A National Balance Sheet Approach to the Natural Rate of Interest

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KEY FINDINGS

- We develop an alternative method of calculating the natural rate of interest at any level of economic output (not only full employment) using a combination of national balance sheet and market information. We then produce a data series for the 1961–2020 period.
- The natural rate of interest has paradoxically been above the full-employment r-star (r*) for much of the past 25 years, suggesting that the Federal Reserve's accommodative policy for the past 2 decades has been more aggressive than previously believed.
- Understanding the difference between our "natural" rate, r*, and current market rates is important for market participants, as it could give insight into the need for future policy changes to correct imbalances created by past policy mistakes.

ABSTRACT

We present a new estimation method for the "natural" interest rate and estimate its value for the US economy from 1961 to 2020. Presuming theoretical balance between returns on national assets and cost of national capital, we use US balance sheet information to derive a "breakeven" or implicit fundamental risk-free rate. Because, unlike r-star (r*), our rate does not presume conditions of full employment, its value should generally be lower than that of r*. We find, however, that our rate has remained above r* for much of the past 25 years, suggesting that the Federal Reserve's accommodative policy for the past two decades has been more aggressive than previously believed. Understanding the difference between our natural rate, r*, and current market rates is critical for proper decisions in the fixed income markets.

The presumed risk-free interest rate at any point in time bears heavily on both monetary and fiscal policy, and serves as the starting point for the valuation of all fixed income, as well as equity securities. Understanding both the determinants and consequences of interest rate changes has therefore arguably never been more urgent. To this end, we seek to contribute to the discussion about the natural interest rate by recommending an alternative estimation method.

We build a national balance sheet and use it to derive a breakeven risk-free interest rate that does not presume full employment as a default. Our rate is based on the presumption that the average level of productivity of a nation's assets should, in equilibrium, equal its average cost of capital (COC). In other words, the rate of return on the assets listed on the left-hand side of the balance sheet ought to equal the direct financial claims (right-hand side) on those assets. It is from this insight that we solve for the breakeven risk-free rate, taking into account the changing capital structure of the economy over time, and examining its effect on the breakeven rate.

Our rate differs from the US Federal Reserve's (the Fed's) rate, often referred to as r-star (r*) (see Holston, Laubach, and Williams 2017; Laubach and Williams 2016; and Laubach and Williams 2003). First, while ours is based on a logical accounting identity, r* is estimated from a statistical model. Second, and perhaps more important, our rate brings the output of the economy in line with the countering financial claims—whatever the state of the economy. The Fed's natural rate, in contrast, represents the Treasury rate believed to be consistent with full employment. While it's true that we would expect our rate and r* to converge as the economy approached full employment, it is this precise criterion that we believe makes r* more aspirational and therefore less relevant to present economic conditions.

Our breakeven rate could be a useful addition to the monetary policy toolbox, as it provides a reference point for comparing policy goals and outcomes. The disparity between our rate and r* could, for example, be used as a proxy for the extent to which the economy falls short of full employment. Furthermore, and likely more important, we believe that the substantial increase over the past 40 years in financial leverage in the US economy has distorted the statistical modeling of r*. Our results indeed suggest that monetary stimulus has been more aggressive than previously thought. Understanding the difference between our rate, r*, and current market and policy rates is important to participants in fixed income markets, as it could provide insight into the need for Fed actions to correct imbalances.

THE NATURAL RATE: BACKGROUND AND CRITIQUE

The subject of interest rates has long confounded experts as well as non-specialists. Although there are countless distinct rates, many see fit to expound on "the" rate as if it were something unique. "The" rate could mean some theoretically representative rate, but alternatively also what some economists refer to as the "natural" rate—which is not the same thing.

What is the natural rate? We can start with a standard definition, provided by the European Central Bank (2004): "The natural rate of interest is the real short-term rate of interest which is consistent with output at its potential level and a stable rate of inflation in the medium term." Yet note a few things. First, there is no mention of risk, so the reader is left wondering whether the natural rate is meant to be a representative risk-free benchmark for all other interest rates, or an "average" of rates of return for both riskless and risky assets. Our own view (which we'll go into later) is that the natural rate is a risk-free benchmark to which all rates—not only interest rates, but also rates of return and even growth rates—are in some way anchored.

Second, notice the inclusion of "consistent with output at its potential level." The natural rate, in other words, presumes (at least in the medium term) conditions of full employment. As we will see, it is possible—indeed preferable—to dispense with this assumption when employing an alternative framework.

Wicksell (1898) is known to have distinguished between two fundamental rates. In contrast to today's use of the term, he considered the natural rate to be roughly synonymous with the profit rate, or what we will, in this paper, be calling the average rate of return on assets (ROA). We can roughly define it as the output of the economy, net of wages and replacement capital, divided by the country's entire base of both financial and non-financial assets. Wicksell's "money" rate, in contrast, was more akin to a firm's average COC, defined as the average cost of the various financial claims on said assets. Following the classical economic logic that savings and investment must balance (the loanable funds model), Wicksell believed that in a well-functioning market the natural and money rates should tend toward equality.

Keynes (1936), in contrast, believed that the rate of interest was a purely monetary phenomenon. Rather than subscribe to the loanable funds model, he believed that the rate of interest depended on consumer liquidity preference. Yet, because Keynes saw the rate of interest as a risk-free reward for deferring consumption, he and Wicksell were really focusing on different phenomena. As we know from theory, each asset should more or less return the maturity-dependent, risk-free rate plus a given risk premium for the asset.[1]

The Fed's r* measure is an empirical estimate of the natural rate as defined earlier by the European Central Bank. It is an interest rate (contrary to Wicksell) and it presumes full employment (unlike Keynes). Much research ties r* to observed changes in productivity growth and labor-force growth (hence GDP growth), though some (e.g., Lubik and Matthes 2015) employ time-varying parameters in their estimates, and Bullard includes a variable that accounts for overall investor desire for safety.[2] But, all told, the differences among these estimates are minor.

