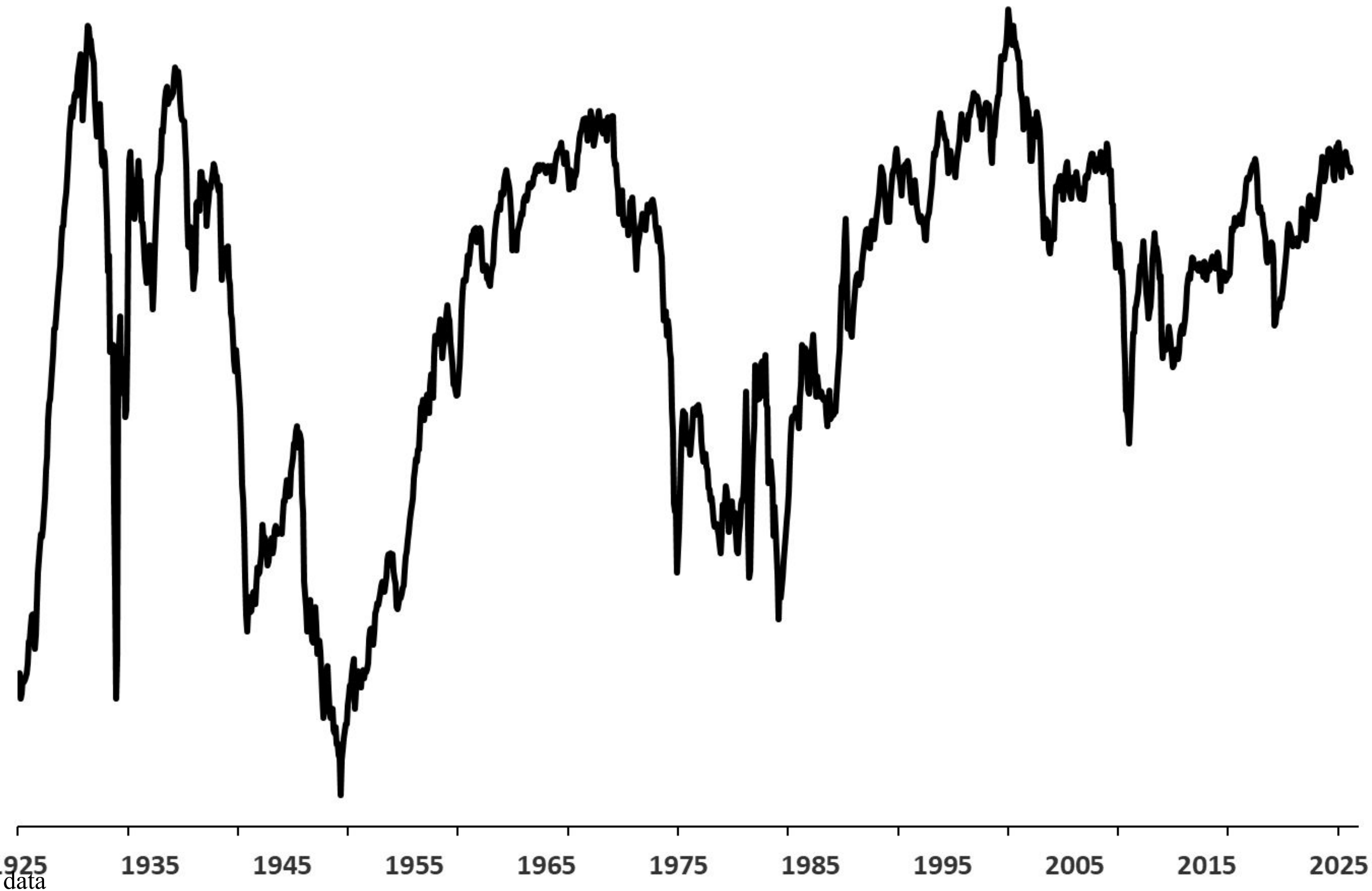
Interest rate-adjusted PE Ratio



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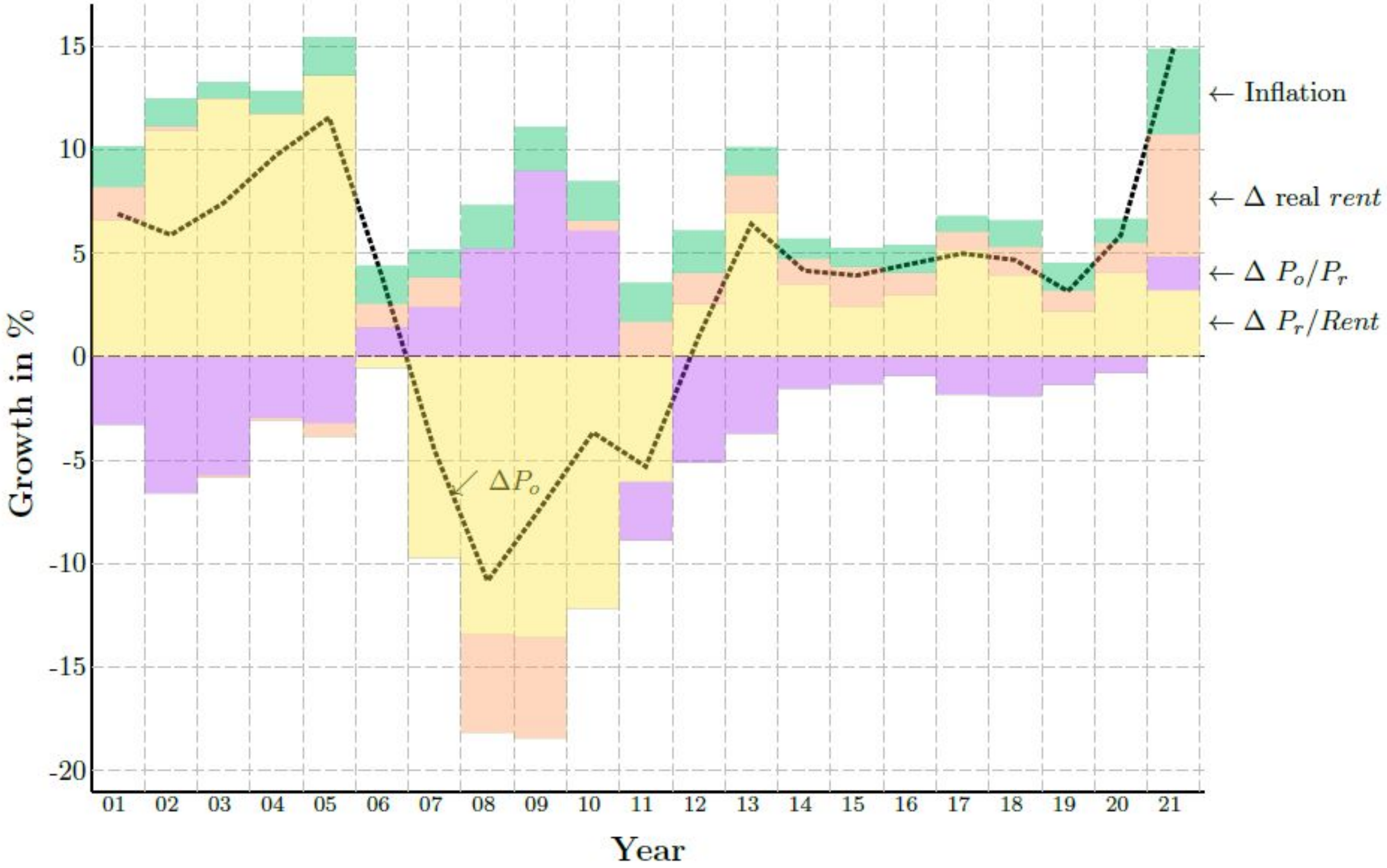
- We are currently in the midst of the an usually-sustained period of low interest rates, so a PE Ratio of 15 may not be the appropriate baseline right now.
- When adjusting for interest rates, PE Ratio still looks quite high, but not as extreme.

