Special Commentary — July 26, 2024

R-Stargazing: Part I

Summary

- With the first rate cut from the FOMC looking increasingly likely to occur in the next few months, a new debate has gathered momentum: what is r* in today's economy, and where is it headed in the future?

- R* (pronounced "R-star"), also known as the natural rate, the neutral rate or the equilibrium rate, is the real (i.e. inflation-adjusted) policy rate that would be expected to prevail over the longer-run with inflation anchored at the central bank's target. In other words, r* is the real short-term interest rate that neither speeds up nor slows down the economy in equilibrium.

- Understanding r* is critical to financial markets and policymaking. An accurate estimate of r* can help central bankers craft monetary policy in a way that meets the needs of the economy at a given point in time. An investor considering whether today's 10-year Treasury note is an attractive investment must weigh not just what short-term interest rates will be over the next year or two but what they will be for the entire next decade.

- Measuring r* is an inherently tricky task. One of the defining characteristics of the natural rate is that it is not directly observable. Unlike employment growth or inflation for consumer goods, r* is a theoretical construct that cannot be sampled. Economists must rely on a variety of tools and methods to estimate r*, and there is inherent uncertainty around those projections.

- Looking across a wide range of measures, including econometric models, financial market instruments, Federal Reserve forecasts as well as private sector economist forecasts, we believe a reasonable range of consensus estimates for r* in the United States at present is ~0.75% on the low side and ~2.50% on the high side, with the median forecast probably closer to the bottom end of that range.

- But what determines r* in the first place? At its core, r* is the market clearing rate for the supply of and demand for savings. Firms and governments demand capital to finance new projects, while the supply of capital originates from savers seeking to earn a rate of return in exchange for delaying consumption.

- Many factors impact the supply of and demand for savings. Over the past few decades, a few forces have put upward pressure on r*, such as an explosion in public debt. However, other factors such as slower productivity growth, an aging population, new financial regulations and a global savings glut have more than offset the upward pressure on r* from fiscal deterioration. These structural changes explain the steady decline in r* and in U.S. interest rates more generally that began in the 1990s and lasted until a few years ago.

- But as we look to the years ahead, will low real rates continue to be the norm? The experiences of the past few years have led to a revisiting of that assumption. Questions abound about the outlook for accelerating labor productivity, rapidly declining birth rates, deglobalization and ballooning public debt. In Part II of this series, we will examine the outlook for these factors and lay out our base case forecast for r*.

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An Economist's North Star Is R-Star

"The natural rate is an abstraction; like faith, it is seen by its works." – John H. Williams.[1]

The Federal Open Market Committee (FOMC) has kept the federal funds rate unchanged for the past year after one of the sharpest policy tightening cycles on record. With inflation inching closer to 2%, economists and market participants continue to debate when the FOMC will initiate the long-awaited rate-cutting cycle.

But in the background, another great debate is occurring. In the decade that preceded the pandemic, nominal and real interest rates were historically low. This was generally true across the entire decade, including the late-2010s period when the U.S. economy was strong, the FOMC had completed a series of rate hikes and the central bank had reduced the size of its balance sheet. Furthermore, the low interest rates of this era were a continuation of a structural decline that had been ongoing through several economic cycles (Figure 1). Policymakers and investors around the world drew the conclusion that equilibrium interest rates had declined due to structural changes in the global economy.

The experiences of the past two years have led to a revisiting of that assumption. In Part I of this two-part series, we lay the foundation for the great debate around r* (pronounced "R-Star"). What is r*? How is it estimated? What are the key factors that drive it? In Part II, we will explore the outlook for the determinants of r* and lay out our base case expectations for this critical economic variable.

Both nominal and real interest rates were historically low in the decade before the pandemic — a continuation of a structural decline that had been ongoing through several economic cycles.