It is generally believed, presuming we know r*, that accommodative policy would have the Fed set its key rate below it and restrictive policy would mean setting it higher (see, e.g., Lansing, 2016). It is precisely for this reason that the stakes are high in "getting r* right." Yet implicit in such reasoning is the idea that r* is a true natural rate; that is, it is independent of policy intervention. However, it is far from self-evident that this is the case.

Borio, Disyatat, and Rungcharoenkitkul (2019), for example, see monetary policy as a prime mover, deeming r* to be determined passively through macroeconomic responses to the Fed's policy. Since there is little question that the Fed exerts some influence over rates, it is undeniable that, at least to some extent, r* is both exogenously and endogenously determined. Yet conceding even this casts significant doubt on the accuracy of r*. Indeed, as noted by Levrero (2019), ignoring the effect of monetary policy on r* leads to misspecification bias in the Fed's statistical model. We believe the problem to be inevitable, precisely because r* is inferred indirectly through statistics. The fact that the Fed suspended its r* estimates at the height of the pandemic is indeed revealing.

Due in part to such doubts, Borio et al. (2017) argue that monetary policy should focus less on inflation targets and more on financial stability. The growing reliance on debt in the US capital structure in recent decades undoubtedly raises concerns over the latter. The cost of getting r* wrong has, in other words, increased. Echoing Borio et al.; Laubach and Williams (2016) argue that monetary policy ought to be robust to mismeasurement in times of growing uncertainty.

Some go further, challenging the very idea of a natural rate of interest. De-Juan (2007), for example, argues for a "conventional" rate of interest that is influenced not only by policy but by real economic factors (e.g., demand, wages). More importantly, he argues that there is no underlying rate that acts as a "gravity center" for market rates. The conventional rate, rather, is path dependent, ever adjusting to changing economic circumstances and shifts in policy. Pilkington (2014) similarly disavows

[1] In addition to risk, other factors generally believed to determine rates are inflation expectations and a term premium for the uncertainty around future rates and inflation (Feldstein and Eckstein 1970).

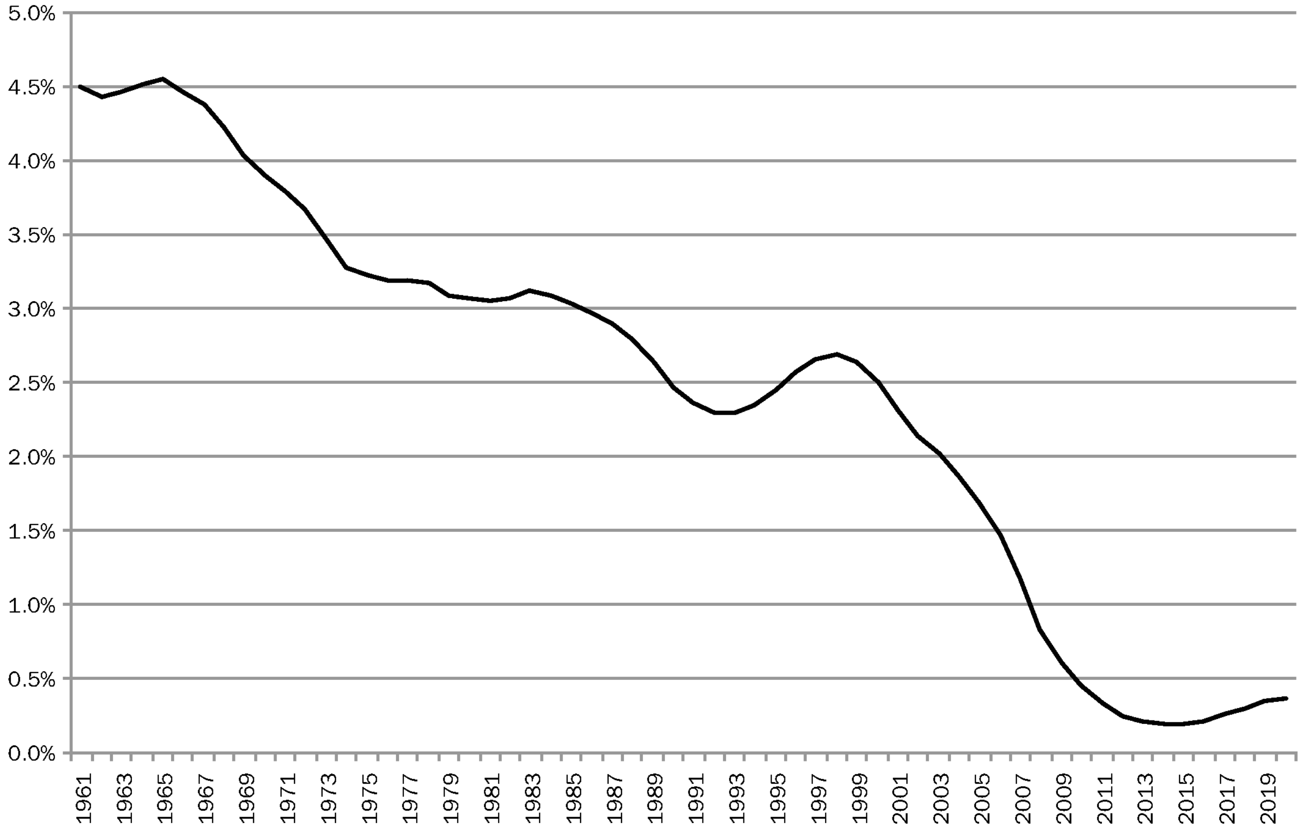
[2] James Bullard, chairman of the St. Louis Federal Reserve, has proposed an alternative approach to the natural rate: one that accounts for generalized risk preferences. Bullard defines his measure (which he calls $r^{\dagger}$ or "r-dagger") according to the following equation:

$$r^{\dagger} = \lambda + \phi + \xi,$$

where λ is the labor-productivity growth rate, ϕ equals the labor-force growth rate, and ξ the extent of investor desire for safe assets. In other words, $r^{\dagger}$ is simply GDP growth plus or minus ξ, which could even be negative if there were an unusually great desire for safe assets.