The analogous measure in the housing market is P/R (price-to-rent)



Source: Loewenstein and Willen (2023)

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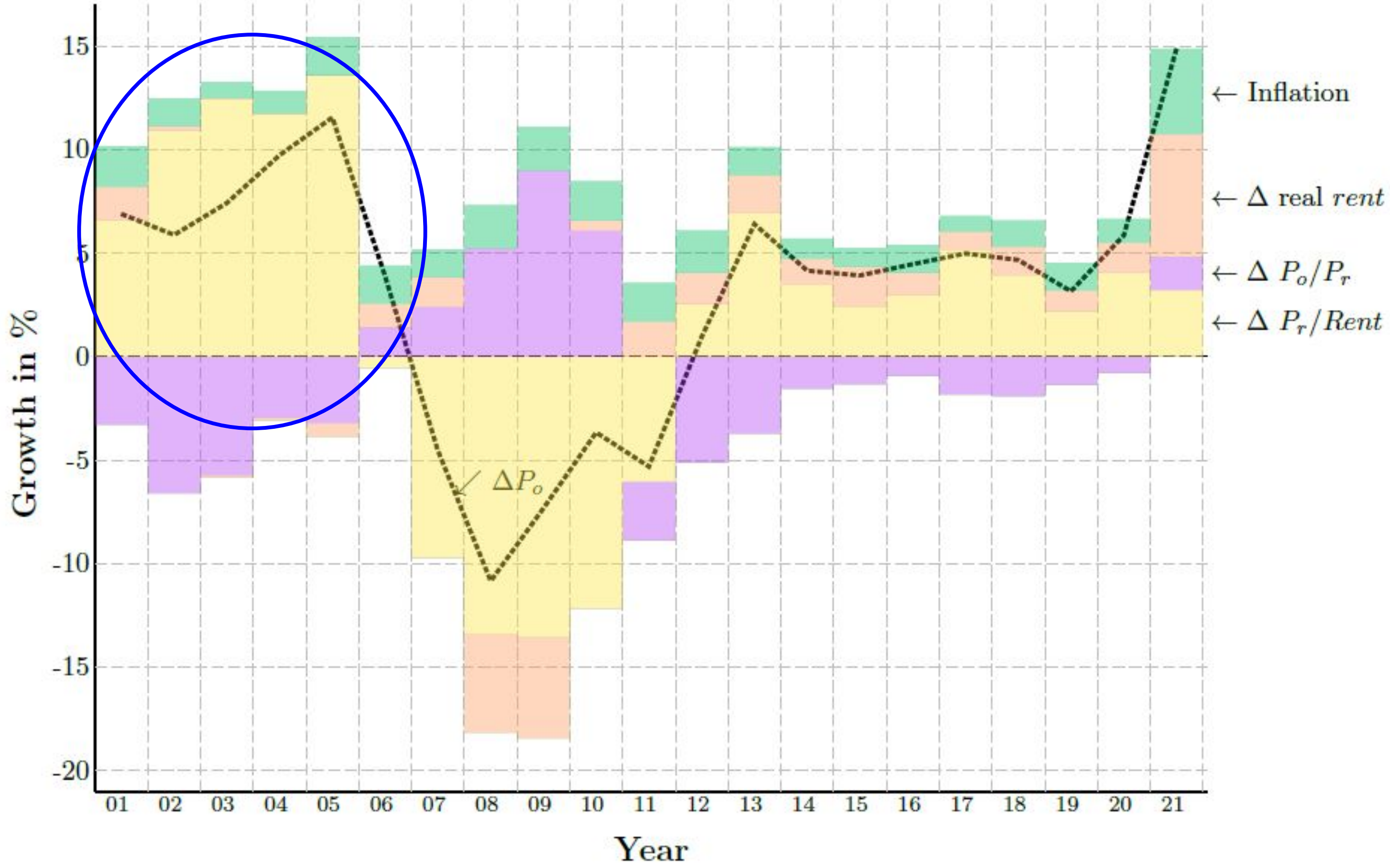
Real price growth in the housing boom of the 