Figure 1
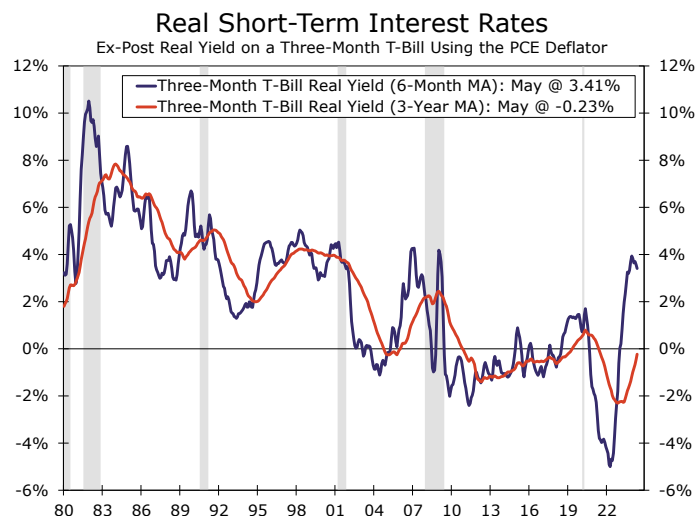
Source: Bloomberg Finance L.P. and Wells Fargo Economics

What Is R*?

Defining r* in simple terms is only a bit easier than estimating its value. In a recent speech, Chris Waller, a member of the Federal Reserve Board of Governors, defined r* as "the real policy interest rate that is neither stimulating nor restricting economic activity with inflation anchored at the central bank's inflation target."[2] In other words, r* is the real (i.e. inflation-adjusted) short-term interest rate that exerts a neutral impact on the economy. Sometimes r* is used interchangeably with the neutral rate or natural rate, terms whose names more clearly signal that r* is the policy rate that is neither speeding up nor slowing down economic growth. Put more academically, r* is the interest rate that equates long-run savings supply and investment demand in the money market.

Another way to think about this concept is that r* is the real policy interest rate that would be expected to prevail over the long run. In the short run, the real policy rate may deviate from r* for a variety of reasons. A recession could create a weak economy, leading monetary policymakers to cut the policy rate well below r* in an effort to revive economic activity. Similarly, an inflation shock may drive policymakers to increase the policy rate above r* in an effort to cool off an overheating economy. R* estimates look beyond these cyclical swings and seek to identify what real policy rate would prevail if the economy was running at full potential with stable inflation.

R is also known as the "neutral rate" or "natural rate," terms that signal r* is the policy rate that is neither speeding up nor slowing down economic growth.*

One might wonder whether the r* debate is merely an academic one. We do not believe that to be the case. Assessing the level and direction of change for r* is critical to policymaking and financial markets. An accurate estimate of r* can help central bankers craft monetary policy in a way that meets the needs of the economy at a given point in time. An investor considering whether today's 10-year Treasury note is an attractive investment must weigh not just what short-term interest rates will be over the next year or two, but what they will be for the entire next decade. If the federal funds rate eventually returns to the ~2% nominal rate and ~0% real rate that prevailed before the pandemic, today's 10-year Treasury yield of 4.25% or so looks quite attractive. But if the federal funds rate remains at its current value of 5.33% for years to come, the current 10-year Treasury yield is likely a poor investment. Understanding r* and its drivers can help better inform decisions like these.
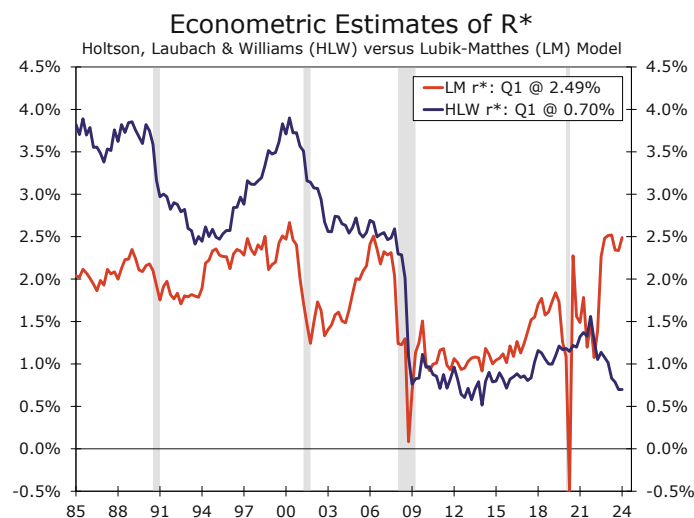
How Is R* Measured?

One of the defining characteristics of r* is that it is not directly observable. Unlike employment growth or inflation for consumer goods, r* is a theoretical construct that cannot be sampled. Economists must rely on a variety of tools and methods to estimate r*, and there is inherent uncertainty around those projections.

