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GOVERNMENT DEBT AND CAPITAL ACCUMULATION IN AN ERA OF LOW INTEREST RATES

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ABSTRACT

This essay discusses the reasons for and implications of the decline in real interest rates around the world over the past several decades. It suggests that the decline in interest rates is largely explicable from trends in saving, growth, and markups. In this environment, greater government debt is likely not problematic from a budgetary standpoint. But a Ponzi-like scheme of perpetual debt rollover might fail, and such a failure would make an already-bad state of the world even worse. In addition, even if a perpetual debt rollover succeeds, the increased debt could still crowd out capital, reducing labor productivity, real wages, and consumption.

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Everyone has heard the apocryphal Chinese curse, "May you live in interesting times." For better or (mostly) worse, we are living in interesting times. One especially interesting feature of the current macroeconomic environment is the low level of long-term real interest rates. The average historical real return on bonds over the past century is around 250 to 300 basis points, and that is about where real yields stood in the mid-1990s. As I write this essay in March 2022, the yields on U.S. inflation-adjusted bonds of all maturities—even as long as 30 years—are less than zero.

This decline in real interest rates is not unique to the United States but is a worldwide phenomenon. In November 2021, the United Kingdom sold a 50-year inflation-adjusted bond with a yield of negative 2.4 percent. That means that bond holders will receive, a half century later, only 30 percent as much purchasing power as they used to buy the security.

Like many economists, I have been pondering the causes of the decline in real interest rates and its implications for fiscal policy. I don't pretend to have all the answers. But this brief essay offers a progress report on my thinking.

Insights from Neoclassical Growth Theory

The place I would like to begin is with neoclassical growth theory. Of course, monetary policy has a dominant influence on interest rates in the short run. But textbook macroeconomics teaches that monetary policy is neutral in the long run. The downward decline in real interest rates has unfolded over several decades, and the current term structure for inflation-indexed bonds suggests that low real rates will likely persist for at least a few decades more. That sounds like the long run to me. To understand the trend in real interest rates, therefore, my thoughts turn to models of long-run growth, which emphasize investment demand and saving propensities rather than monetary policy.

In particular, by "neoclassical growth theory," I mean the Solow growth model and the Diamond overlapping-generations model. These models assume certainty and competitive markets, and shortly, I will suggest that these assumptions are problematic. But these models are a good starting point, and they offer some useful insights. I will assume that the reader is familiar with them. If you are not, get yourself a copy of David Romer's wonderful textbook, pronto.

Using conventional notation and assuming a Cobb-Douglas production function, the steady-state real interest rate in the Solow model is given by the equation

$$r = \alpha \left(\frac{n + g + \delta}{s} \right) - \delta,$$

where α is capital's exponent in the production function, n is the rate of population growth, g is the rate of labor-augmenting technological progress, δ is the depreciation rate, and s is the gross saving rate. This equation follows from the model's steady-state condition and the equality of the real interest rate with the net marginal product of capital.

One nice thing about this equation is that it allows us to glean how various changes in the economic environment affect the equilibrium real interest rate. For example, some economists have suggested that the saving rate has increased because rising inequality has shifted income toward households with higher propensities to save.[1] Others have suggested that the world is

[1] See, for example, Straub (2019).

experiencing a "saving glut" due to the rapid growth of high-saving economies, such as China.[2] Whatever the reason, other things being equal, a higher saving rate depresses the real interest rate.

How big is this effect? Differentiating the above equation yields

$$\frac{\partial r}{\partial s} = -\,\alpha\left(\frac{n+g+\delta}{s^2}\right).$$

A plausible calibration is $\alpha = 1/3$, $n = 0.01$, $g = 0.02$, $\delta = 0.05$, and $s = 0.24$, which tells us

