



FEDERAL
RESERVE
BANK *of*
ST. LOUIS

R-Star Wars: The Phantom Menace

James Bullard

President and CEO

34th Annual National Association for Business
Economics (NABE) Economic Policy Conference

Feb. 26, 2018

Washington, D.C.

*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 if the current policy rate setting is accommodative, neutral or restrictive.
- In practice, pinning down empirical values for the natural rate of interest involves imputing an underlying trend from raw data, which can be difficult.
- Hence, this variable is something of a “phantom menace.”

Key themes in this talk

- The main themes in this talk are as follows:
 - 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

- Short-term real interest rates are at the center of macroeconomic theory and monetary policy.
- 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.
- There are many ways to detrend the data.

Raw data

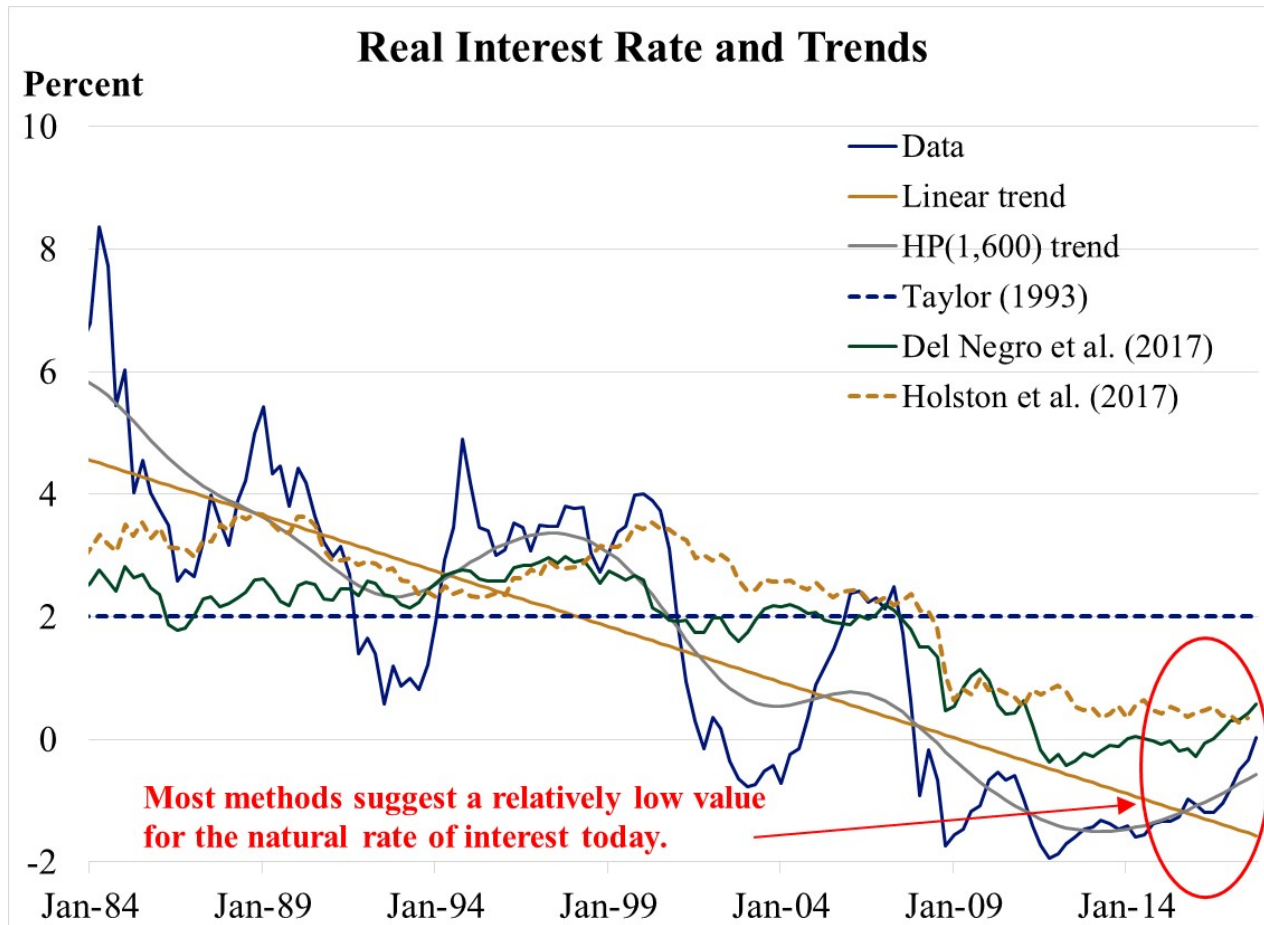
- The raw data for this talk are one-year ex-post real interest rates on U.S. Treasury bills from 1984 to the present.¹
- The following are four methods to detrend the data:
 - Use a constant as in Taylor (1993).²
 - Use a model, such as Holston et al. (2017) or Del Negro et al. (2017).³
 - Use a linear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

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

² J. Taylor, 1993, "Discretion versus policy rules in practice," Carnegie-Rochester Conference Series on Public Policy, 39, pp. 195-214.