Econometric Models

Economists have developed various statistical methods to tease out r* from actual data. At present, there are two widely followed estimates of r* in the United States: one produced at the Federal Reserve Bank of New York and one at the Federal Reserve Bank of Richmond. These two models differ in their underlying assumptions and methodologies, and thus they produce different estimates for r*. The Lubik-Matthes (LM) estimate from the Richmond Fed shows that r* has jumped since the pandemic, while the Holston-Laubach-Williams (HLW) model from the New York Fed shows a continuation of the secular decline in r* that began in the late 1990s (Figure 2).

One of the defining characteristics of r is that it is not directly observable.*

Figure 2

Econometric Estimates of R*
Holston, Laubach & Williams (HLW) versus Lubik-Matthes (LM) Model

— LM r*: Q1 @ 2.49%
— HLW r*: Q1 @ 0.70%

Source: Federal Reserve System and Wells Fargo Economics

Figure 3

U.S. Potential GDP Growth Has Slowed

— HLW Trend Growth: 2023 @ 2.2%
— CBO Real Potential Growth: 2023 @ 2.2%

Source: Congressional Budget Office, Federal Reserve Bank of New York and Wells Fargo Economics

The HLW r* estimate—which generally garners the most attention, in part because the model was co-developed by current New York Fed President John Williams—conceptualizes r* in relation to the output gap (i.e., whether actual output is above or below potential output). In this way, the HLW model exploits the theoretical tie between potential growth and r* (which we explore in greater detail in the next section). As President Williams remarked in a recent speech, the model assumes U.S. potential GDP growth in 2023 was essentially unchanged from its 2019 value, and this slow pace of trend growth is a key factor keeping r* close to its pre-pandemic level (Figure 3).

The LM model, on the other hand, is motivated by the idea that the actual real interest rate should converge to r* over time. Accordingly, the LM model estimates r* as the 5-year ahead forecast of the real interest rate. The model output is not restricted to follow specific assumed relationships; rather, the LM model captures the statistical co-movement in interest rates, inflation and growth.

Given the historical pattern of the data and the fact that economic growth has held up well over the past few years even as the real federal funds rate has remained elevated, the LM model assumes r* has risen substantially. That said, the present high reading for r* may be attributed to a model that could extrapolate too much based on recent data, a known problem Lubik and Matthes have written about.[3] It is possible that, with a few additional quarters of data and some FOMC rate cuts, the model may eventually interpret the recent elevated real rate of interest as volatility around r* rather than as demonstrative of the underlying trend.

Of course, econometric models are far from perfect, and the LM and HLW models illustrate that different econometric approaches can sometimes produce very different outputs. Where else can we turn to examine various estimates for r*?

Market-Based Measures

One place to look is financial markets. As we have discussed previously, r* is a theoretical construct and not an observable variable, and as a result, there is no direct market-based measure of r*. However, there are a few proxy measures that come close. For example, longer-run market pricing for the Secured Overnight Financing Rate (SOFR) minus expected inflation should approximate r* since SOFR is an overnight interest rate based on very safe transactions in the Treasury repo market. As of this writing, SOFR futures five years or so out are sitting at roughly 3.50%-3.75%, while longer-run market-based inflation expectations are close to 2% on a PCE inflation basis.[4] Another proxy using overnight index swaps based on the federal funds rate shows similar values. These measures suggest r* is in the ballpark of 1.25% (Figure 4). Admittedly, these proxies are not perfect and may be biased due to liquidity and term premiums, but they serve as a useful guide to where markets think overnight rates are headed over the longer-run. Markets appear to be priced for real short-term interest rates that are higher than what prevailed in the 2010s but still below 1990s and 2000s levels.
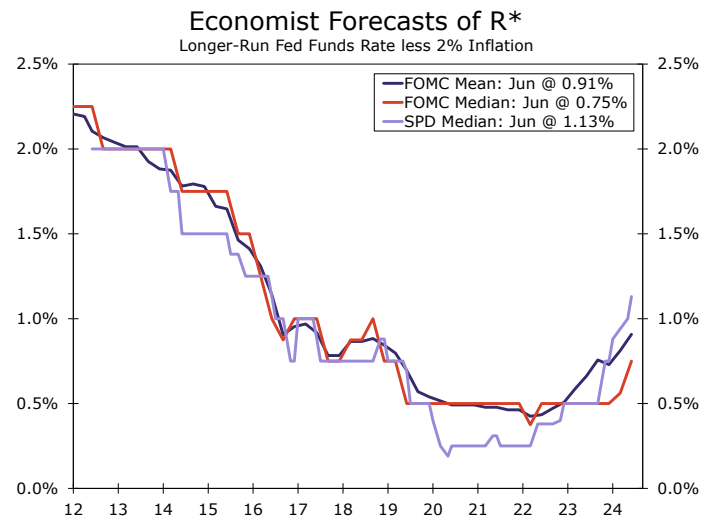
Market-based proxies for r* appear to be priced for real short-term interest rates that are higher than what prevailed in the 2010s but still below 1990s and 2000s levels.

