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# The Monetary Policy Implications of a Low R-Star: An Update

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De Nederlandsche Bank

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*Any opinions expressed here are my own and do not necessarily reflect those of the  
Federal Open Market Committee.*

# Introduction

# The phantom menace

- This talk is a commentary on issues around  $r^*$ , the natural real rate of interest.
- According to leading contemporary theories, policymakers need to know the value of  $r^*$  in order to decide whether the current policy rate setting is accommodative, neutral or restrictive.
- In this talk, I will update my views on this issue from the paper “R-Star Wars: The Phantom Menace.”<sup>1</sup>
  - The phantom menace aspect is that it can be difficult to understand  $r^*$  because it is unobservable.

<sup>1</sup> J. Bullard, 2018, “[R-Star Wars: The Phantom Menace](#),” *Business Economics*, 53(2), pp. 60-65.

# Key themes

- The main themes are:
  - $r^*$  is, in practice, a low-frequency trend measure of a short-term real interest rate, and this talk will take a regime-switching view of this issue.
  - Observed low real interest rates are associated with government debt, not necessarily with capital.
  - There appears to be a large demand for safe assets globally, and this may be the largest factor driving real interest rates to low levels in the past three decades.
  - There is only modest evidence that key trends influencing the natural rate of interest are changing today.

# Raw Data and the Trend

# Short-term real interest rates

- This talk views the natural real rate of interest as the *trend component* of short-term real interest rates.
- The Fed can influence the real rate of interest but not the trend in the real rate of interest, which is viewed as driven by fundamental factors.
- I will call the slow-moving trend value “r-dagger” (or  $r^\dagger$ ).
- There are many ways to detrend the data.

# Raw data

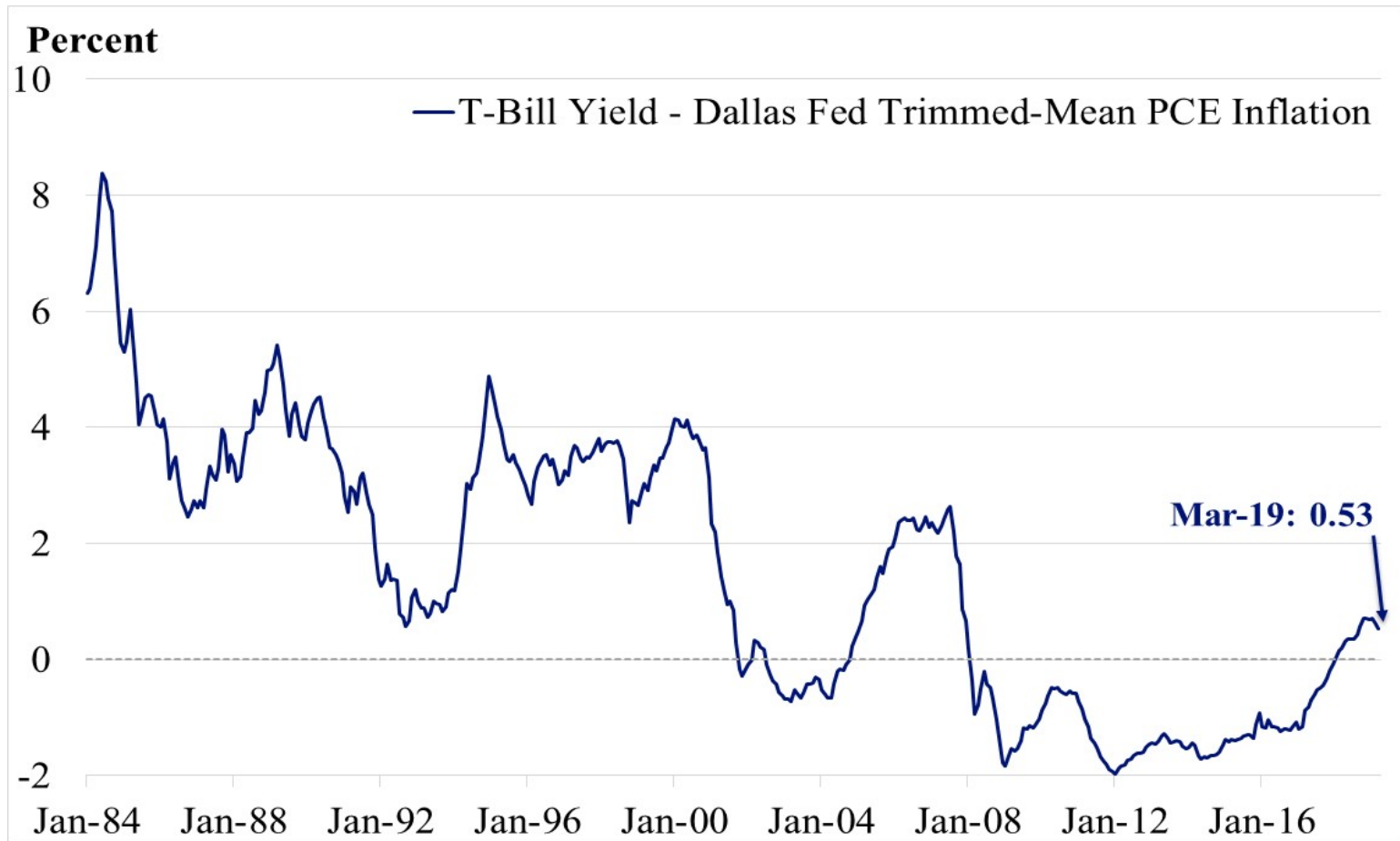
- The raw data for this talk are one-year ex-post real interest rates on U.S. Treasury bills from 1984 to the present.<sup>1</sup>
- Many possible methods to detrend the data:
  - Use a constant as in Taylor (1993).<sup>2</sup>
  - Use a model, such as Holston et al. (2017) or Del Negro et al. (2017).<sup>3</sup>
  - Use a linear trend.
  - Use an atheoretical filter, like the Hodrick-Prescott filter.

<sup>1</sup> Forward-looking measures, based on the FRB of Cleveland data, are similar but more volatile.