2000s came almost exclusively from P/R: classic sign of a bubble



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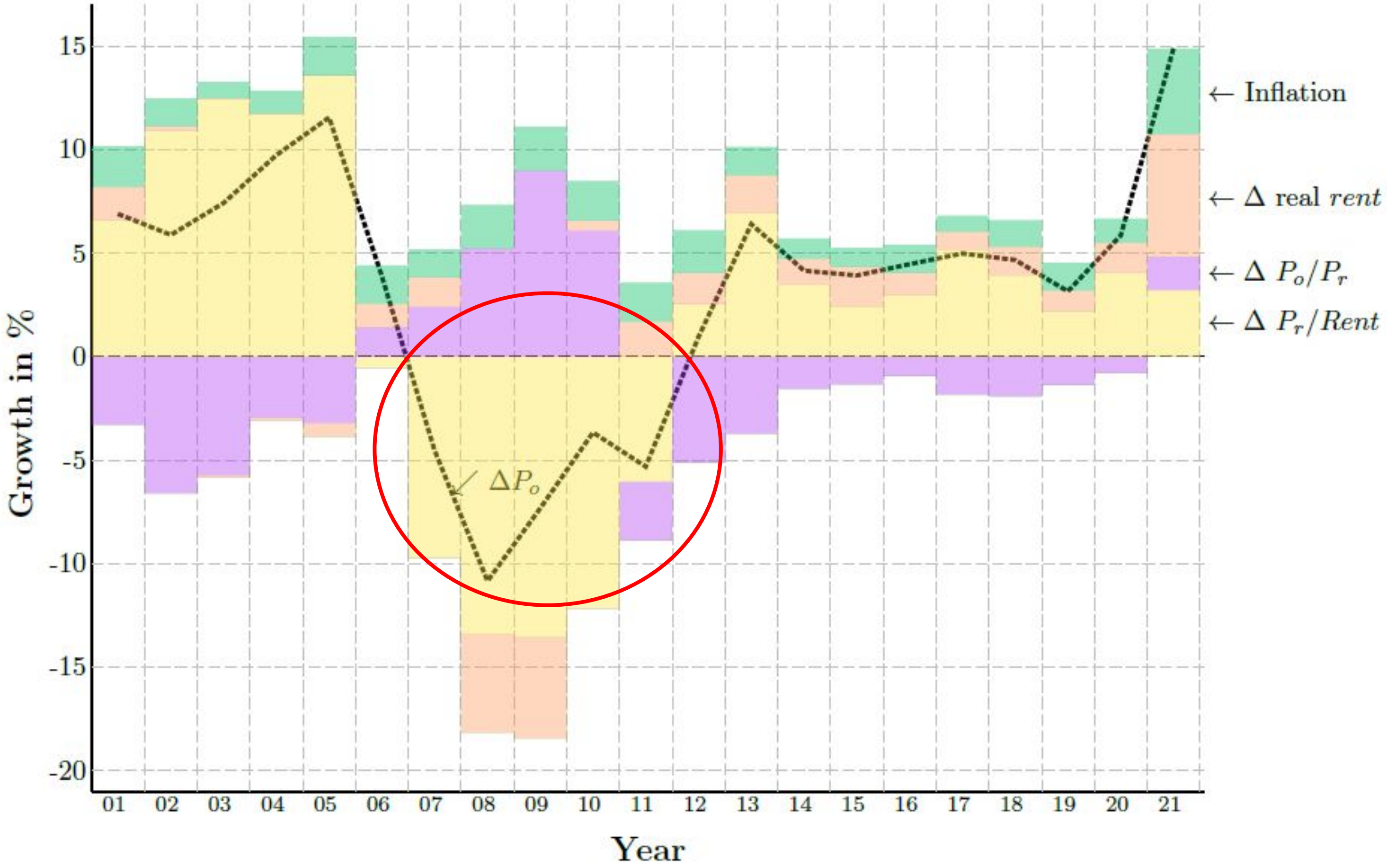
As we've seen with stocks throughout the years, this was resolved by a collapse in prices.