Figure 4
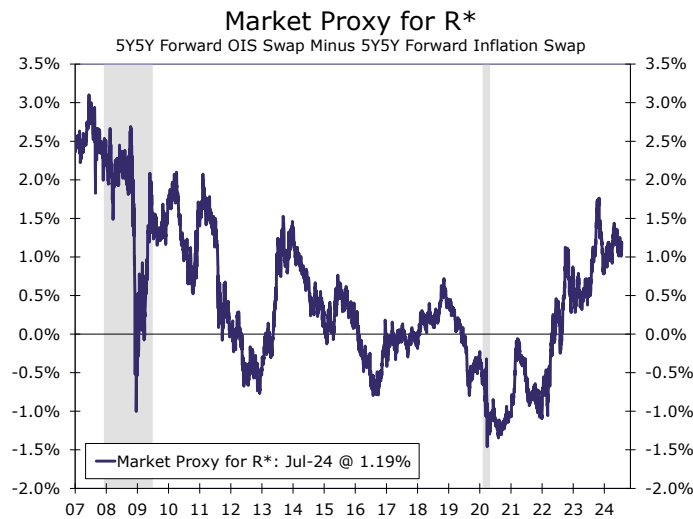
Market Proxy for R*
5Y5Y Forward OIS Swap Minus 5Y5Y Forward Inflation Swap

Market Proxy for R*: Jul-24 @ 1.19%

Source: Bloomberg Finance L.P. and Wells Fargo Economics

Figure 5

Economist Forecasts of R*
Longer-Run Fed Funds Rate less 2% Inflation

FOMC Mean: Jun @ 0.91%
FOMC Median: Jun @ 0.75%
SPD Median: Jun @ 1.13%

Source: Federal Reserve System and Wells Fargo Economics

Economist Forecasts

The FOMC produces a longer-run estimate of the federal funds rate in its quarterly dot plot. By subtracting out the 2% inflation participants project over the longer-run, we can approximate the Committee's view on r*. The June dot plot implied a median r* estimate of 0.75% and a mean estimate of 0.91% (Figure 5). Notably, these views are much closer to the HLW model output for r* compared to the LM model output. The New York Fed's Survey of Primary Dealers (SPD) offers insights into private sector forecasts of r*. The SPD comprises responses from the 24 financial firms that are trading counterparties with the Federal Reserve Bank of New York. The median response in the most recent SPD projected a 3.1% federal funds rate and 2% inflation over the longer-run, implying an r* of about 1.1%. Like the FOMC, private sector economists and analysts seem to believe that current short-term interest rates are well above the neutral rate.

Economist forecasts for r* have crept higher over the past year and are now in the ballpark of 1%.

One dynamic that is clear from this discussion and the charts above is that r* declined in the United States starting in the 1990s and continuing through the 2010s. With the advantage of hindsight, this is clear in realized short-term interest rates, various r* models and economist forecasts. Estimating r* in real time is far more difficult, but we believe a reasonable range of consensus estimates for r* at present is ~0.75% on the low side (FOMC median longer-run dot, HLW model) and ~2.50% on the high side (LM model) with most other projections in between (market-based measures, private sector forecasters).

What Determines R*?

At its core, r* is the market clearing rate for the supply of and demand for savings. Firms and governments demand capital to finance new projects, while the supply of capital originates from savers seeking to earn a rate of return in exchange for delaying consumption. In an economy operating at full potential with stable inflation, r* can be viewed as the equilibrium rate bringing savers and borrowers into balance.