<sup>2</sup> J. Taylor, 1993, "[Discretion versus policy rules in practice](#)," Carnegie-Rochester Conference Series on Public Policy, 39, pp. 195-214.

<sup>3</sup> K. Holston, T. Laubach and J.C. Williams, 2017, "[Measuring the natural rate of interest: International trends and determinants](#)," Journal of International Economics, 108(S1), pp. S59-75; and M. Del Negro, D. Giannone, M.P. Giannoni and A. Tambalotti, 2017, "[Safety, Liquidity and the Natural Rate of Interest](#)," Brookings Papers on Economic Activity, Spring, pp. 235-303.

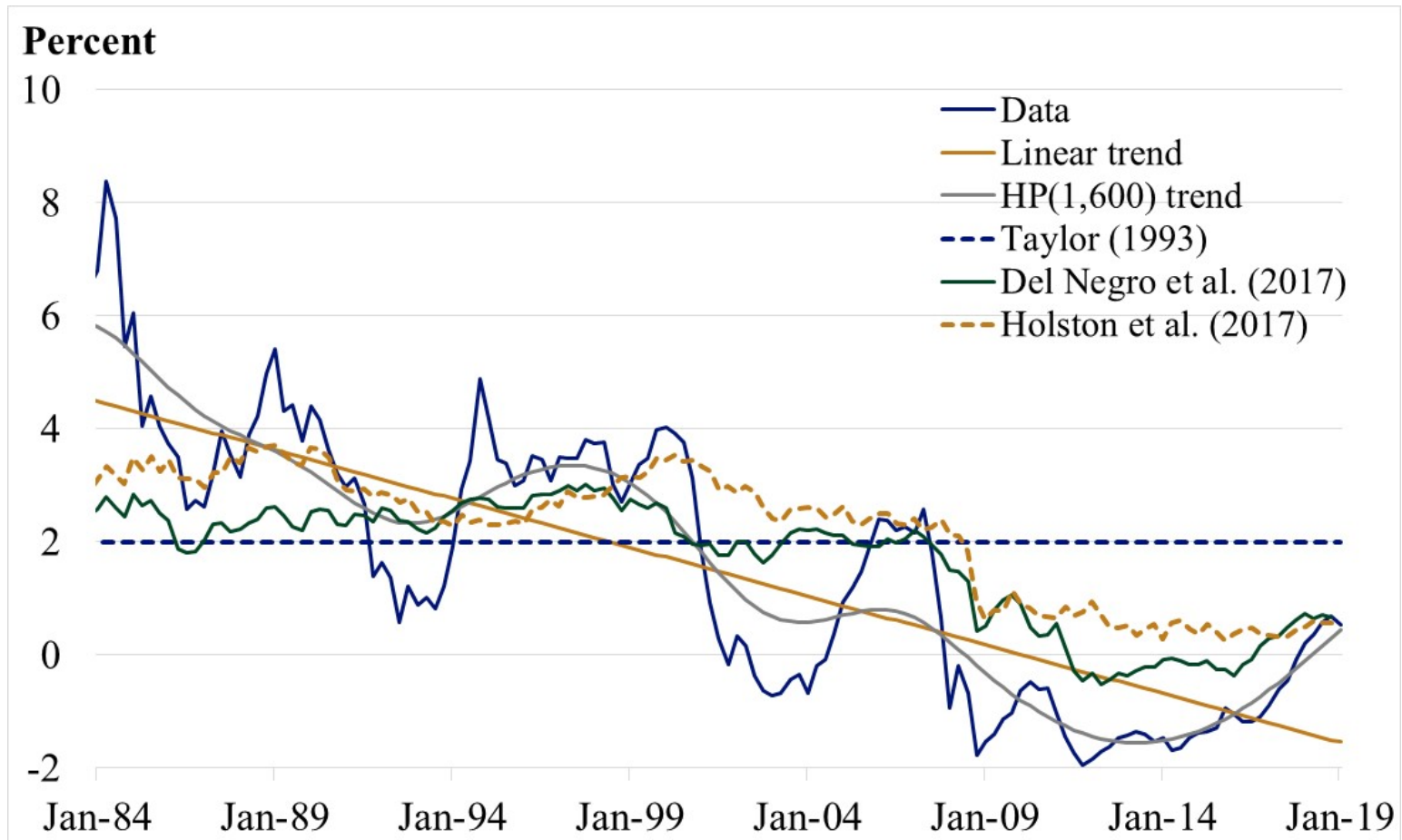
# U.S. ex-post 1-year real yield



Sources: Federal Reserve Board, FRB of Dallas and author's calculations. Last observation: March 2019.



# Raw data with trends



Sources: Federal Reserve Board, FRB of Dallas, Taylor (1993), Del Negro et al. (2017), Holston et al. (2017) and author's calculations. Last observations: 2019-Q1 and 2018-Q4.

# A regime-switching view

- In this talk, I will give a regime-switching view of these issues.
- Fundamental factors—mostly the same as those that others have looked at—are viewed as switching between high-mean and low-mean states.
- To center the analysis, I will consider all issues in the context of a Taylor-type policy rule.
- I will give the policy implications of my view at the end of the talk.

# The Natural Rate of Interest in a Taylor-Type Policy Rule

## Why worry about $r_t^\dagger$ ?

- In a Taylor-type rule, the trend natural real interest rate,  $r_t^\dagger$ , determines the intercept:

$$i_t = r_t^\dagger + \pi_t^e + \phi_\pi \pi_t^{GAP} + \phi_y y_t^{GAP},$$

where  $\pi_t^e = \pi^* = 2$  percent, the FOMC's inflation target.

- When the gaps are zero, a Taylor-type rule simply recommends setting the policy rate equal to the value of  $r_t^\dagger$  plus the inflation target.
- But what is the value of  $r_t^\dagger$ ?

# Decomposing the natural real rate

- One way to think of the underlying or trend natural real rate of interest is to divide it into three factors:

$$r_t^{\dagger} = \lambda_t + \psi_t + \xi_t, \quad \text{where}$$

- $\lambda_t$ : the labor productivity growth rate
- $\psi_t$ : the labor force growth rate
- $\xi_t$ : an investor desire for safe assets. A strong desire for safe assets would imply a relatively large negative value for  $\xi_t$ , whereas an ordinary desire for safe assets would imply a value closer to zero.