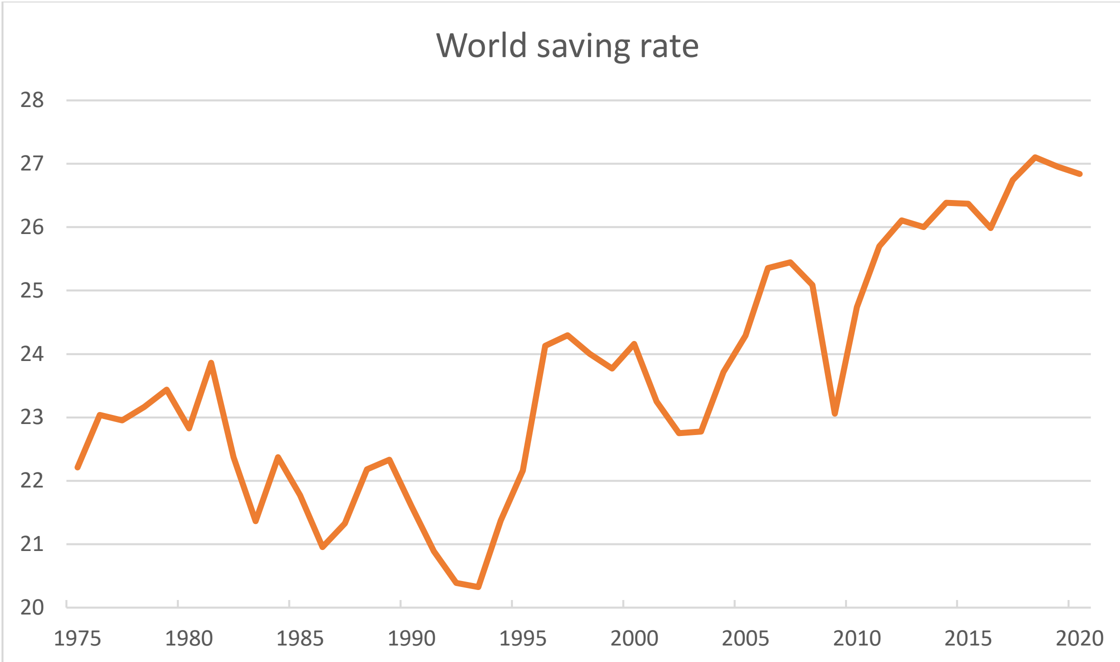
$$\frac{\partial r}{\partial s} \approx \; -(1/3)\left(\frac{.01+.02+.05}{.24^2}\right) \;=\; -0.46.$$

Each additional percentage point in the saving rate reduces the steady-state real interest rate by 46 basis points.

The World Bank reports data on the world gross saving rate (as a percent of GNI) from 1975 to 2020. It shows a clear upward trend, as seen in the following figure:[3]

[2] See, for example, Bernanke (2005).

[3] Data are available at https://data.worldbank.org/indicator/NY.GNS.ICTR.GN.ZS.



The world saving rate averaged 25.1 percent during the latter half of this period, compared with 22.2 percent during the first half. An increase in the saving rate of 2.9 percentage points can explain a decline in the real interest rate of about 133 basis points.

Another development, however, is more important. The rate of growth, represented in the Solow model by $n + g$, has declined in recent years, in part due to lower population growth and in part due to lower productivity growth. Again, the Solow model yields a precise answer about how much this change affects the steady-state interest rate:

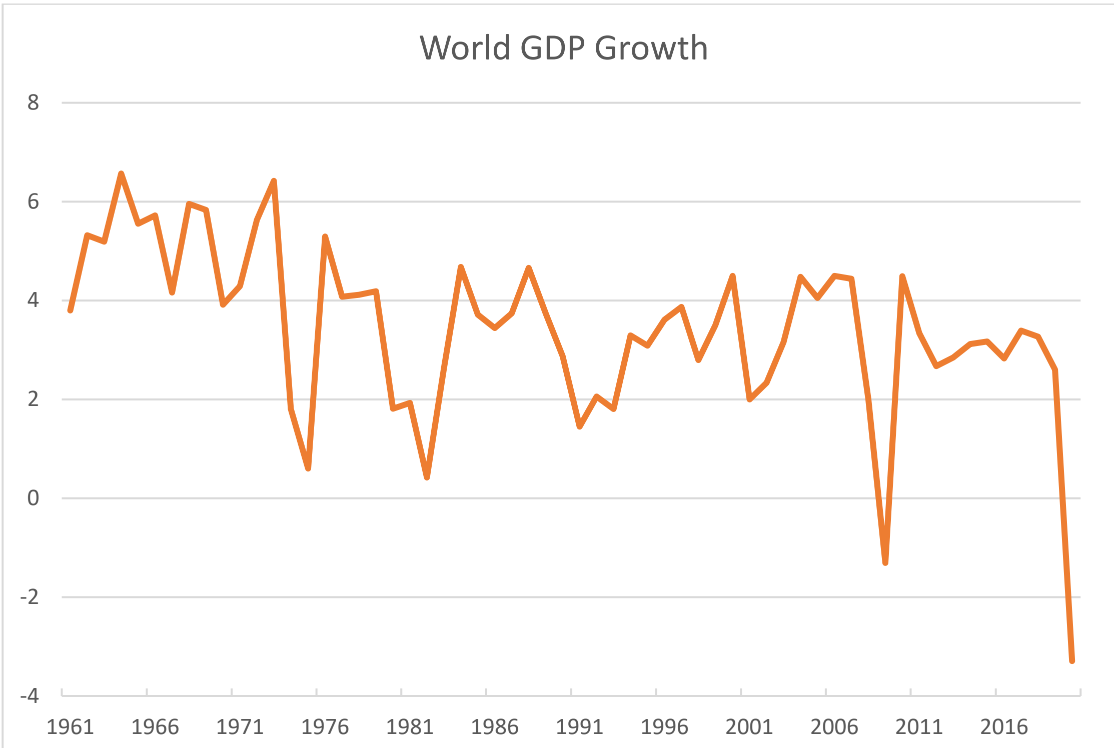
$$\frac{\partial r}{\partial(n+g)} = \frac{\alpha}{s}.$$