At its core, r is the market clearing rate for the supply of and demand for savings. Accordingly, factors that impact the supply and demand of safe and liquid assets drive changes in r*.*

A perfectly risk-free asset probably does not exist in the world, but arguably the closest thing we have is U.S. Treasury securities. The U.S. dollar is the world's reserve currency and is backed by the world's most powerful military and the world's largest, most diversified economy. The U.S. Treasury market is the deepest and most liquid bond market in the world with a long history of strong creditworthiness. As a result, the supply of and demand for U.S. Treasuries is closely related to U.S. values for r* over long periods of time.

But what drives changes in r*? Many factors impact the supply of and demand for savings, and quantifying their impacts is often no easy task. That said, understanding why r* fell in the years leading up to the pandemic can help offer insights into where it is today and where it is headed in the future. Productivity growth is one important determinant of r*. Stronger productivity drives faster economic growth, and this in turn raises demand for new investments and, by extension, r*. Slower labor productivity growth has been cited as one driver behind a lower r* since 2008 ([Figure 6]).[5]

Productivity growth is one important determinant of r.*

Figure 6

Nonfarm Labor Productivity Growth
Year-over-Year Percent Change, 10-Year Moving Average
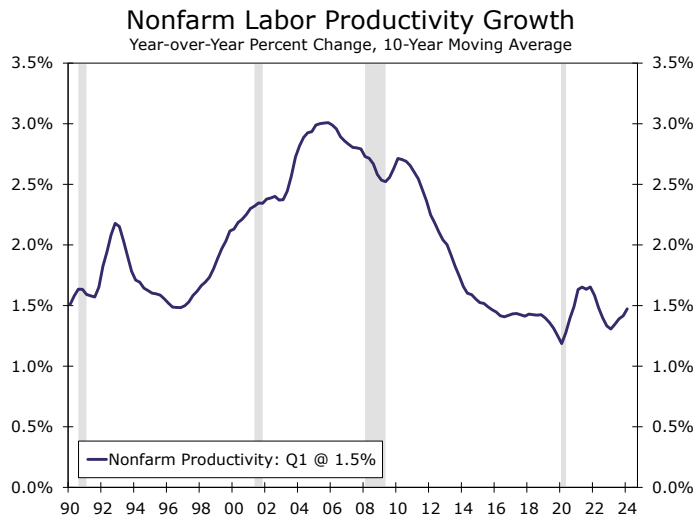
Source: U.S. Department of Labor and Wells Fargo Economics

Figure 7

Share of U.S. Civilian Population Over 65

Source: U.S. Department of Commerce and Wells Fargo Economics

Demographics are another important factor in r* estimates. The share of the U.S. population aged 65 or older has increased from 11% in 1990 to just under 16% today, and life expectancy has increased for Americans over the past several decades ([Figure 7]). These trends are occurring not just in the United States but in many other countries around the world. Aging populations and longer lifespans put downward pressure on r* via two channels. First, an aging population increases demand for safe assets such as Treasury securities as older individuals seek to ensure their financial security in retirement via purchases of fixed income instruments, such as Treasuries. This in turn puts downward pressure on r*, all else equal. Similarly, slower working-age population growth puts downward pressure on potential GDP growth and thus demand for new investment.[6] As discussed earlier, tepid growth in the working-
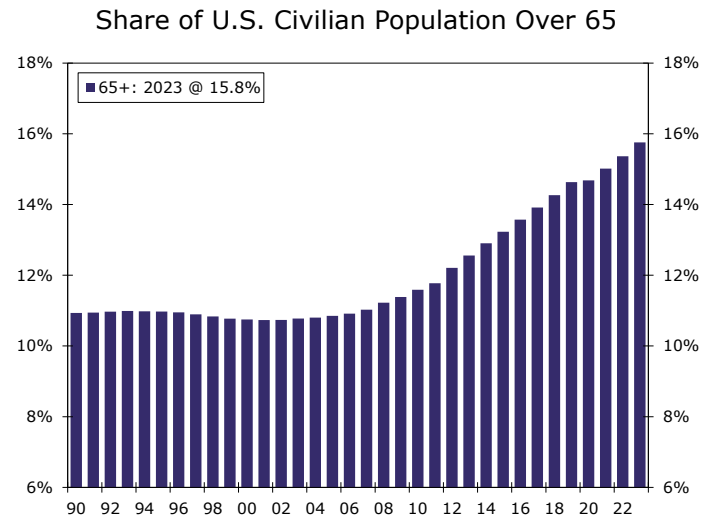
A global trend of aging populations and longer lifespans has put downward pressure on r.*

age population and labor productivity are key drivers behind the decline in r* in the HLW model over the past 25 years.