³ 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.

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 observation: 2017-Q4.

A regime-switching view

- In this talk I will give a regime-switching view of these issues.
- Fundamental factors—mostly the same as what others have looked at—are viewed as switching between high-mean and low-mean states.
- I will call the natural rate of interest “r-dagger” (or r^\dagger) in order to emphasize that these estimates use an alternative methodology.
- 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 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 natural real rate of interest is to divide it into three factors:

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

- λ_t : the labor productivity growth rate
- ψ_t : the labor force growth rate
- ξ_t : an investor desire for safe assets. A strong desire for safe assets would imply a relatively large negative value for ξ_t , whereas an ordinary desire for safe assets would imply a value closer to zero.

Why this decomposition of r^{\dagger} ?

- Assumptions:
 - log preferences T-period OLG with no discounting
 - fixed capital and no other frictions
- In this type of model, if there was no special desire for safe assets, r^{\dagger} would equal the real output growth rate (also the consumption growth rate), $\lambda + \psi$, along the balanced growth path.
- This is one concept of a natural real rate of interest.

Longer-run outcomes as regimes

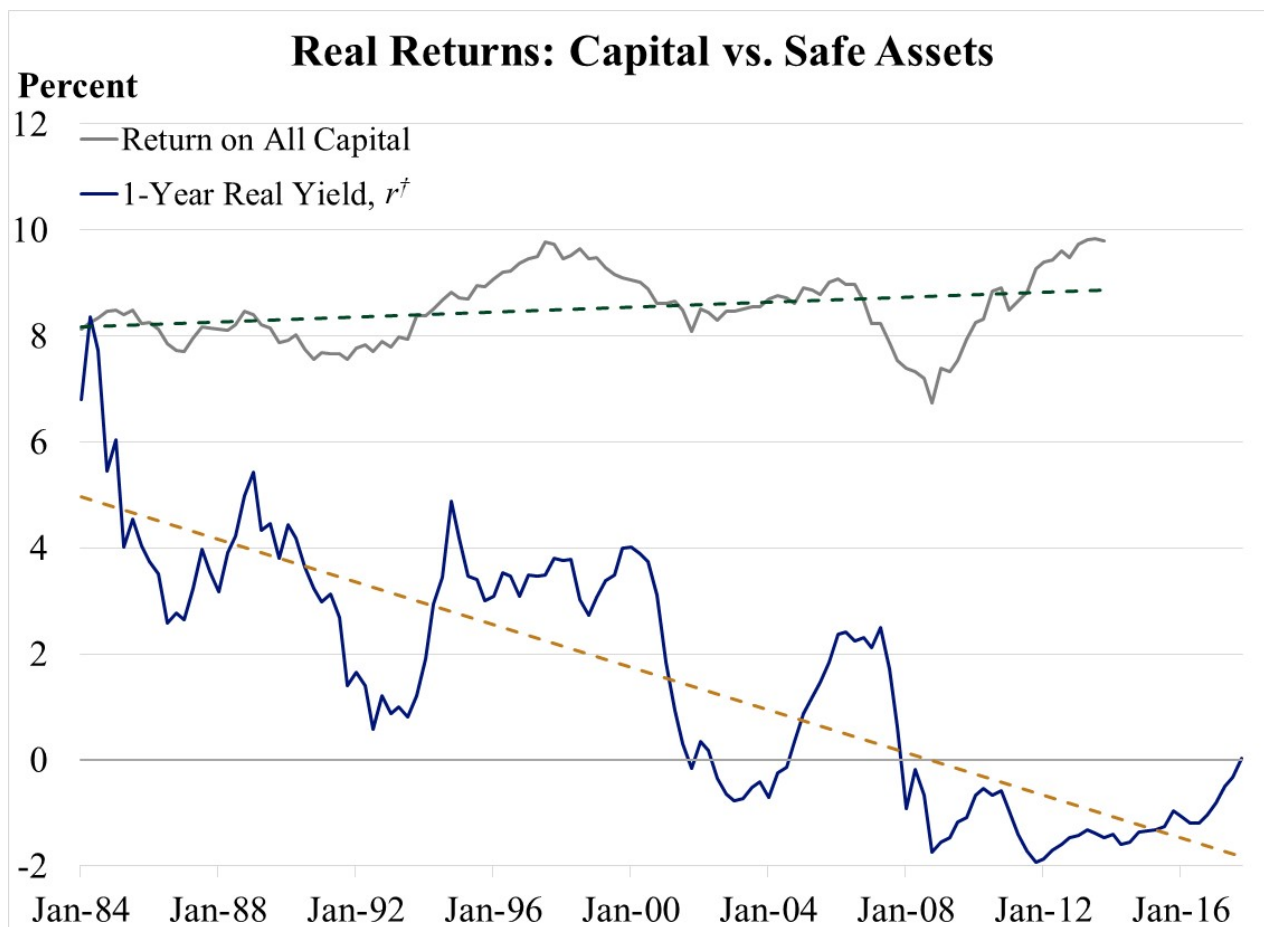
- This conception of the natural real rate of interest suggests r^{\dagger} will have a constant mean associated with a single possible balanced growth path.
- The point of this presentation is that this mean may be better modeled as shifting over time.
- Shifting means can be modeled as regime-switching processes.
 - For example, relatively long eras of high productivity growth may be followed by relatively long eras of low productivity growth, and the natural real 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. national 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 ξ factor above, which measures the desirability of holding safe assets relative to capital.¹