EXHIBIT 1

US r* as Calculated using the Laubach-Williams Model, 1961–2020



SOURCE: Federal Reserve Bank of New York (2021b). Data series suspended after June 2020.

the notion of a natural rate, claiming that money and rates are endogenous; that is, determined by real economic factors.

Our approach to the natural rate employs a national balance sheet methodology to tease out a theoretical risk-free rate to serve as an alternative to r*. It offers a compromise of sorts—one that combines the insights of Wicksell and Keynes. While conceding that money and rates must be endogenous to some extent, exogenous factors are also likely to play a role in the determination of rates. We therefore believe that viewing a natural rate as one that equilibrates asset returns and costs of capital makes sense.

On the other hand, we follow Keynes on the question of full employment. Rather than restrict our estimate of the prevailing rate to the ideal case where an output gap is absent, our approach reflects the far more realistic case where GDP often falls short of full employment.

Why more realistic? The fact is that r*, and rates in general, have been declining substantially, especially since the late 1990s. Exhibit 1 shows the extent of the fall in r*. It is likely, moreover, to remain at low levels in the medium and long term, even if recent evidence of inflation—if sustained—could call the matter into question. Williams (2017, 2019), for example, envisions not only a low r*, but also weak returns across both asset classes and the world, attributing the trends to an expected demographic implosion and a sustained productivity slowdown. While persistently low rates ought to favor "tangible" business interests, the unabated spread of financialization could be distorting market signals. For this reason, it is critical to better understand the relationship between our breakeven rate, r*, and Fed policy rates.

Even if there were a "true" full-employment natural rate, r* would likely deviate from it for another reason: the regression equation employed for its estimation does not appear to account for the changing capital structure in the US economy over time. As we will see, the total US asset base shifted markedly from equities to debt from 1961 to 2020, with undeniable consequences for medium- to long-term interest rates.

We now turn to the national balance sheet accounting upon which our natural rate estimate is based.

METHOD

Toward an Equilibrium Risk-Free Rate

As we see it, it makes more sense that the theoretical risk-free rate be an equilibrium rate based on present economic reality. The "reality" to which we refer, going back to Wicksell's two rates, consists of equilibrium between the average ROA and the average COC, independent of whether an output gap exists. Since the COC (we believe equivalent to what Wicksell had called the "money" rate) is really a weighted average of the incomes paid to claimants on a given set of assets, it is itself composed of many rates that roughly fall into three main categories: the interest rate, the dividend rate, and the capital gains rate.

Wicksell's premise was that in a well-functioning market economy, the COC should equal the expected ROA. In the absence of any debt, the latter should equal the expected return on the security (e.g., equity) that represents ownership of the corresponding assets. More importantly, the equality holds in the far more realistic case where debt is present. Even though adding debt changes both assets and liabilities, it should not affect the equivalence between asset returns and COC (ignoring international liabilities if present), since it equally affects both sides of the balance sheet.

Claims on assets are comprised of government paper (i.e., Treasury obligations); non-government debt (e.g., corporate loans and home mortgages); and equity (i.e., shares of stock securities, private ownership of businesses, or ownership of individual assets such as homes, net of their corresponding debt obligations). Compared to the government claims, which are virtually risk-free, all other obligations expect higher returns, with the difference between the return in each case and the return on government debt referred to as the risk premium. The riskiness of non-government debt increases as its share of claims on total assets increases, just as someone trying to borrow more money must generally pay a higher rate of interest. Similarly, as discussed by Goldberg and Torras (2021), increases in financial leverage (i.e., a greater share of debt relative to all assets) increase the ceteris paribus riskiness of the equity claims, hence their required returns. The increase in the returns translates into higher risk premiums for the corresponding assets.

The US Balance Sheet

If we represent the aggregate COC in terms of an average risk premium above a going risk-free rate of return, we should, given reliable data, be able to solve for the prevailing equilibrium risk-free rate—a rate that does not presume the absence of an output gap (i.e., full employment). In what follows, we will use $\hat{r}$ to refer to this theoretical risk-free breakeven rate.

Aside from the effects of unexpectedly rapid inflation, the average ROA tends to remain very stable over time as both output and total assets are slow-moving series.

Although GDP growth is generally far more variable, both assets and output changed significantly during the pandemic, as the economy mostly shut down and the government injected a significant amount of newly created financial assets. Total US asset value increased by about 10% in 2020, while real GDP declined by 2.3%. Yet, even given such extraordinary changes, average real asset returns only declined from 3.8% to 3.1%. Therefore, in the absence of an extraordinary and prolonged period of GDP and asset dislocation, we believe that ROA best proxies a forward-looking long-term estimate and should be in equilibrium with current forward-looking costs of capital embedded in financial data.