A third factor to consider is the role of globalization. Beginning in roughly the early 1990s, globalization began to gather momentum through deeper integration in global trade and capital flows.[7] The fall of the Berlin Wall, economic integration of Europe, China's rise as an economic superpower and numerous other factors helped spur this more liberalized trade regime. Global exports as a share of GDP rose from roughly 15% in the early 1990s to 25% at its peak in 2008 (Figure 8). This increased globalization coincided with a significant buildup of foreign exchange reserves, especially in Asia. Official foreign exchange reserves have increased from roughly $1.4 trillion in 1995 to more than $12 trillion today, with the share held in U.S. dollar-denominated assets averaging 64% over the period (Figure 9). Many of those dollar-denominated reserves are held in safe assets such as U.S. Treasury securities. This accumulation of reserves and recycling into safe assets—a phenomenon that became popularly known as the "global savings glut," a term coined by Ben Bernanke—put downward pressure on r*, all else equal.[8]

The post-1990 era of increasing globalization coincided with increased demand for safe assets such as U.S. Treasury securities, depressing r*.

Figure 8

Global Goods Exports
Trillions of Dollars; Share of Nominal Global GDP

Source: International Monetary Fund and Wells Fargo Economics

Figure 9

Global Offical Foreign Exchange Reserves
Trillions of U.S. Dollars
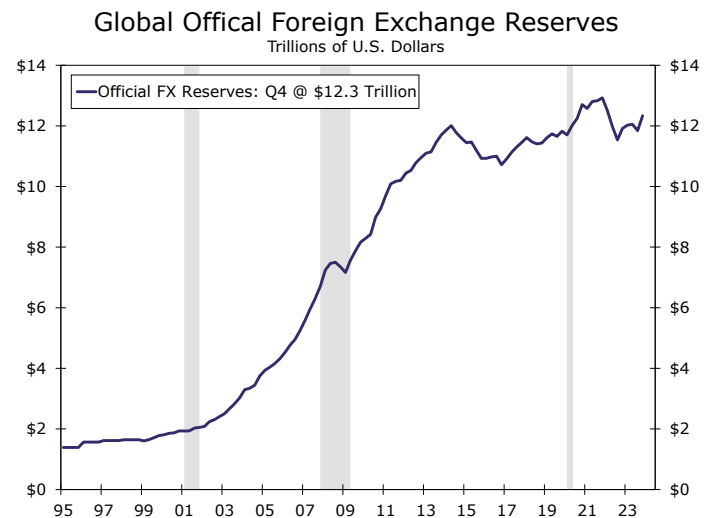
Source: International Monetary Fund and Wells Fargo Economics

A slew of other factors can determine longer-term real interest rates beyond just the well-known drivers such as productivity growth, demographics and global saving patterns. Financial regulations can play a role in determining demand for safe assets. After the 2008 financial crisis, a slew of new regulations led to much larger bank holdings of relatively safe and liquid assets, such as Treasury securities (Figure 10).[9] These regulations also have been a contributor to the Federal Reserve's outsized Treasury security holdings relative to pre-2008 (Figure 11). Risk preferences are another r* determinant, and they can vary for both cyclical and structural reasons. For example, there is evidence to suggest that U.S. households became more risk averse in the wake of the 2008 financial crisis.[10] The capital intensity of new technologies can also influence r* just as much as the pace of innovation. Building the transcontinental railroads and adopting electricity in the United States in the 19th and early 20th centuries took huge quantities of capital, while the development of new applications for smartphones in the 2010s were comparatively capital light.
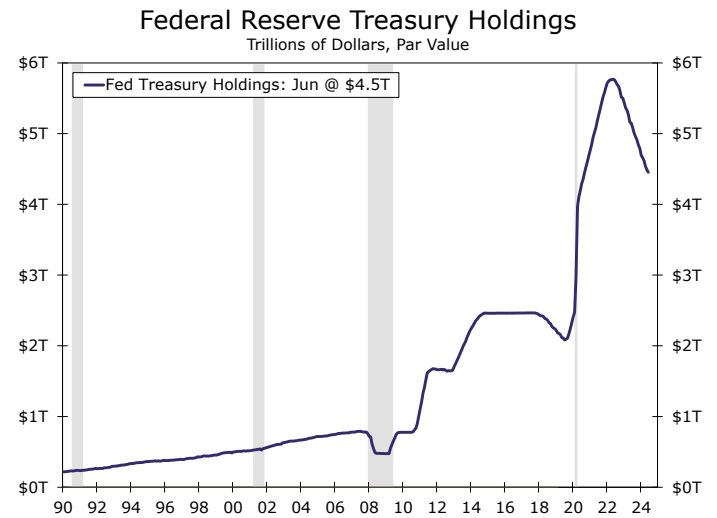
The slew of new banking regulations and heightened risk aversion after the 2008 financial crisis also increased demand for safe and liquid assets.