¹ 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: 2017-Q4.

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

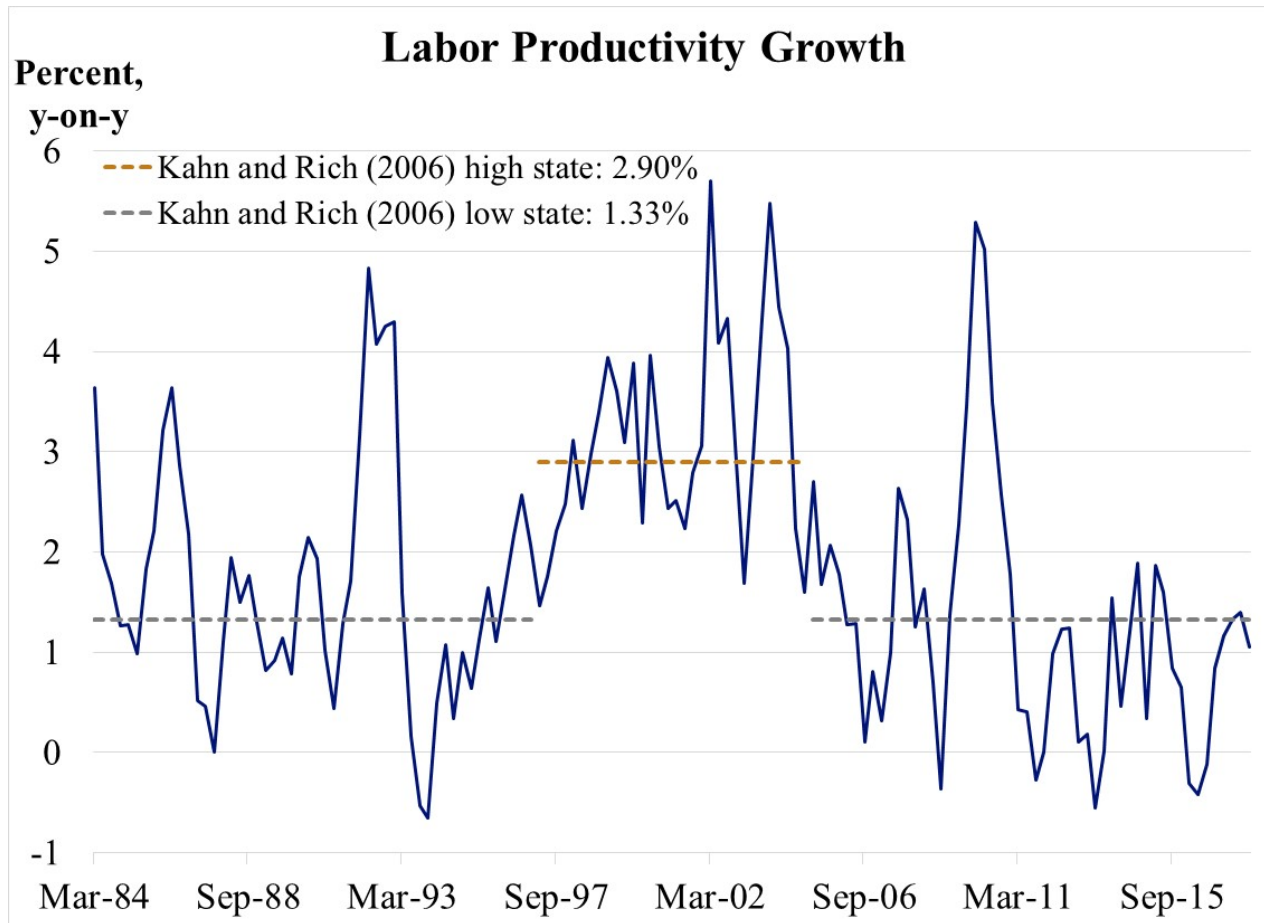
U.S. labor productivity growth has been low