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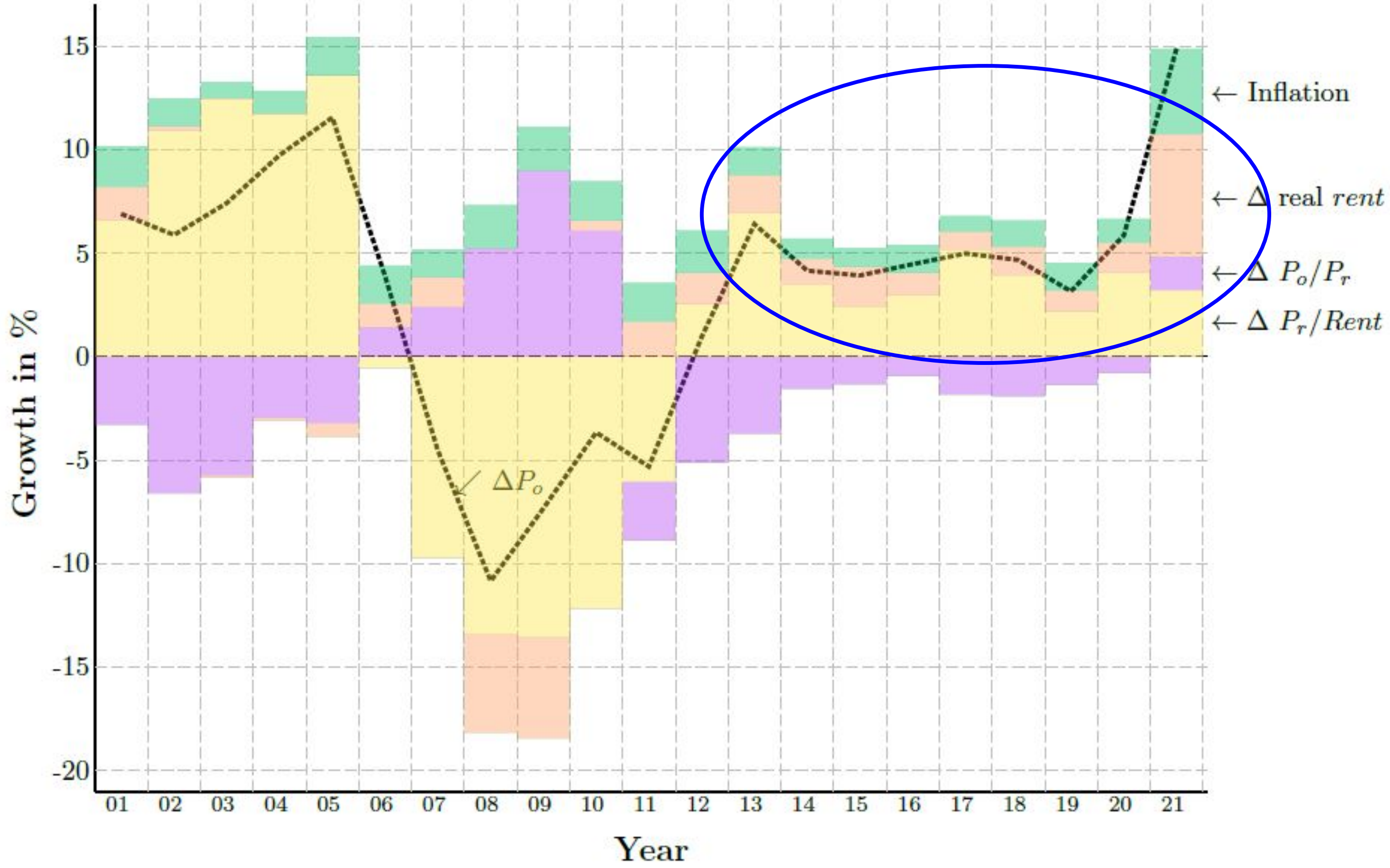
Over the past decade, there has again been strong real price growth, but is far more driven by growth in rents than the prior boom, suggesting the price growth reflects "fundamentals" rather than a bubble. (Or at least, some of both.)