# A model with this decomposition

- One model that produces a decomposition of this sort is outlined in “Optimal Monetary Policy for the Masses.”<sup>1</sup>
- The model is a 241-period life-cycle DSGE with certain “symmetry assumptions.”
- A balanced growth path of the model would have a decomposition comparable to the one outlined in the previous slide.
- This provides one concept of the Wicksellian natural real rate of interest.

<sup>1</sup>J. Bullard and R. DiCecio, 2019, “[Optimal Monetary Policy for the Masses](#),” FRB of St. Louis Working Paper No. 2019-009C.

# Longer-run outcomes as regimes

- This conception of the natural real rate of interest suggests  $r^{\dagger}$  will have a constant mean associated with a single possible balanced growth path.
- The point of this presentation is that this mean may be better modeled as shifting over time.
- Shifting means can be modeled as regime-switching processes.
  - For example, relatively long eras of high productivity growth may be followed by relatively long eras of low productivity growth, and the natural rate of interest would be different in the two regimes.

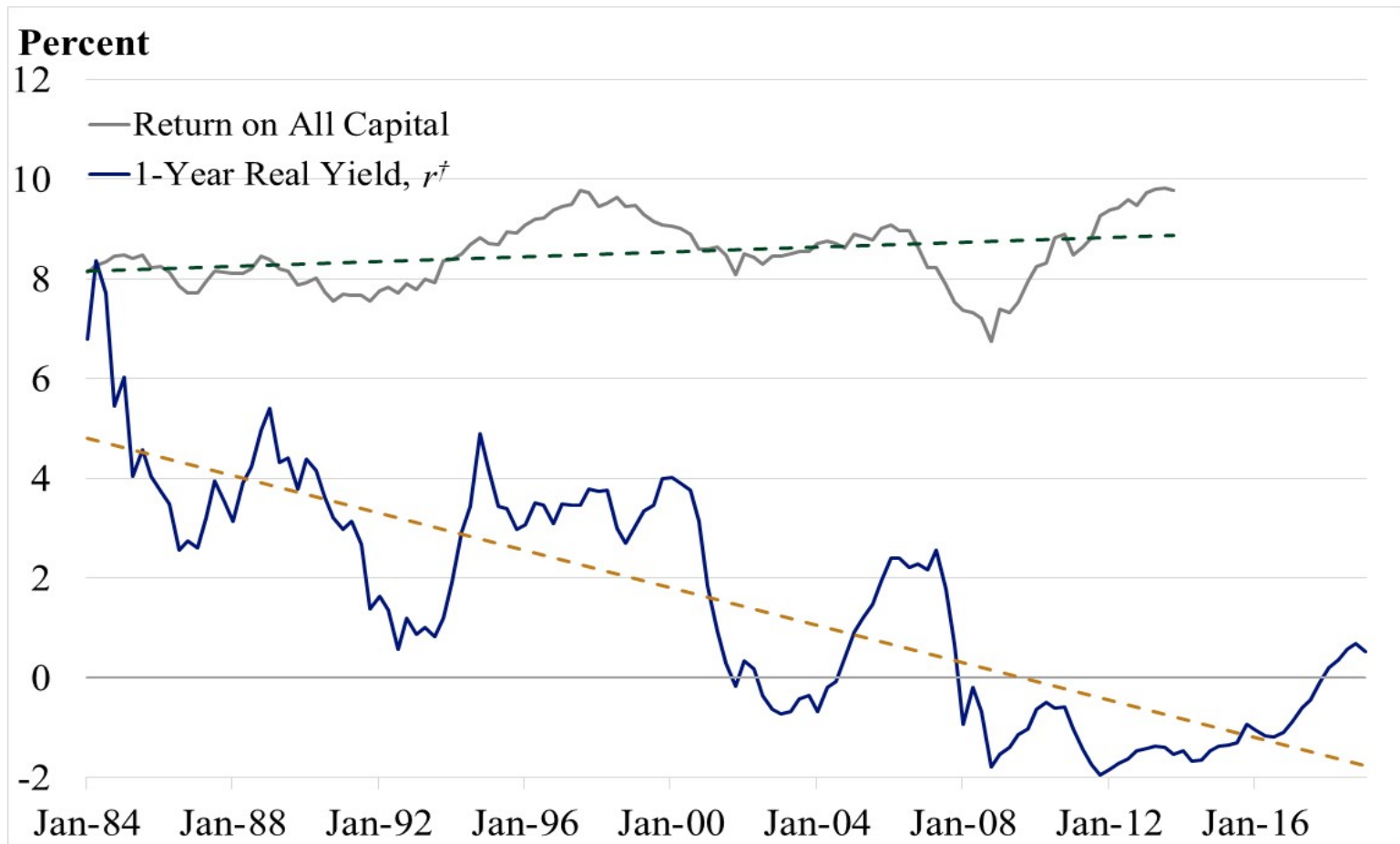
# The declining trend is on government paper only, not on capital

- The raw data show a declining trend on an ex-post real return to holding government paper.
- The declining trend does not appear to extend to ex-post real returns on claims to capital as measured from the U.S. GDP accounts.
- That return has been fairly constant since the 1980s, as shown in the next chart.
- This provides a rationale for the inclusion of the  $\xi$  factor above, which measures the desirability of holding safe assets relative to capital.<sup>1</sup>

<sup>1</sup> For an alternative perspective on this issue, see J.C. Williams, "[Three Questions on R-star](#)," FRB of San Francisco Economic Letter No. 2017-05, Feb. 21, 2017.



# Real returns on capital and safe assets



Sources: P. Gomme, B. Ravikumar and P. Rupert. "[Secular Stagnation and Returns on Capital](#)," FRB of St. Louis Economic Synopses No. 19, 2015; Federal Reserve Board; FRB of Dallas; and author's calculations. Last observation: 2019-Q1.