- 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.¹
- The most recent estimates, based on the Kahn and Rich (2006) methodology, put the growth rate in the low (high) state at 1.33 percent (2.90 percent).²
- The U.S. economy was in the high-productivity-growth regime from early 1997 to late 2004.

¹ 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).

² In previous talks, I have used even lower productivity growth assumptions.

The high- and low-productivity-growth regimes



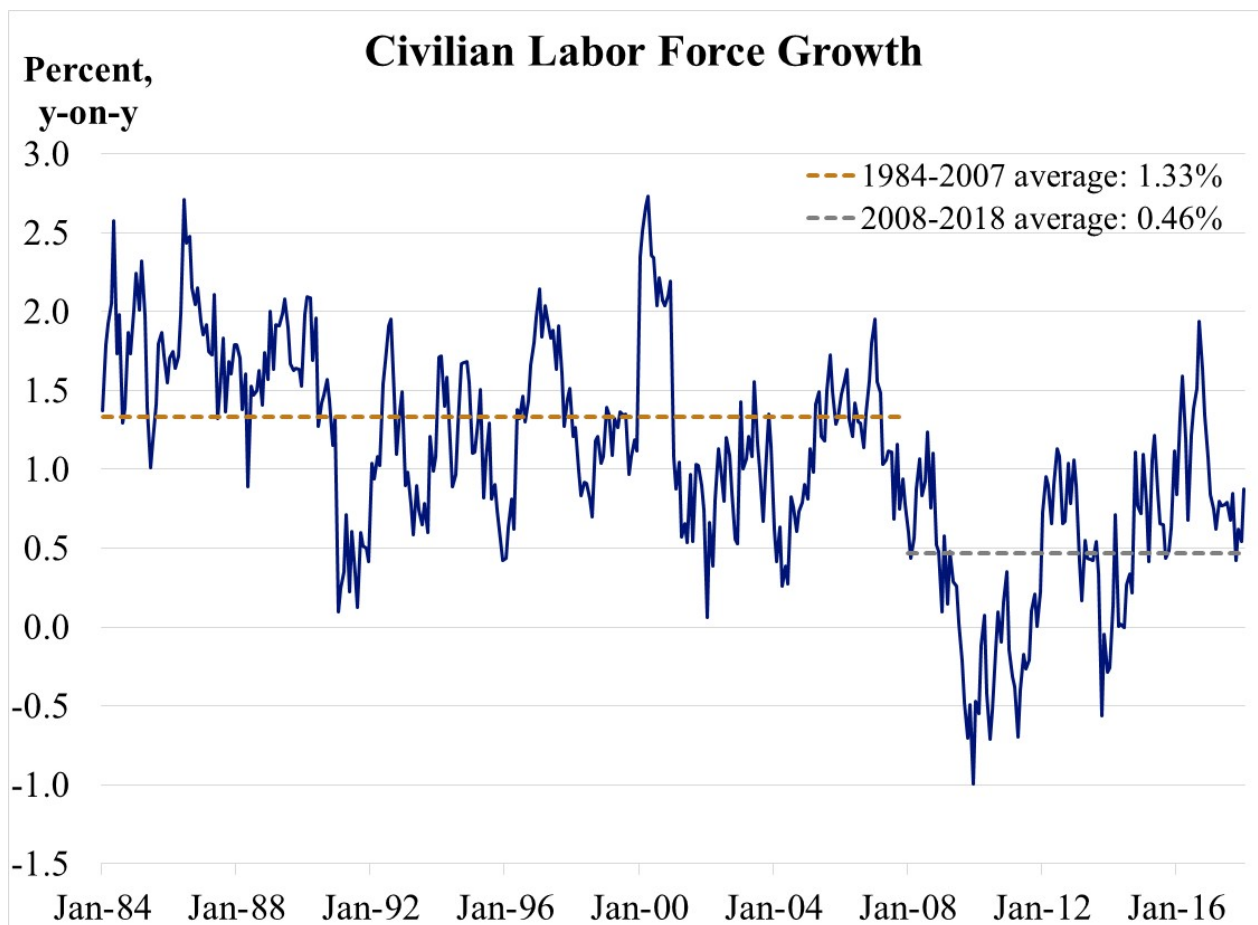
Sources: Kahn and Rich (2006) and FRB of New York. Last observation: 2017-Q4.