Figure 10

U.S. Bank Treasury Holdings
Trillions of Dollars, Market Value

Source: Federal Reserve System and Wells Fargo Economics

Figure 11

## Federal Reserve Treasury Holdings
Trillions of Dollars, Par Value

Source: Federal Reserve System and Wells Fargo Economics

Furthermore, the supply of risk-free assets matters just as much as the demand. As a result, the supply of Treasury securities can have important implications for r*.[11] The U.S. fiscal outlook has changed materially in recent decades. Between 1990 and 2007, the U.S. debt-to-GDP ratio declined from 40% to 35% as a relatively strong economy, favorable demographics and fiscal discipline kept deficits in check. However, since 2007 the federal debt-to-GDP ratio has mushroomed to 97% (Figure 12). Over the past several years, the fiscal outlook has deteriorated further. The U.S. federal budget deficit was less than 3% as recently as 2016, a degree of red ink that was smaller than the average over the past half-century (Figure 13). But since then, the gap between revenues and outlays has exploded, with tax collections as a share of GDP down modestly and outlays up significantly. Furthermore, fiscal deterioration has not been a phenomenon exclusive to the United States, as we discussed in a recent report.

On the supply side, a significant increase in public debt since 2007 has put upward pressure on U.S. rates, all else equal. But, not all else has been equal over that time period.

Figure 12
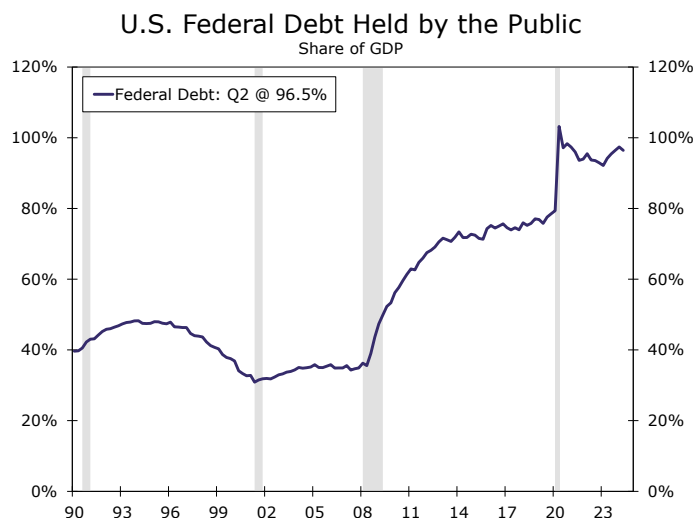
U.S. Federal Debt Held by the Public
Share of GDP

Source: U.S. Department of the Treasury, U.S. Department of Commerce and Wells Fargo Economics