# Main question

- Which of the three factors is most important in accounting for the downward trend? Is it productivity growth, labor force growth or the desirability of safe assets?
- I will treat each of these three factors as following a two-state Markov-switching intercept process:

$$x_t = x(s_t) + \varepsilon_t, \text{ where } \varepsilon_t \text{ is an i.i.d. error term}$$

$s_t$  can take two values, high and low.

- The two possible mean values are called regimes.
- The idea is that these types of factors generally have constant means, but that there can be infrequent shifts in mean. I want to characterize these shifts statistically.

# Labor Productivity Growth

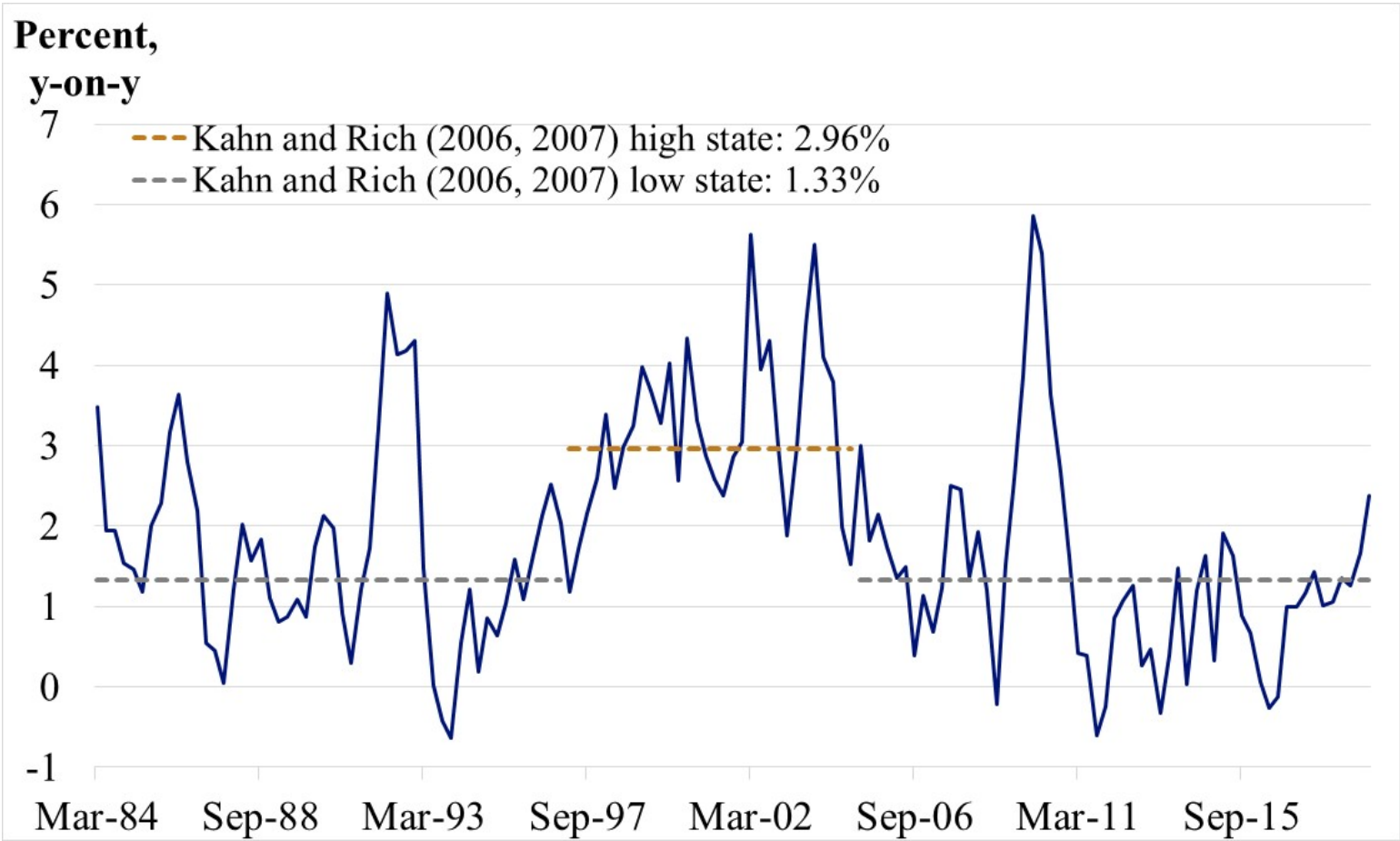
# U.S. labor productivity growth has been low

- A statistical model that estimates the probability that the U.S. economy is in a low-productivity-growth regime puts nearly all the probability on the low-growth regime.<sup>1</sup>
- The most recent estimates, based on the Kahn and Rich (2006, 2007) methodology, put the growth rate in the low (high) state at 1.33 percent (2.96 percent).<sup>2</sup>
- The U.S. economy was in the high-productivity-growth regime from early 1997 to late 2004.

<sup>1</sup> See J.A. Kahn and R.W. Rich, 2006, "[Tracking Productivity in Real Time](#)," FRB of New York, Current Issues in Economics and Finance, 12(8); and J.A. Kahn and R.W. Rich, 2007, "[Tracking the New Economy: Using Growth Theory to Detect Changes in Trend Productivity](#)," Journal of Monetary Economics, 54(6), pp. 1670-1701.

<sup>2</sup> In previous talks, I have used even lower productivity growth assumptions.