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 0.46 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.

High- and low-labor-force-growth regimes



Sources: Bureau of Labor Statistics and author's calculations. Last observation: January 2018.

Investor Desire for Safe Assets

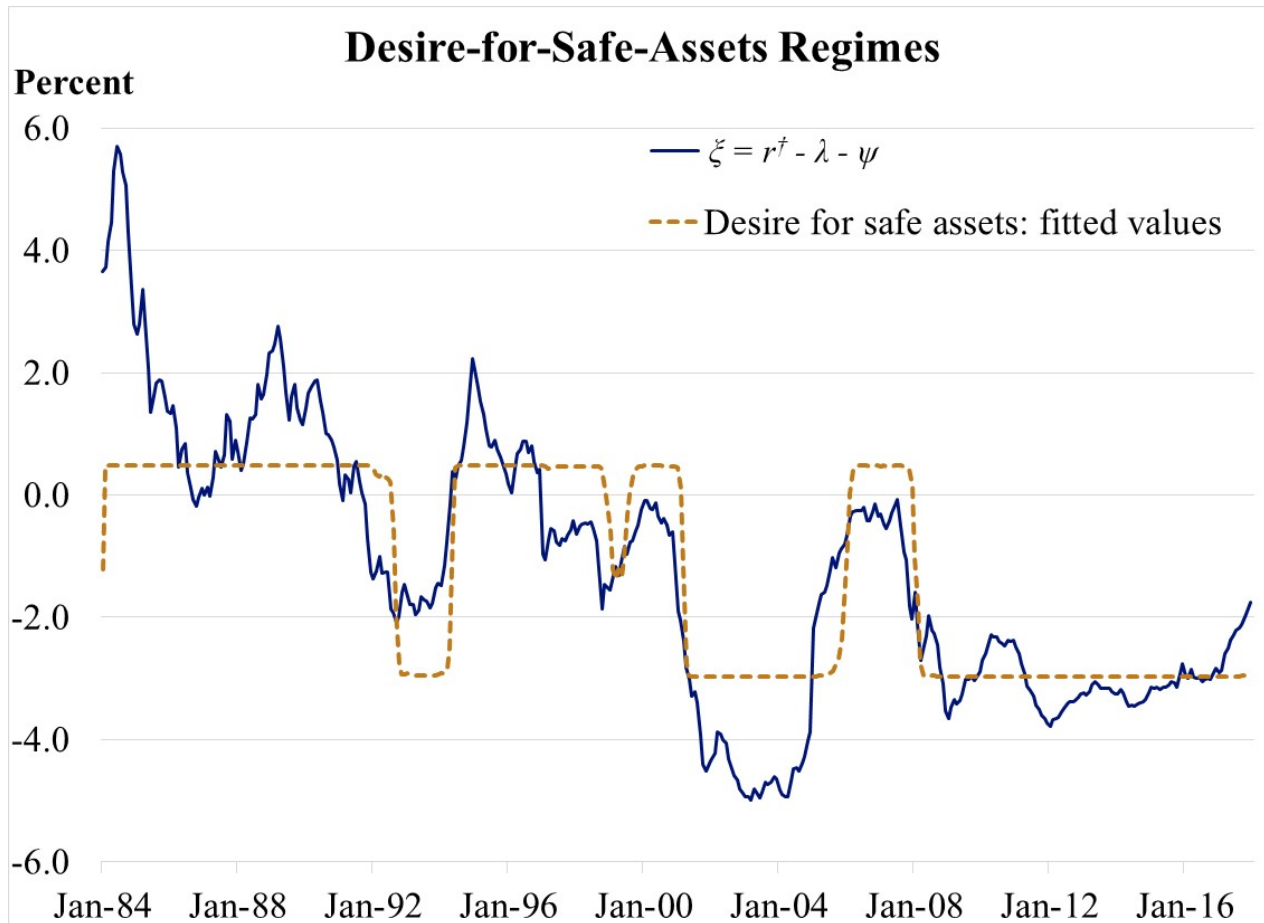
Investor desire for safe assets

- 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 ξ are -3.06 percent in the high-desire-for-safe-assets regime and 0.57 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.