In what follows, we use data from the US balance sheet (following Goldsmith 1985 and, more recently, Goldberg and Torras 2021) to find the rate $\hat{r}$ that equates ROA (based on the left-hand side) to the COC (right-hand side). The balance sheet summary for select years is shown in Exhibit 2. As can be seen, growth in financial assets was unmatched by growth in either non-financial assets or GDP.

Estimation Method

We begin by calculating annual ROA figures for the US using national balance sheet numbers from 1961 to 2020. Since it represents the net economic output of the total asset base as a fraction of that base, net output amounts to GDP minus the cost of "reproduction" of inputs—that is, wages and depreciation expenses. We therefore define ROA as:[3]

$$\text{ROA} = \frac{(\text{GDP} - \text{Wages} - \text{Depreciation})}{\text{Average Assets}}. \tag{1}$$

In order to proxy for the COC, we estimate the weighted average expected return for all financial claims on the assets of the US economy.[4] In other words, we calculate the weighted average cost of government debt, non-government debt, and equity capital. We base the weights on yearly data for the US capital structure—information that is gleaned from the national balance sheet. Using this approach, the COC for the US economy equals:

$$\text{COC} = r_{MKT} + P_K, \tag{2}$$

where r_{MKT} is the market expectation for the long-term path for short term rates, arrived at by subtracting the Treasury term-premium from 10-year Treasury rates; and P_K is the capital risk premium. P_K is itself a weighted average of risk premiums for different capital "types," so that:

$$P_K = \omega_D P_D + \omega_E P_E, \tag{3}$$

where the ωs and the Ps represent the weights and risk premiums for private debt and equities. Combining Equations (2) and (3), we obtain:

$$\text{COC} = r_{MKT} + \omega_D P_D + \omega_E P_E. \tag{4}$$

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[3] GDP is modified to include gross interest income on debt assets held in the US rather than net interest, to be consistent with our total asset calculation. Wage numbers may understate labor compensation to the extent that some privately owned businesses shift a portion of their management labor to profits, in order to avoid paying unemployment insurance and ordinary income on wages.

[4] Forward-looking, or required, returns are the best estimate of current costs of capital. They do not suffer from the volatility of realized returns brought about by the marking to market of not only the changes in the current economic climate, but also the reassessment of all future cash flows associated with the asset base.

EXHIBIT 2

US Balance Sheet—Select Years (All Numbers in Billions of Dollars)

	Assets		Liabilities
Panel A: 1961			
Non-Financial	2,286	Government Debt	301
Financial	2,042	Non-Government Debt	1,270
		Equity	2,757
Total	4,328		4,328
GDP	562		
Federal Reserve Balance Sheet	52		
Panel B: 1975			
Non-Financial	7,323	Government Debt	763
Financial	6,758	Non-Government Debt	4,289
		Equity	9,030
Total	14,081		14,081
GDP	1,685		
Federal Reserve Balance Sheet	121		
Panel C: 1990			
Non-Financial	24,952	Government Debt	4,650
Financial	30,539	Non-Government Debt	20,074
		Equity	30,766
Total	55,491		55,491
GDP	5,963		
Federal Reserve Balance Sheet	319		
Panel D: 2005			
Non-Financial	62,839	Government Debt	13,491
Financial	94,669	Non-Government Debt	70,059
		Equity	73,959
Total	157,508		157,508
GDP	13,037		
Federal Reserve Balance Sheet	848		
Panel E: 2020			
Non-Financial	100,128	Government Debt	45,024
Financial	203,958	Non-Government Debt	140,458
		Equity	118,605
Total	304,086		304,086
GDP	20,937		
Federal Reserve Balance Sheet	7,363		

SOURCE: Bureau of Economic Analysis (2021), Federal Reserve Bank (2021a), Federal Reserve System (2021) Bao et. al. (2018), and authors' calculations.

The assumption that ROA equals COC allows us to solve for the breakeven risk-free rate $\hat{r}$. In a sense, $\hat{r}$ is what we obtain by trying to back into r_{MKT} by setting ROA and COC equal to each other. In other words, $\hat{r}$ calculates the r_{MKT} that would equate ROA and COC:

$$\mathrm{ROA} = \mathrm{COC} = \hat{r} + \omega_D P_D + \omega_E P_E, \tag{5}$$

and, solving for $\hat{r}$, we define it in terms of the asset return and capital risk premium:

$$\hat{r} = \mathrm{ROA} - \omega_D P_D - \omega_E P_E. \tag{6}$$

Our breakeven rate, $\hat{r}$, corresponds to current output. It is, if you like, our estimate of the equilibrium r_{MKT} that would prevail in the absence of both central-bank rate management and Treasury-rate term premiums, independent of any output gap or GDP shortfall. In other words, $\hat{r}$ amounts to the long-term equilibrium rate that reflects the expected unmanaged, short-term Treasury rates. In contrast, r* represents the theoretical risk-free rate consistent with full employment and non-accelerating inflation. It is also likely, as noted by Borio et al. (2017), and Levrero (2019), that the r* estimation is not independent of monetary policy. It is a crucial difference.

DATA AND SOURCES

We base our estimates of ROA on US balance sheet and flow data obtained from the US Federal Reserve Bank (2021a) and Bureau of Economic Analysis (2021). These are straightforward, since, as mentioned, ROA is a simple average of the returns from financial and non-financial assets, weighted according to the capital structure of the economy.

Because they are based on the weighted average costs of government debt, non-government debt, and equity, the COC calculations are more involved. For government debt, we presume that the expected long-term cost of rolling over short-term debt is approximated by the current long-term Treasury rate reduced by the term premium embedded in the yield curve. The term premium refers to the extra yield—positive or negative—required by investors to purchase long-term Treasury securities instead of holding and rolling over short-term Treasury securities, and is collected from a series generated by the Federal Reserve Bank of New York (2021a). In other words, it is not compensation for default, but rather compensation for the uncertainty about the extent to which the path of short-term rates will differ from current estimates due to changes in the base real-rate and inflation.[5] A negative term premium implies that investors are willing to invest in long-term treasuries at a rate below the expected path of short-term rates, sacrificing expected yield for the safety of certainty.