# Labor productivity growth



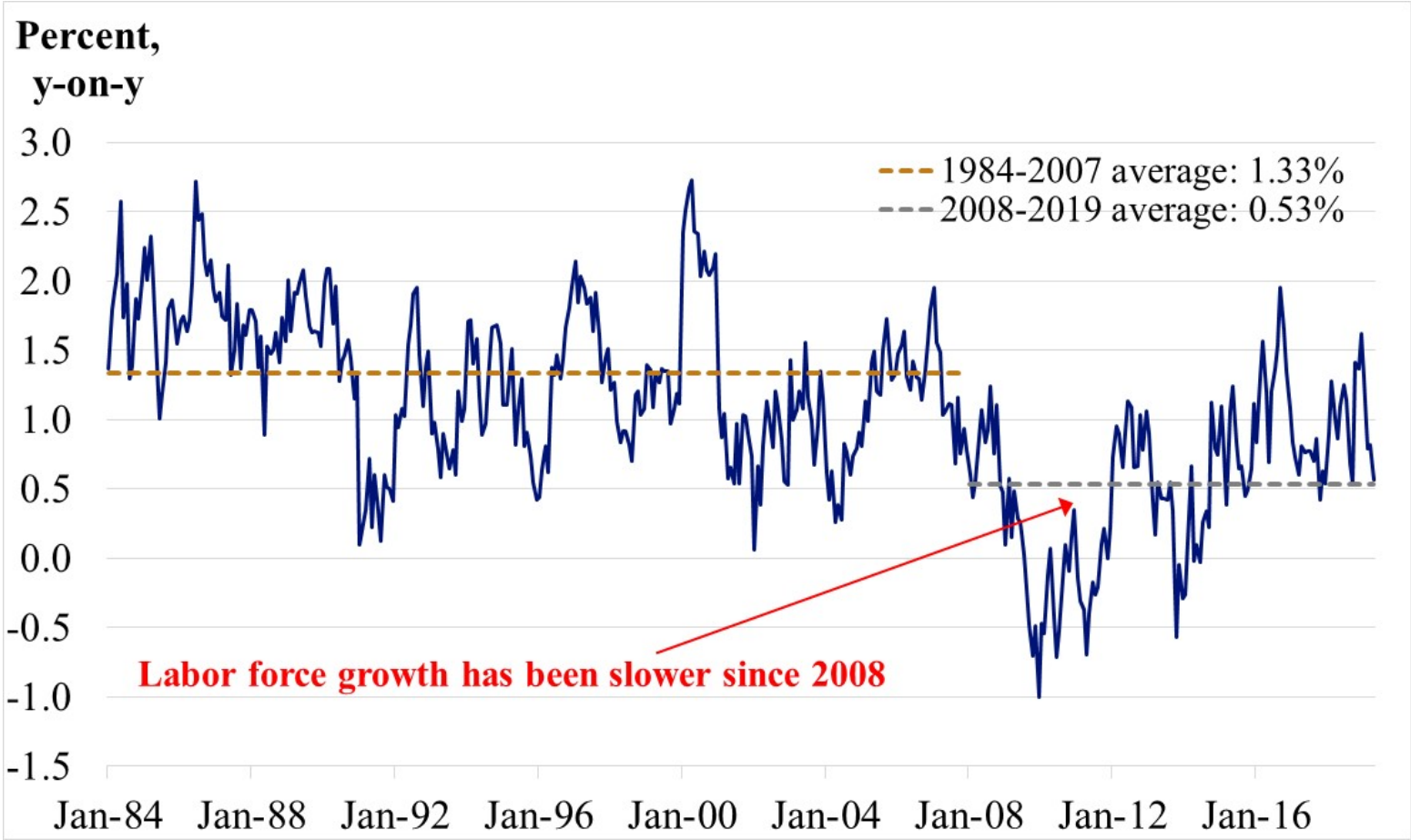
Sources: Kahn and Rich (2006, 2007) and FRB of New York. Last observation: 2019-Q1.

# Labor Force Growth

# Labor force growth has been low

- The U.S. labor force had been growing at a 1.33 percent annual rate until the financial crisis.
- The growth rate has been 0.53 percent since the financial crisis.
- It appears that the U.S. is in a low-growth state, but statistically the two regimes are not precisely estimated.
- In discussing the policy implications below, I will consider the possibility that the U.S. is in either state.

# Labor force growth



Sources: Bureau of Labor Statistics and author's calculations. Last observation: April 2019.



# Investors' Desire for Safe Assets

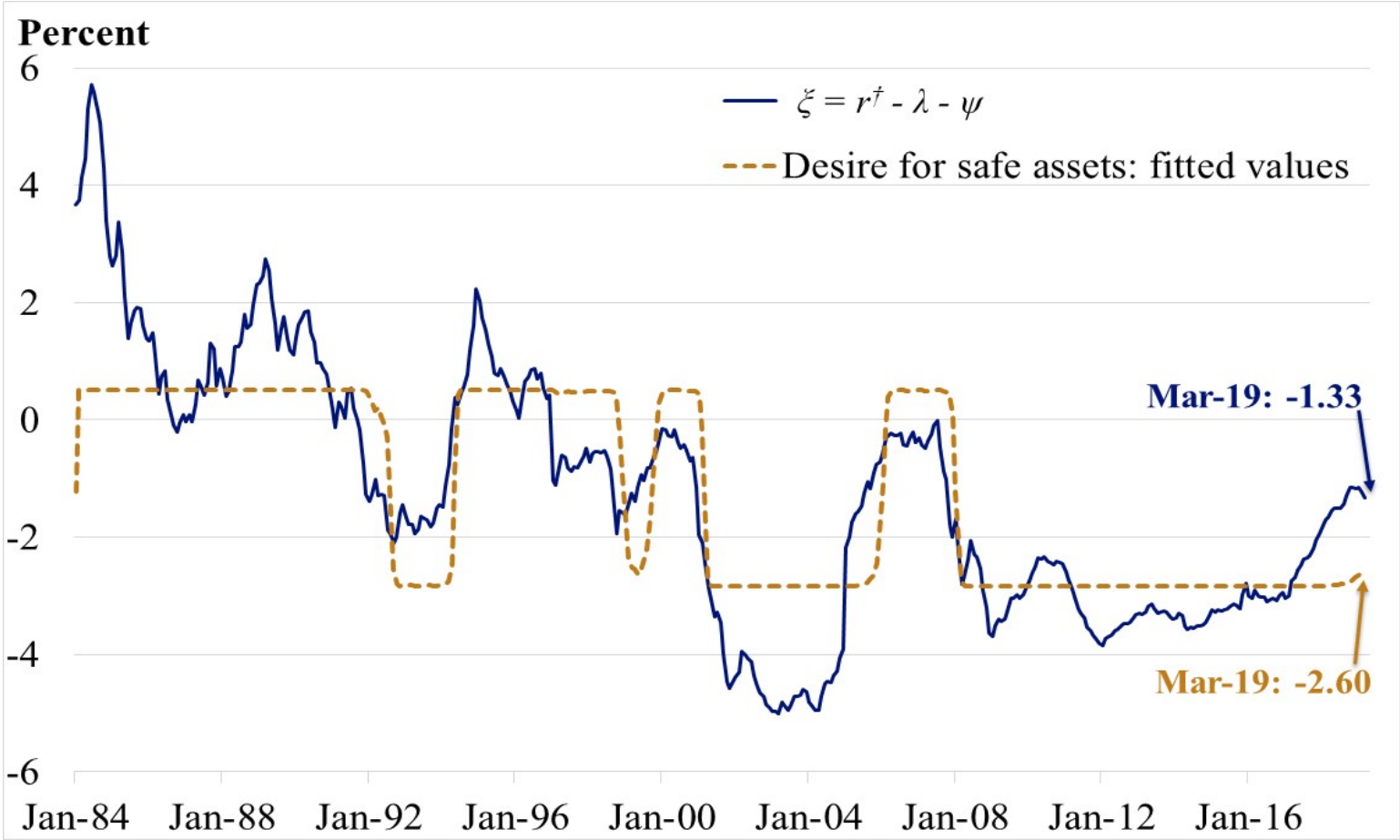
# Strong desire versus a more normal desire for safe assets