Figure 13

U.S. Federal Government Budget Balance
Share of GDP
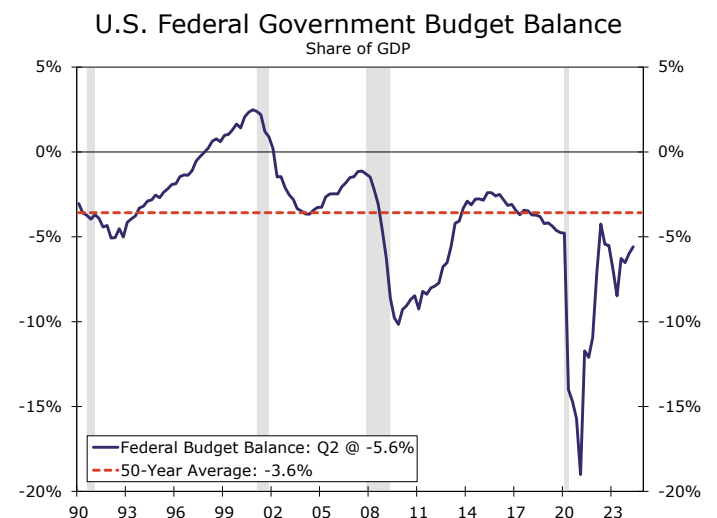
Source: U.S. Department of the Treasury, U.S. Department of Commerce and Wells Fargo Economics

Looking to the Stars for Answers

The increase in Treasury supply since 2007 has put upward pressure on r*, all else equal, but not all else has been equal over that period of time. Many of the other factors we have discussed, such as

slower productivity growth, an aging population, new financial regulations and increased globalization have more than offset the upward pressure on r* from fiscal deterioration. These structural changes explain the steady decline in r* and interest rates more generally that began in the 1990s and lasted until a few years ago. But as we look ahead to the next decade, will that continue to be the case? Questions abound about the outlook for accelerating labor productivity, rapidly declining birth rates, deglobalization and ballooning public debt. In Part II of this series, we will examine the outlook for these factors and lay out a base case forecast for r*.

Endnotes

1 – John H. Williams. "The Monetary Doctrines of J. M. Keynes." *The Quarterly Journal of Economics* 45, no. 4, 547-587. August 1, 1931. (Return)

2 – Governor Christopher Waller. "Some Thoughts on r*: Why Did It Fall and Will It Rise?" At the Reykjavik Economic Conference, Reykjavik, Iceland. May 24, 2024. (Return)

3 – Thomas Lubik and Christian Matthes. "The Stars Our Destination: An Update for Our R* Model." Federal Reserve Bank of Richmond. Economic Brief No. 23-32. September 2023. (Return)

4 – 2% inflation on the PCE deflator is consistent with roughly 2.4% CPI inflation based on the long-run historical gap between the two measures. (Return)

5 – Kathryn Holston, Thomas Laubach, John C. Williams. "Measuring the Natural Rate of Interest: International Trends and Determinants." Federal Reserve Bank of San Francisco. December 2016. (Return)

6 – See Etienne Gagnon, Benjamin Johannsen and David Lopez-Salido. "Understanding the New Normal: The Role of Demographics." IMF Economic Review. March 15, 2021 and Carlos Carvalho, Andrea Ferrero and Fernanda Nechio, "Demographics and Real Interest Rates: Inspecting the Mechanism." Federal Reserve Bank of San Francisco. April 23, 2016. (Return)

7 – For more detail on the rise and potential reversal of globalization, see our report "Globalization in Retreat: Implications for the U.S. Economy" from March 2023. (Return)

8 – Thiago Ferreira and Samer Shousha. "Supply of Sovereign Safe Assets and Global Interest Rates," International Finance Discussion Papers 1315. Board of Governors of the Federal Reserve System. April 2021; See also Bernanke's remarks: "The Global Savings Glut and the U.S. Current Account Deficit" from the Sandbridge Lecture, Virginia Association of Economists. Federal Reserve Board. March 10, 2005. (Return)

9 – Jane Ihrig, Edward Kim, Cindy Vojtech and Gretchen Weinbach. "" Federal Reserve Bank of St. Louis Review, Third Quarter 2019, 101(3). (Return)

10 – See Sarah Necker and Michael Ziegelmeyer. "Household Risk Taking After the Financial Crisis." The Quarterly Review of Economics and Finance, Vol. 59. February 2016; Emmanuel Farhi and François Gourio. "Accounting for Macro-Finance Trends: Market Power, Intangibles, and Risk Premia." NBER Working Paper 25282. February 2019. (Return)

11 – Edward Gamber and John Seliski. "The Effect of Government Debt on Interest Rates." Congressional Budget Office. March 2019. (Return)

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