Based on US Treasury Data from the Office of Debt Management (2015), the average maturity of US government debt has averaged just under five years over the past four decades. Accordingly, we remove one half of the term premium from the 10-year Treasury rate to approximate the expected long-term cost of rolling over short-term government debt.[6] We obtain the Treasury bond rates themselves from the Federal Reserve Bank of New York (2021a).

In the case of non-government debt, we use the risk premiums for investment grade bonds. We derive corporate bond spreads by subtracting long-term US Treasury rates from Moody's Baa long-term bond rates. We then convert the bond spreads to risk premiums by adjusting for the probability of recovery-adjusted default, following Goldberg (2015) (See Moody's 2019 and 2021). As with US Treasury debt, the average maturity of corporate debt is considerably shorter than 10 years, with approximately one-half of the debt due in less than four years (Standard and Poor's, 2019). To adjust for this, we also remove one-half of the term premium when calculating the non-government debt risk premium.

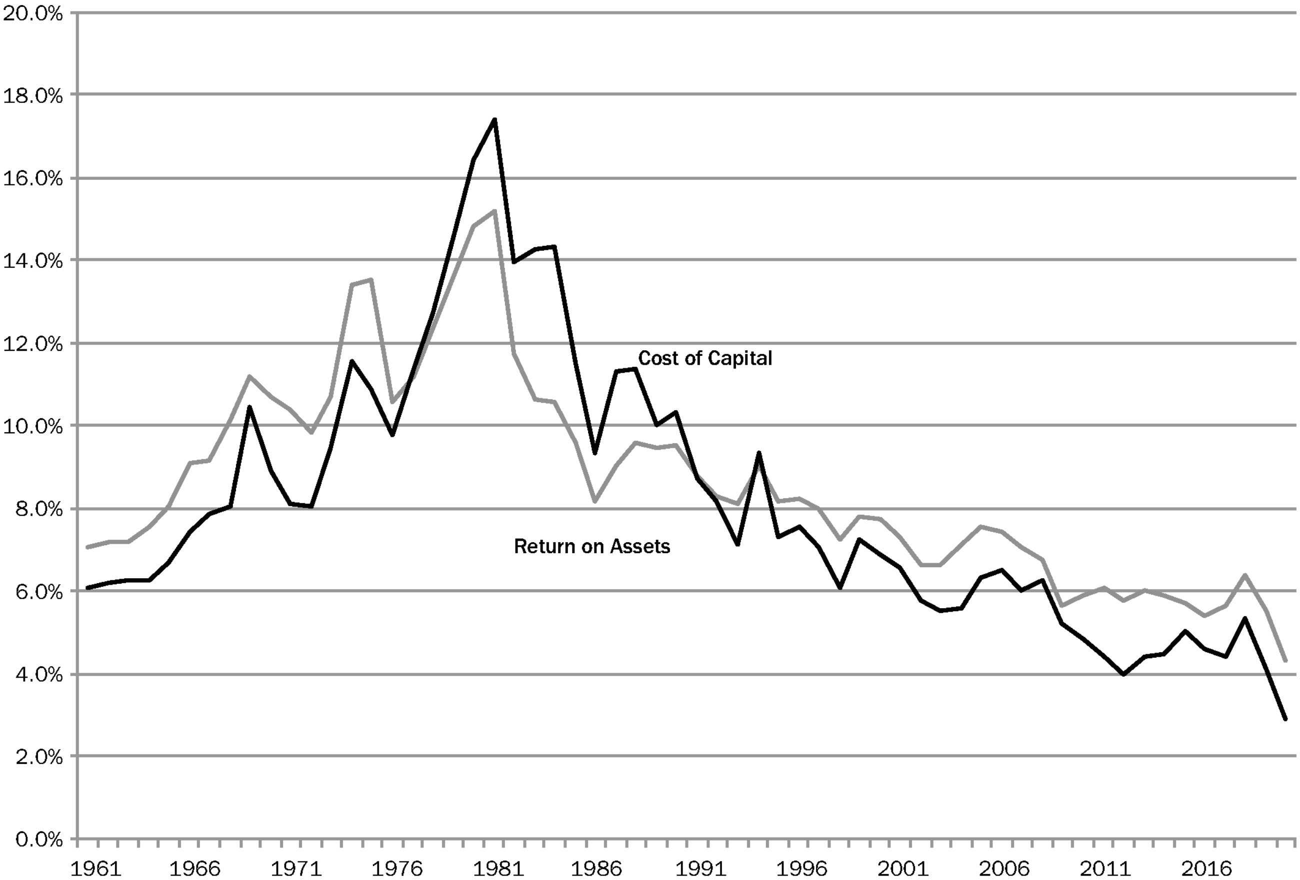
Finally, for the equities portion of COC to be consistent with the forward-looking Treasury rates and non-government debt rates, we obtain "forward-looking" equity

[5] Term premiums are not explicitly visible in the term structure of rates, but can be inferred using both survey data and modeling. A series is provided by the Federal Reserve Bank of New York (2021a).

[6] In other words, if the government debt were all 10-year, then we would need to subtract the entire term premium. If, on the other hand, the government debt were all short-term, then no adjustment would be necessary.

EXHIBIT 3

Average US ROA and COC, 1961–2018



risk premiums from Damodaran (2021) based on estimates of *expected* returns on equity relative to risk free rates.