With my calibrated parameters, this becomes

$$\frac{\partial r}{\partial(n+g)} \approx \frac{1/3}{0.24} = 1.39.$$

A decline in the growth rate of one percentage point reduces the real interest rate by 139 basis points.

This effect goes a long way toward explaining the decline in interest rates. The World Bank reports data on world GDP growth from 1961 to 2020, shown in this figure:[4]



World GDP growth averaged 2.8 percent per year in the most recent three decades, compared with 4.1 percent per year in the previous three—a fall of 1.3 percentage points. A change of this magnitude can explain a decline in real interest rates of about 181 basis points.

These calculations lead me to conclude that the decline in the real interest rate over the past few decades is not all that mysterious.[5] Based on just the textbook Solow model, the observed

[4] Data are available at https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

[5] Rachel and Smith (2017) reach a similar conclusion.

higher saving and lower growth rates can together explain a decline in the real interest rate of more than 3 percentage points, which is in the ballpark of what has occurred.

To be sure, this application of the Solow model might strike some readers as audacious or perhaps even foolhardy. The world does not constitute a single economy with fully integrated capital markets. Even if it did, convergence to the Solow steady state may be slow enough that applying steady-state conditions is not fully appropriate. I present these rough calculations not to reach a definitive conclusion but, instead, to establish proof of concept. Increasing saving and declining growth are powerful forces that have been exerting strong downward pressure on real interest rates around the world. Neoclassical growth theory suggests that as long as saving remains high and growth remains low, real interest rates are unlikely to return to historical norms.

What does a low interest rate mean for fiscal policy? To answer this question, we must turn from the Solow growth model to its close cousin, the Diamond overlapping-generations model. The Diamond model follows the Solow model in assuming certainty, competitive markets, and a production technology with constant returns to scale in capital and labor and exogenous technological progress. But the Diamond model replaces the assumption of an exogenous saving rate with finitely lived agents who optimize subject to explicit budget constraints. This change permits the incorporation of government debt, so we can examine how debt affects capital accumulation and welfare.

The bottom line from the Diamond model is that the comparison of the real interest rate and the growth rate is crucial (as indeed it is in the Solow model). If the interest rate is less than the growth rate, as seems to be the case today, the economy is in a dynamically inefficient equilibrium. That is, it is saving so much that the capital stock exceeds the level that maximizes steady-state consumption. (Phelps, 1961, dubbed this the Golden Rule level of capital.) In this case, the government can run a sustainable Ponzi scheme by issuing debt and rolling it over, along with the accumulating interest, forever.[6] To be sure, the government debt will absorb saving and crowd out capital, but that is a good thing because the economy has too much of it. Government debt can raise welfare when the debt is issued, in the steady state, and along the entire transition path.

At this point, one might think that neoclassical growth theory offers a sanguine view about our current situation of high and growing government debt. And, indeed, that seems to be the stance of some who have been warning about secular stagnation.[7] They have, at least implicitly, been seeing the world through the lens of neoclassical growth theory. From this perspective, low interest rates are a sign of too much saving and too much capital.[8] This problem can be solved by what might otherwise be considered profligate fiscal policy.

But not so fast. In my discussion so far, I have been sweeping under the rug a notable problem with applying conventional neoclassical growth theory. While it can plausibly explain the decline in real interest rates, it cannot as easily explain the level. Let's return to the equation I started with and plug in my parameters:

$$r = \alpha\left(\frac{n+g+\delta}{s}\right) - \delta \approx \left(\frac{1}{3}\right)\left(\frac{.01+.02+.05}{.24}\right) - .05 = .061.$$

[6] For more on this topic, see O'Connell and Zeldes (1988).