- I now remove the regime-switching trends for both labor productivity and labor force growth from the raw data on ex-post safe real returns.
- This leaves us with a time series of adjusted safe real returns, and this series still has a downward trend.
- I then fit a two-state regime-switching process to these residual values, and I interpret the two states as a strong desire for safe assets versus a more normal desire for safe assets.

## High-desire-for-safe-assets regime

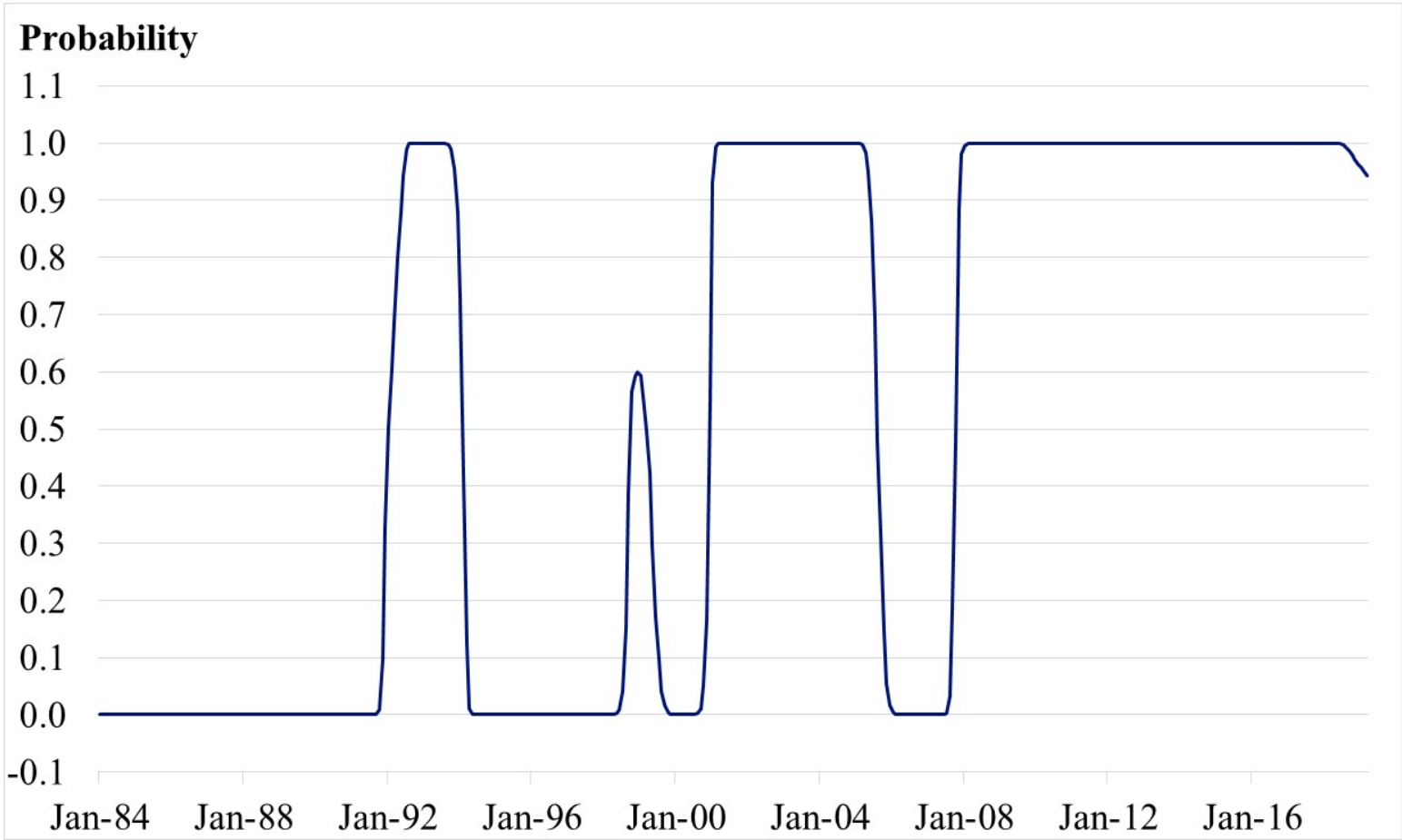
- The estimated values for  $\zeta$  are -2.94 percent in the high-desire-for-safe-assets regime and 0.62 percent in the normal-desire-for-safe-assets regime.
- The U.S. is currently in the regime with a high desire for safe assets.
- The difference between the two regimes is largest for this factor; in some sense, it is the “most important” of the three.

# Desire-for-safe-assets regimes



Source: Author's calculations. Last observation: March 2019.