DISCUSSION

As we suspected, ROA and COC have tracked very closely over the 1961–2020 period (Exhibit 3). In the early to mid 1960s asset returns exceeded capital costs as the economy continued its strong post-war growth, a value-creating financial condition equivalent to positive net present value at the corporate level. The relatively large difference between the mid-1960s and the mid-1970s is likely a result of the methodology used to account for inflation. ROA incorporates current inflation, while COC reflects expected inflation. Normally, there should not be a significant difference, but during this period, and particularly in the early to mid 1970s, actual inflation surpassed expected inflation to an exceptional extent. The 15-year period starting in the mid 1970s exhibits a reversal of the earlier trend, since inflation expectations eventually overshot the mark.[7]

[7] Some of the ROA numbers needed to be inflated to make them directly comparable with the COC figures. See Appendix for a more detailed discussion.

Returns and costs were relatively close from the late 1980s through the 1990s. The renewed divergence in the early 2000s reflects the aggressive lowering of rates by the monetary authorities to counteract the effects of the bursting of the internet bubble. This distortion, contributing to a sharper drop in the COC than ROA, characterized most of the past two decades. It endured through 2021, as government policy continued to pursue an exceptionally low risk-free rate policy—at least until inflation reared its head. Perhaps more important, government also encouraged considerable risk taking via the various types of support put in place to backstop the economy and markets following both the financial crisis and current pandemic. The result was a fall in risk premiums and spiraling asset speculation.

Our calculated breakeven risk-free rate $\hat{r}$ was 2.4 percent at the end of 2020 (Exhibit 4), significantly above the nominal adjusted published estimate in midyear 2020 for r* of 1.6 percent. During the 1960s, r* tracked closely with $\hat{r}$, with both rates significantly above r_{MKT}. We can explain the difference between $\hat{r}$ and r_{MKT} as the difference between asset returns and COC noted above. In other words, even in the absence of Fed accommodation, the fact that ROA exceeds COC means that $\hat{r}$ must, by Equations 5 and 6, overestimate r_{MKT}.

During the 1970s, in contrast, r* and $\hat{r}$ likely exceeded r_{MKT} because the actual inflation reflected in ROA far surpassed the expected inflation recorded in COC. Yet $\hat{r}$ remained consistently below "full employment" r* during this period because the economy was weak. It is also almost certain that both equity and (to a lesser extent) non-government debt risk premiums were elevated to reflect unusually high inflation risk components—that is, beyond what was incorporated into the term structure of nominal Treasury rates. These higher-than-normal risk premiums, when subtracted from ROA, further contribute to $\hat{r}$ being lower than r*.

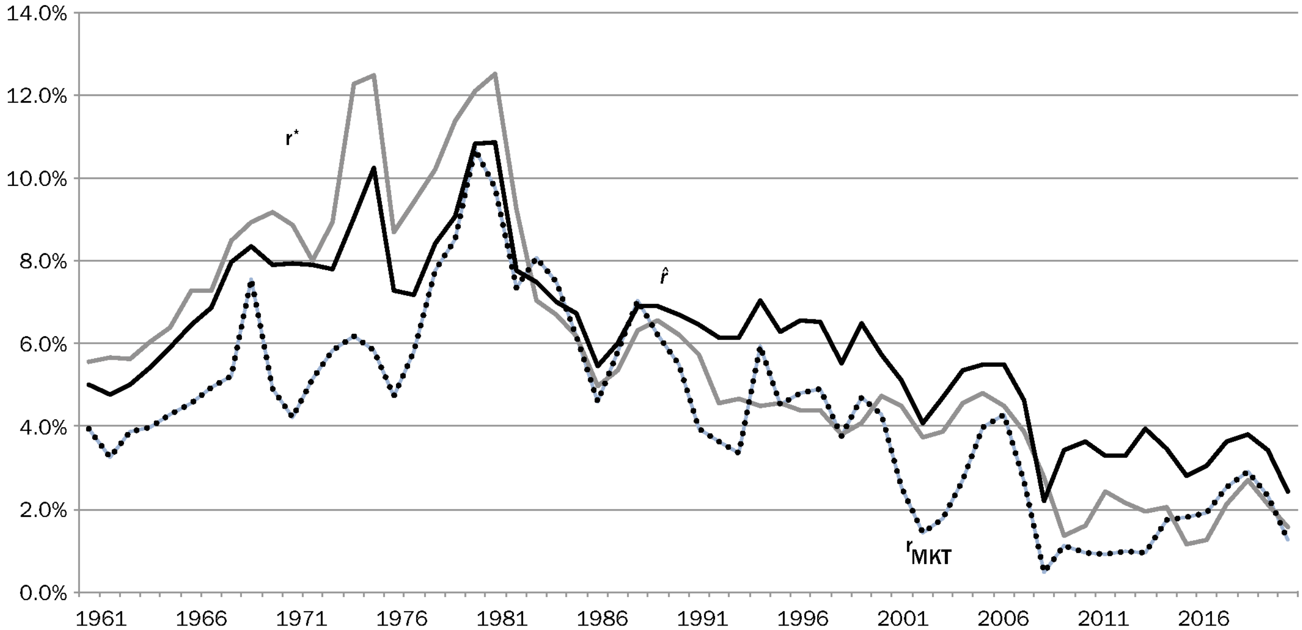
The 1980s showed a very tight banding of r*, $\hat{r}$, and r_{MKT}, with all rates beginning their steady move down to lower levels. It was partly due to reduced inflationary expectations, but the fall in rates also reflected a decline in real average asset returns. During the 1990s, r* was fairly in line with r_{MKT} and has remained so to the present, except during the aftermath of the internet bubble and the financial crisis, when monetary authorities went to extraordinary lengths to support the economy. Aggressive monetary stimulus persisted until 2021, with short-term government rates near 0%. However, long-term expectations for short-term rates continue to be more in line with r*.