[7] See, for example, Summers (2016).

[8] This situation of low real interest rates also makes the zero lower bound a more frequent constraint on monetary policy, but I won't address that topic here.

The calibrated Solow model gives a real interest rate of about 6 percent. No plausible set of parameters gives an interest rate less than zero, as we are now observing for long-term inflation-adjusted bonds.

Something must be missing from the model. In fact, two things are missing: risk and market power. Here I consider them separately, though the real world includes risk and market power simultaneously. More research is needed on their possible interactions.

Adding Risk

Let's first consider risk. In the Diamond model, the real interest rate on government bonds equals the net marginal product of capital. But that is not true in the world. Government bonds are safe, whereas growth and capital ownership are risky. A risk premium separates the return on safe assets from the return on capital.

An increase in the risk premium can drive down the safe interest rate, and it is possible that a rising risk premium can help explain the observed decline in real interest rates. Gauging this effect is difficult because changes in risk premiums are hard to measure. But I doubt that a rising risk premium is an important part of the story. Stock market valuations, such as price–earnings ratios, have risen while real interest rates have fallen, suggesting that the expected return on risky assets has fallen as well. My best guess is that a rising risk premium does not explain the decline in real interest rates, though the existence of a risk premium is one reason real rates are always low compared with the return on capital.

A small literature reexamines the issues of dynamic efficiency, capital accumulation, and government debt in environments with uncertainty. Many years ago, I wrote a paper on this topic with Andy Abel, Larry Summers, and Richard Zeckhauser and then another one with Larry Ball and Doug Elmendorf. Olivier Blanchard's AEA Presidential Address in 2019 has renewed interest in the subject. This literature has not settled all the issues, but let me summarize what I believe to be true.

First, comparing an economy's safe interest rate with its average growth rate does not reveal anything about its dynamic efficiency. Uncertainty generates a risk premium, which depresses the safe interest rate. Economies that are efficient in every way can have low safe rates of interest if risk and risk aversion are high enough.

Second, judging the efficiency of capital accumulation is harder in economies with uncertainty, but it is not impossible. Abel, Summers, Zeckhauser, and I proposed a criterion for overlapping-generations models with uncertainty: If the cash flow earned by capital always exceeds the cash flow used for capital investment, the economy is efficient.[9] That criterion appears to be satisfied in actual economies.[10]

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[9] The efficiency criterion in Abel et al. establishes a form of Pareto optimality: No person can be made better off without someone else being made worse off. But note that they define a "person" to be someone born in a particular time and a particular state of nature. This approach precludes some welfare improvements from intergenerational risk sharing. These could require a person to be born at a particular time to evaluate her situation as of time zero, recognizing the various states of nature that might occur when she is born. In a sense, a person in pre-birth limbo must be willing to tradeoff welfare among different possible versions of herself.

[10] Because the AMSZ condition appears to be satisfied in the real world, my subsequent work on this topic typically restricts itself to theoretical frameworks in which this condition holds. That is not true of all work in this literature. For example, the AMSZ condition does not hold in the example emphasized in Blanchard (2019).

Third, if the government in a dynamically efficient economy observes a safe rate much below the average growth rate and tries to run a Ponzi scheme by issuing a lot of debt and rolling it over forever, it is gambling. The policy may well work, but it might not. And the circumstances in which it fails are particularly dire. The big losers are the generations alive when the scheme fails, who must endure either a debt default or higher taxes. The failure is especially painful because it occurs in a state of world with extraordinarily low growth and thus high marginal utility of consumption. A government running a Ponzi scheme with debt is like a homeowner canceling his fire insurance to save money or an investor selling deep out-of-the-money puts: It works most of the time, but when it doesn't, all hell breaks loose.[11]

Fourth, even if the economy is dynamically efficient in the sense of not accumulating excessive capital, there still might be some potential welfare improvements from intergenerational risk sharing.[12] From the perspective of time zero, a yet-to-be-born generation does not know whether it will arrive during a lucky or unlucky time, and it may want to share that risk with other generations. This intergenerational risk sharing can be achieved with well-designed fiscal policy. How this risk sharing interacts with debt policy is, I admit, still not completely clear to me, though some recent work explores this topic.[13] There are likely more papers to be written on this issue before it is resolved.

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[11] See Mian, Straub, and Sufi (2022) for a recent contribution to the literature on debt sustainability. Their Proposition 5 suggests that the increase in debt must be sufficiently small to guarantee success of the Ponzi scheme.

[12] See Ball and Mankiw (2007) for one approach to this topic.