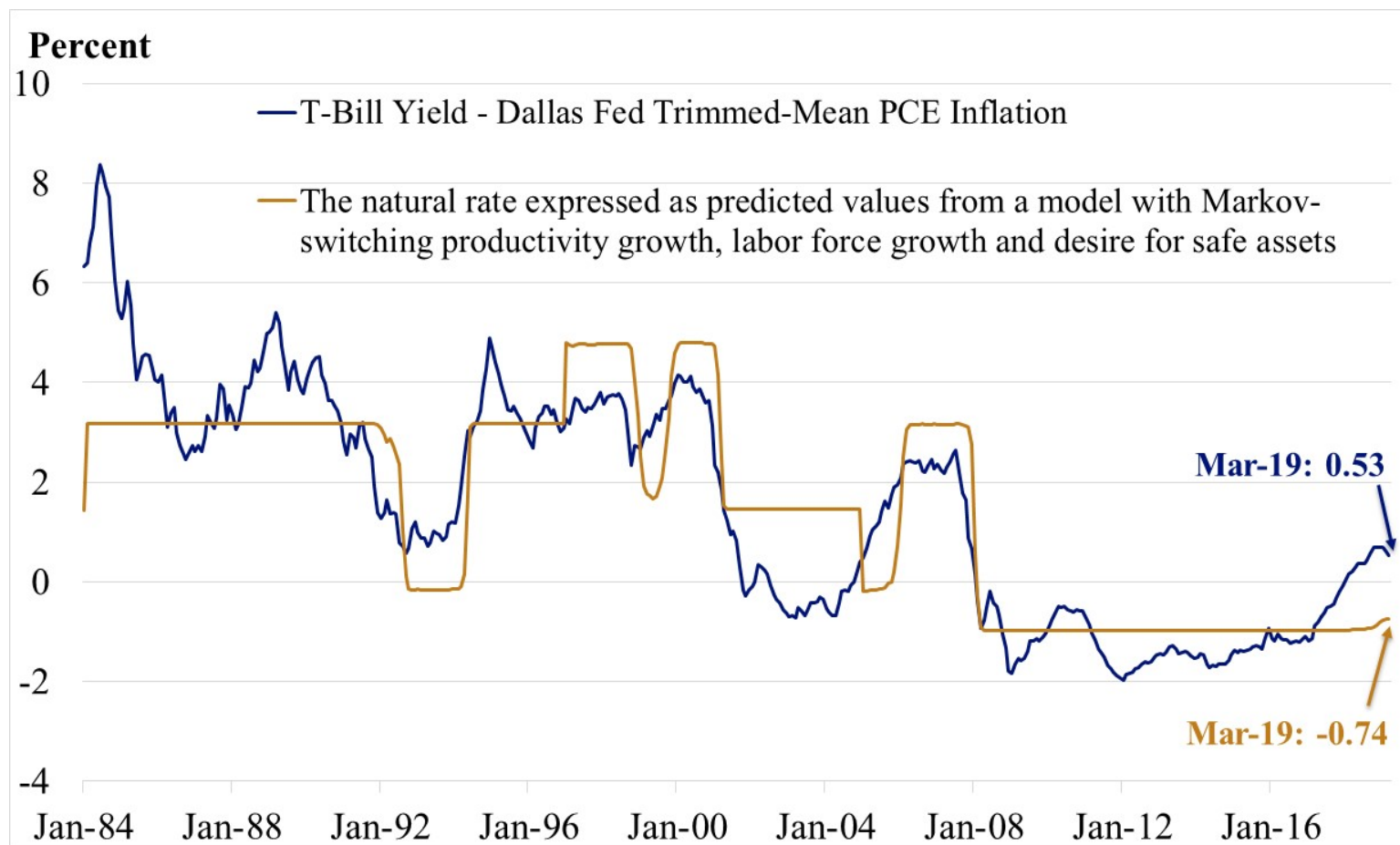
# High-desire-for-safe-assets regime: smoothed probabilities



Source: Author's calculations. Last observation: March 2019.

# What Does This Imply for the Natural Real Rate of Interest?

# $r^*$ : data and fitted values



Sources: Federal Reserve Board, FRB of Dallas and author's calculations. Last observation: March 2019.

# State values for each factor

Factor	High state	Low state	High-low state difference
Labor productivity growth, $\lambda$	296	133	163
Labor force growth, $\psi$	133	53	80
Investor desire for safe assets (inverse), $\xi$	62	-294	356
<b>Max/min natural rate, <math>r^{\dagger}</math></b>	<b>491</b>	<b>-108</b>	<b>599</b>

*All values are expressed as basis points. The max (min) natural rate is the value corresponding to all three factors taking the value in the high (low) state.*



# Using the regime-switching approach

- Labor productivity appears to be in the low-growth regime:  $\lambda = 1.33$  percent.
- The labor force appears to be in the low-growth regime as well:  $\psi = 0.53$  percent. Plausibly, labor force growth could be interpreted as still consistent with the high-growth regime,  $\psi = 1.33$  percent.
- There also appears to be a high desire for safe assets:  $\xi = -2.94$  percent.
- According to this analysis,  $r^{\dagger} = \lambda + \psi + \xi$  is either -108 basis points or -28 basis points, depending on how one views labor force growth.

# Recent Related Estimates from the Literature

## Related literature and regime switching

- There is a fairly large and growing literature trying to understand the downward trend in the natural real rate of interest.
- The literature tends to be quite a bit more sophisticated than the analysis presented here.
- The only point here is to think in terms of regime switching.
- Two of the three factors analyzed—labor productivity growth and the desire for safe assets—are in the low state and do not appear to be shifting to the high state.
- This suggests the natural safe real rate of interest, and hence the Fed's policy rate, can remain low over the forecast horizon.

## Related literature on the natural rate

- Laubach and Williams (2003) impose a structural model and estimate a relatively low  $r^*$ .<sup>1</sup>
  - Holston et al. (2017) extend the analysis to other countries.
- Curdia (2015) performs a similar analysis with somewhat altered assumptions and gets a very low  $r^*$ .<sup>2</sup>
- Del Negro et al. (2017) impose a structural model, include an evolving demand for safe assets and get a low value for  $r^*$ .
- I have imposed less structure along with an alternative stochastic conception, regime switching. This suggests a different view of mean-reversion properties.