Most importantly, since the mid-1980s, $\hat{r}$ has mostly remained higher than the other two rates, and often significantly so. In the case of r_{MKT}, we believe that the gap between it and $\hat{r}$ reflects a sustained period of highly accommodative monetary policy, exaggerated by government policies that have supported financial markets, leading to reduced risk premiums. Since $\hat{r}$ derives from subtracting risk premiums from asset returns, the lowered risk premiums drive $\hat{r}$ up relative to the other rate estimates. The looseness of monetary policy is, in other words, understated by r_{MKT} and other related rates.

Recall that, in the case of r*, we face a counterintuitive outcome where it is also consistently below $\hat{r}$ in recent years. Because the economy is not regularly at or even near full employment, one might have expected r* to be consistently higher than our rate, which does not assume that it is. But the changing capital structure favoring much greater leverage is a phenomenon unlikely to be properly reflected in the r* methodology. The increase in systemic risk brought about by the spread of financialization would, ceteris paribus, support higher rates. It is therefore quite possible that r* would be much higher—higher even than $\hat{r}$ in the presence of a positive output gap—if it properly took financialization into account. Our conclusion here is speculative, however, and more research is indeed called for.

EXHIBIT 4

Comparing $\hat{r}$, r*, and r_{MKT}, 1961–2020



NOTE: r* is inflated for consistency with the other numbers, all of which are in nominal terms.

SOURCE: Federal Reserve Bank of New York (2021b), US Federal Reserve Bank (2021b), and authors' calculations.

CONCLUSION

We use the US balance sheet from 1961 to 2020 to calculate both the country's ROA and COC, and then to estimate our breakeven risk-free rate. We then compare it to our approximation of the market-based natural rate (r_{MKT}) and to the Fed's estimate (r*). We find our breakeven rate to have been significantly above both r_{MKT} and r* over the past 25 years. We conclude, first, that the difference between our rate and r_{MKT} might signal the extent to which the Fed has been "over-accommodating" in its policy by providing unprecedented amounts of liquidity to ensure extraordinarily low short- and long-term rates.

While our rate accounts for the now seemingly institutionalized lower risk premiums resulting from the Fed's continued willingness to provide a backstop to the financial system, r_{MKT} does not do so. It is precisely because changes in investor perception of risk do not figure directly in either r_{MKT} or r* that we believe $\hat{r}$ has far exceeded both over the past decade and a half. Insofar as a "natural" rate exists at all, it might therefore make sense to target our breakeven rate, $\hat{r}$, as a first approximation instead of r*. The Fed might already be thinking along such lines: at the time of writing, it had just raised the federal funds rate 400 basis points in hopes of stemming inflation.

Our rate has also significantly exceeded r* in recent times. The second main inference that we draw from our analysis is that the gap is due to r* being a poor approximation of any "true" natural rate, likely because the changing capital structure favoring much greater leverage is a phenomenon not properly reflected in the r* methodology. The result is that r* likely underestimates the natural rate, probably to a significant degree, leading to monetary policy that was far more accommodative than previously thought.

Finally, the steady decline that we have observed in all rates, including r* and $\hat{r}$, suggests that there is much more at work than a greater desire for safety. Were it merely the latter, we would have seen significant increases in the capital risk premium, and even more so because of the phenomenal increases in financial leverage. It therefore appears that falling rates might be explained by some combination of diminished real investment opportunities and Fed distortion-driven financial speculation, resulting in a dilution of remaining productive output across an ever-increasing array of financial claims. Further research is undoubtedly called for. But in light of the recent surge in prices, a coherent narrative that explains what has transpired over the past 40 years appears to be indispensable for policy makers, as well as for fixed income and equity investors.

APPENDIX

USING NOMINAL VERSUS REAL RATES

To determine the nominal return on assets (ROA), we add the GDP deflator to the non-debt asset portion of the calculated return. We use nominal figures to be consistent with the market-based cost of capital (COC) numbers to which we will be comparing ROA. Implicit, of course, is the assumption that the deflator reflects asset inflation, and we know that it does not. But there is also an implicit inflation assumption embedded in the COC measure, and discussions around that inflation rate typically reference the CPI or some other measure of price inflation.

Comparing real ROA with real COC would require removing long-term inflation expectations from market-based COC components. There are some inflation forecasts that go back to the 1970s. However, true market-based expectations have only become available since the 1990s, with the introduction of Treasury Inflation Protected Securities, and that data has its own set of measurement errors related to liquidity and embedded term-premium components.

For example, using data from the St. Louis Federal Reserve Survey of Professional Forecasters (2019), during the fourth quarter of 1973, the forecast for inflation for 1974 was 5.4% and actual inflation was 9.0%. Similarly, the forecast for the following year for 1975 was 7.7% with an actual result of 9.3%. These underestimations continued through 1981. This trend then reversed, with estimates of inflation well above actual results. For example, the forecast for 1982 was 7.5%, with an actual result of 6.2%. The following year was forecast at 5.6% with an actual result of 3.9%. These overestimations continued through 1988.

Using nominal numbers has its own challenges, as COC numbers reflect long-term inflation expectations, and these expectations may not line up with short-term realized inflation as expressed in ROA. When inflation is steady, the difference between these two measures is likely small, but during periods of turbulence such as those experienced in the early 1970s through the early 1980s, the differences may be large and distort the comparison of ROA and COC.