Current regime: High desire for safe assets



Source: Author's calculations. Last observation: December 2017.

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

State values for each factor

Factor	High state	Low state	High-low state difference
Labor productivity growth, λ	290	133	157
Labor force growth, ψ	133	46	87
Investor desire for safe assets (inverse), ξ	57	-306	363
Max/min natural rate, r^{\dagger}	480	-127	607

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, so set $\lambda = 1.33$ percent.
- The labor force appears to be in the low-growth regime as well, so set $\psi = 0.46$ 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, so set $\xi = -3.06$ percent.
- According to this analysis, $r^{\dagger} = \lambda + \psi + \xi$ is either -127 basis points or -40 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^* .¹
 - 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^* .²
- 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.

¹ T. Laubach and J.C. Williams, “Measuring the Natural Rate of Interest,” *Review of Economics and Statistics*, November 2003, 85(4), 1063–70.

² 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).¹
- 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.² Their analysis emphasizes monetary regimes over long eras.
- Even more data: Homer and Sylla (2005).³

¹ L. Rachel and T.D. Smith, “Secular drivers of the global real interest rate,” Bank of England Staff Working Paper No. 571, December 2015.

² 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.

³ 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 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

- The U.S. inflation rate has been below the 2 percent inflation target since 2012.*
- Inflation measured from one year earlier is currently (December 2017) between 30 and 48 basis points below target:
 - Dallas Fed trimmed-mean PCE 1.67%
 - Headline PCE 1.70%
 - Core PCE 1.52%

* 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 (2017-Q4): 0.47 percent
- The deviation from HP_{1,600} trend (2017-Q4): 0.14 percent
- Okun's law implied gap: 0.92 percent
 - St. Louis Fed's "no-recession regime" estimate: $u^* = 4.5$ percent
 - Unemployment rate (January 2018): $u = 4.1$ percent
 - Output gap: $2.3*(4.5 - 4.1) = 0.92$ percent

Data summary and two policy rules

- I consider two Taylor-type rules:¹

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

1. Taylor (1993): $\phi_{\pi} = 1.5, \phi_y = 0.5$
2. Taylor (1999):² $\phi_{\pi} = 1.5, \phi_y = 1$
 - Inflation target: $\pi^e = \pi^* = 200$
 - Natural real rate: $r^{\dagger} \in [-127, -40]$
 - The inflation gap: $\pi^{GAP} \in [-48, -30]$
 - The output gap: $y^{GAP} \in [14, 92]$

¹ All values in these calculations are expressed as basis points.

² J. Taylor, "A Historical Analysis of Monetary Policy Rules," in J. Taylor, ed., *Monetary Policy Rules*, University of Chicago Press, ch. 7, pp. 319-48, 1999.

Policy rate recommendations

- Based on these data and rules, then the policy rate i should be set as:
 1. Taylor (1993) implies $i \in [8, 161]$.
 2. Taylor (1999) implies $i \in [15, 207]$.
- The FOMC's target range for the federal funds rate today is 125 to 150 basis points, and the federal funds rate is trading at about 142 basis points.
- This value is within the range of the recommendations.
- However, if the Committee raises the policy rate substantially from here without other changes in the data, the policy setting could become restrictive.

Mean-reversion properties

- The regime-switching approach suggests that the current setting of the policy rate is broadly appropriate.
- It also suggests that r^{\dagger} is unlikely to shift over a forecast horizon of two years (the typical time frame for monetary policy decisions).
- This suggests 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^{\dagger} has strong mean reversion.

Conclusion

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).



FEDERAL
RESERVE
BANK *of*
ST. LOUIS

Connect With Us

James Bullard

stlouisfed.org/from-the-president

STLOUISFED.ORG

Federal Reserve Economic Data (FRED)

Thousands of data series, millions of users

Blogs and Publications

News and views about the economy and the Fed

Economic Education Resources

For every stage of life

Community Development

Promoting financial stability of families, neighborhoods

SOCIAL MEDIA



ECONOMY MUSEUM



AT THE FEDERAL RESERVE BANK OF ST. LOUIS