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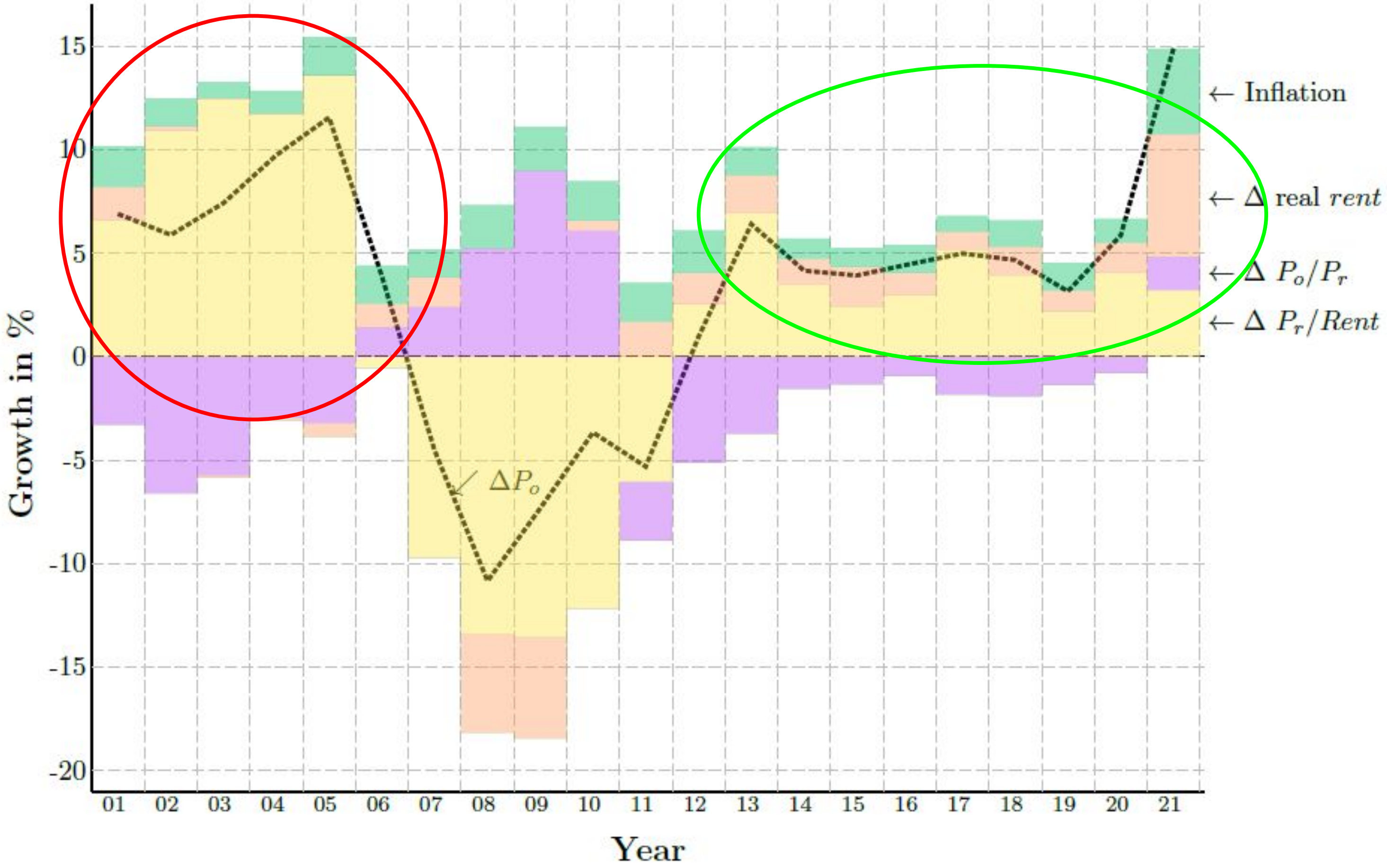
- 2000s: people were paying a lot for homes went rent was low. Translation: expecting huge price gains/bubble.
- 2010s/20s: people are paying a lot for houses seemingly because rents are very high, making houses fundamentally valuable.



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