REFERENCES

Bao, C., J. Chen, N. Fries, A. Gibson, E. Paine, and K. Schuler. 2018. "The Federal Reserve System's Weekly Balance Sheet since 2014." *Studies in Applied Economics* Working Paper No.115. Accessed January 19, 2021 from: http://www.centerforfinancialstability.org/hfs/Federal-Reserve-Systems-Weekly-Balance-Sheet-Since-1914.pdf.

Board of Governors of the US Federal Reserve System. "Assets: Total Assets: Total Assets (Less Eliminations from Consolidation): Wednesday Level [WALCL]." Federal Reserve Economic Data, Federal Reserve Bank of St. Louis. Accessed May 27, 2021 from: https://fred.stlouisfed.org/series/WALCL.

Borio, C., P. Disyatat, M. Juselius, and P. Rungcharoenkitkul. 2017. "Why So Low for So Long? A Long-Term View of Real Interest Rates." Working Paper No. 685. Basel, Switzerland: Bank for International Settlements.

Borio, C., P. Disyatat, and P. Rungcharoenkitkul. 2019. "What Anchors for the Natural Rate of Interest?" Working Paper No. 777. Basel, Switzerland: Bank for International Settlements.

Bureau of Economic Analysis. 2021. "Gross Domestic Product." Accessed May 27, 2021 from: https://www.bea.gov/data/gdp/gross-domestic-product.

Damodaran A. 2021. "Annual Returns on Stocks, T-Bonds and T-Bills: 1928–2021." Accessed July 26, 2021 from: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histretSP.html.

De-Juan, O. 2007. "The Conventional versus the Natural Rate of Interest: Implications for Central Bank Autonomy." *Journal of Post-Keynesian Economics* 29 (4): 645–666.

European Central Bank. 2004. "The Natural Real Interest Rate in the Euro Area." *ECB Monthly Bulletin*, May: 57–69.

Federal Reserve Bank of New York. 2021a. "Term Premium." Accessed May 27, 2021 from: https://www.newyorkfed.org/research/data_indicators/term_premia.html.

——. 2021b. "R*." Accessed May 27, 2021 from: https://www.newyorkfed.org/research/policy/rstar.

Feldstein, M., and O. Eckstein. 1970. "The Fundamental Determinants of the Interest Rate." *The Review of Economics and Statistics* 52 (4): 363–375.

Goldberg, R. 2015. "A Methodology for Computing and Comparing Implied Equity and Corporate-Debt Sharpe Ratios." *Review of Quantitative Finance and Accounting* 4: 733–754.

Goldberg, R., and M. Torras. 2021. "Explaining Stagnant Living Standards in a Generalized Asset Growth Context." *Journal of Economic Issues* [forthcoming].

Goldsmith, R. 1985. *Comparative National Balance Sheets*. Chicago, IL: University of Chicago Press.

Holston, K., T. Laubach, and J. Williams. 2017. "Measuring the Natural Rate of Interest: International Trends and Determinants." *Journal of International Economics* 108: S59–S75.

Keynes, J.M. 1936. *The General Theory of Employment, Interest, and Money*. London, UK: Macmillan.

Lansing, K. 2016. "Projecting the Long-Run Natural Rate of Interest." Economic Letter No. 25. San Francisco, CA: Federal Reserve Bank of San Francisco.

Laubach, T., and J. Williams. 2003. "Measuring the Natural Rate of Interest." *The Review of Economics and Statistics* 85 (4): 1063–1070.

Laubach, T., and J. Williams. 2016. "Measuring the Natural Rate of Interest Redux." *Business Economics* 51 (2): 57–67.

Levrero, E. 2019. "Estimates of the Natural Rate of Interest and the Stance of Monetary Policies: A Critical Assessment." Working Paper No. 88. New York, NY: Institute for New Economic Thinking.

Lubik, T., and C. Matthes. 2015. "Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches." *Economic Brief* No. 15–10. Richmond, VA: Federal Reserve Bank of Richmond.

Moody's. 2019. "Moody's Default and Ratings Analytics." Accessed June 7, 2019 from: https://www.moodys.com/Pages/rr003_0.aspx?bd=003009&ed=&rd=003009&tb=0&po=0&lang=en&cy=global&kw=&stop_mobi=yes.

——. 2021. "Moody's Seasoned Baa Corporate Bond Yields." Accessed May 27, 2021 from: https://fred.stlouisfed.org.

Office of Debt Management, US Department of the Treasury. 2015. "Report to the Treasury Borrowing Advisory Committee of the Securities Industry and Financial Markets Association." Accessed June 17, 2020 from: https://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Documents/August2015TreasuryPresentationToTBAC.pdf.

Pilkington, P. 2014. "Endogenous Money and the Natural Rate of Interest: The Reemergence of Liquidity Preference and Animal Spirits in the Post-Keynesian Theory of Capital Markets." Working Paper No. 817. Annandale-On-Hudson, NY: Levy Economics Institute,

US Federal Reserve Bank. 2021a. "Z1 Tables." Accessed May 27, 2021 https://www.federalreserve.gov/releases/z1/.

——. 2021b. "H.15 Selected Interest Rates." Accessed May 27, 2021 from: https://www.federalreserve.gov/datadownload/Choose.aspx?rel=H15.

Wicksell, K. 1898. *Geldzins and Guterpreise* (Interest and Prices). Translated by R.F. Kahn. Jena: Gustav Fischer. London, UK: Royal Economic Society.

Williams, J. 2017. "Three Questions on R-star." Economic Letter No. 5. San Francisco, CA: Federal Reserve Bank of San Francisco.

Williams, J. 2019. "When the Facts Change…" Remarks at the 9th High-Level Conference on the International Monetary System. Zürich, Switzerland.