[13] See, for example, Brumm, Feng, Kotlikoff, and Kubler (2021).

Adding Market Power

In addition to risk, another reason the interest rate on government debt can fall below the net marginal product of capital is market power. If firms charge prices above marginal cost, there is a wedge between the cost of capital (as reflected by market interest rates) and the marginal product of capital. The logic is straightforward. In the presence of market power, the price of output is a markup over marginal cost:

$$P = \mu MC.$$

One measure of marginal cost is the cost of capital divided by the marginal product of capital:

$$MC = \frac{(r + \delta)P}{MPK}.$$

These two equations imply that the real interest rate is

$$r = \frac{MPK}{\mu} - \delta.$$

Thus, even under certainty, market power causes the real interest rate to fall below the net marginal product of capital. In a recent paper, Larry Ball and I calibrate this effect and conclude that the wedge is about 4 percentage points.[14]

[14] Ball and Mankiw (2021) develop and calibrate a version of the Solow model that includes firms with market power and, because of fixed costs, increasing returns to scale. That paper shows that, in the presence of market power, the marginal product of capital can either exceed or fall short of measured capital income per unit of capital. In the realistic calibration presented there, the marginal product of capital exceeds capital income per unit of capital. This finding tends to reinforce the conclusion that the economy is dynamically efficient.

The earlier equation for the steady-state real interest rate in the Solow model can be generalized for an economy with market power:

$$r = \alpha\left(\frac{n+g+\delta}{\mu s}\right) - \delta.$$

The markup attenuates the effects of saving and growth on the real interest rate (for a given α).[15] But this generalization also provides another reason that interest rates might have declined. Many observers have suggested that, over the past several decades, markets have become less competitive, and markups have increased.[16] Other things being equal, a higher markup reduces the equilibrium interest rate.[17]

Again, we can get a sense of how large this effect might be. The previous equation implies

$$\frac{\partial r}{\partial \mu} = -\alpha\left(\frac{n+g+\delta}{\mu^2 s}\right).$$

With my calibrated parameters and a markup of, say, 20 percent (so $\mu = 1.2$), this becomes

$$\frac{\partial r}{\partial \mu} \approx -\left(\frac{1}{3}\right)\left(\frac{.01+.02+.05}{1.2^2(.24)}\right) = -.08.$$

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[15] A nettlesome but important detail: Calibrating α, the exponent on capital in the Cobb-Douglas production function, is now more difficult. In the competitive economy of the standard Solow model, α equals capital's share of income. That is not necessarily the case in an economy with market power. The calibration in Ball and Mankiw (2021) suggests that α is larger than the measured capital share. As a result, the effect of greater saving and lower growth on the real interest rate is only slightly smaller than in my earlier calculations for a competitive economy.

[16] See, for example, Barkai (2020), De Loecker, Eeckhout, and Unger (2020), and Philippon (2020). The size of the change in markups is controversial; see Basu (2019).

[17] Eggertsson, Robbins, and Wold (2018) explore this issue.

An increase in the markup of 1 percentage point reduces the real interest rate by 8 basis points. Some of the literature suggests that markups have increased by 20 percentage points or more. This change could explain a decline in real interest rates of about 160 basis points.

The wedge induced by market power can have profound implications for fiscal policy. In our 2021 paper, Ball and I show that by reducing the interest rate, the wedge makes it easier for the government to roll over debt forever. But unlike in a competitive economy, a successful Ponzi scheme in an economy with market power can reduce welfare. When the government debt crowds out capital, the output loss from the smaller capital stock is determined not by the real interest rate but by the much higher marginal product of capital. Even if high government debt is benign from the standpoint of the budgetary sustainability, it can still reduce steady-state labor productivity, real wages, and aggregate consumption.

Key Takeaways

So where does that leave us? Let me suggest four tentative conclusions.

- The decline in real interest rates around the world over the past several decades is not a mystery. It appears to be the result of an increase in world saving, a decline in world growth, and possibly an increase in market power.
- Because interest rates are so low, greater government debt is most likely not problematic from a budgetary standpoint. The government can probably roll over the debt and the accumulating interest forever, in essence letting growth take care of the debt.

- There is an outside chance that this Ponzi scheme of perpetual debt rollover will fail. That possible outcome is especially dire because the failure makes an already-bad state of the world even worse.
- Even if the perpetual debt rollover succeeds, the increased debt could still crowd out capital. If the economy's capital stock is less than the Golden Rule level, as appears to be the case, this reduction in capital accumulation will, in the long run, depress not only labor productivity and real wages but also the resources available for consumption.

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