<sup>1</sup> T. Laubach and J.C. Williams, "[Measuring the Natural Rate of Interest](#)," Review of Economics and Statistics, November 2003, 85(4), 1063–70.

<sup>2</sup> V. Curdia, "[Why So Slow? A Gradual Return for Interest Rates](#)," FRB of San Francisco Economic Letter No. 2015-32, Oct. 12, 2015.

## Additional related literature

- More possible factors impacting real rates are analyzed in Rachel and Smith (2015).<sup>1</sup>
- One could also take a longer-run view of the natural safe real rate of interest.
  - Borio et al. (2017) consider a panel dataset for 19 countries from 1870 to the present.<sup>2</sup> Their analysis emphasizes monetary regimes over long eras.
- Even more data: Homer and Sylla (2005).<sup>3</sup>

<sup>1</sup> L. Rachel and T.D. Smith, "[Secular drivers of the global real interest rate](#)," Bank of England Staff Working Paper No. 571, December 2015.

<sup>2</sup> C. Borio, P. Disyatat, M. Juselius and P. Rungcharoenkitkul "[Why so low for so long? A long-term view of real interest rates](#)," Bank for International Settlements Working Papers No. 685, December 2017.

<sup>3</sup> S. Homer and R. Sylla, A History of Interest Rates, Fourth Edition, John Wiley & Sons Inc., 2005.

# Implications for the Policy Rate

# Implications for monetary policy

- I now return to a Taylor-type monetary policy rule to give some sense of the policy impact of this analysis.
- As I noted earlier, if the gaps in a Taylor-type rule are viewed as close to zero, the rule would recommend a policy rate setting equal to the natural real rate plus the inflation target.
- The gap variables are probably not exactly zero today, so I now turn to a brief discussion of the values for gap variables.

# The inflation gap

- Inflation is currently (March 2019) between -51 and -4 basis points from target:<sup>1</sup>
  - Dallas Fed trimmed-mean PCE 1.96 percent
  - Headline PCE 1.49 percent
  - Core PCE 1.55 percent

<sup>1</sup> The inflation target is in terms of the annual change in the price index for personal consumption expenditures (PCE).



# The output gap

- I look at three ways to calculate an output gap.
- The CBO output gap (2019-Q1): 0.85 percent
- The deviation from HP(1,600) trend: 0.44 percent
- Okun's law implied gap: 2.07 percent
  - St. Louis Fed's "no-recession regime" estimate:  $u^* = 4.5$  percent
  - Unemployment rate (April 2019):  $u = 3.6$  percent
  - Output gap:  $2.3*(4.5 - 3.6) = 2.07$  percent

# Taylor-type rules

- I consider two Taylor-type rules:

$$i = r^{\dagger} + \pi^e + \phi_{\pi} \pi^{GAP} + \phi_y y^{GAP}$$

1. Taylor (1993):  $\phi_{\pi} = 1.5, \phi_y = 0.5$
2. Taylor (1999):  $\phi_{\pi} = 1.5, \phi_y = 1$ 
  - Inflation target:  $\pi^e = \pi^* = 200$
  - Natural real rate:  $r^{\dagger} \in [-108, -28]$
  - The inflation gap:  $\pi^{GAP} \in [-51, -4]$
  - The output gap:  $y^{GAP} \in [44, 207]$

# Policy rate recommendations

- Based on these data and rules, then
  1. Taylor (1993) implies  $i \in [38, 270]$ .
  2. Taylor (1999) implies  $i \in [60, 373]$ .
- The Federal Open Market Committee's (FOMC) target range for the federal funds rate today is 225 to 250 basis points, and the federal funds rate is trading at about 240 basis points.
- This value is within the range of the Taylor (1993, 1999) recommendations.

# Observations for Policymakers

# Alternative Taylor-type rules

- Modernized Taylor-type policy rules tend to put less weight on the output gap term.<sup>1</sup>
- If we use a coefficient  $\phi_y = 0.1$ , keeping other values the same, then the Taylor rule recommends lower policy rates:  $i \in [20, 187]$ .
- In this case, the actual U.S. policy rate setting would appear to be somewhat high.

<sup>1</sup> See J. Bullard, “[Modernizing Monetary Policy Rules](#),” remarks delivered at the Economic Club of Memphis, Memphis, Tenn., Oct. 18, 2018; and J. Bullard, “[More on Modern Monetary Policy Rules](#),” remarks delivered at the Indiana Economic Outlook Forum, Carmel, Ind., Dec. 7, 2018.

## Less demand for safe assets

- The desire for safe assets has a large effect on the policy rate recommendation.
- If the desire for safe assets returns to a low level, then  $r^* \in [248, 328]$  and
  1. Taylor (1993) implies  $i \in [394, 626]$ .
  2. Taylor (1999) implies  $i \in [416, 729]$ .
- This portion of the analysis suggests that better understanding of the worldwide demand for safe assets is critical to future monetary policy.

# Mean-reversion properties

- The regime-switching approach suggests that the current setting of the policy rate in the U.S. may be somewhat restrictive.
- It also suggests that  $r^*$  is unlikely to shift over a forecast horizon of two years (the typical time frame for monetary policy decisions).
- This means that forward guidance should be characterized by a relatively flat policy rate path, as opposed to an upward-sloping one that would be appropriate if  $r^*$  has strong mean reversion.
  - The FOMC median Summary of Economic Projections has adopted a relatively flat policy rate path in recent communications.

# Conclusions



# Conclusions

- This analysis has provided some background on how one might begin to think about recent trends in the natural safe real rate of interest in a regime-switching context.
- According to the analysis presented here, the natural safe real rate of interest, and hence the appropriate policy rate, is relatively low and unlikely to change very much over the forecast horizon.
- A more rigorous and thorough analysis that reaches a similar conclusion is Del Negro et al. (2017).



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