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# Productivity Growth and Interest Rate Trends: a Long-Run Analysis

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Many observers noted that global interest rates have been declining for several decades, with real interest rates most recently moving into a negative territory. Other analysts raise related concerns about slow productivity growth that may be one reason for the observed interest rate decline. These observations raise the question of how to interpret these trends and how to incorporate the new evidence into long-run interest rate projections.

This paper develops a new measure of after-tax rate of return on aggregate wealth that can be constructed with national accounts data. The rate of return measure provides information additional to financial market variables, and it naturally maps into the standard neoclassical growth model. Using the constructed rate of return in structural estimation allows justification of long-run interest rate assumptions, putting them in context of other related evidence. In particular, an estimated structural relationship provides information on the long-run interest rate's sensitivity to productivity growth changes. Results in this paper and in recent, related studies indicate that the long-run interest rate rises slightly more than one for one with productivity growth rate.

Model-based parameter estimates are further used in constructing long-run interest rate projections and in evaluating the long-run interest rate assumptions in the 2015 Technical Panel on Assumptions and Methods (TPAM) report. The proposed method disciplines the projections by requiring that they be consistent with available evidence on productivity growth, consumption, equity risk premium, and the share of public debt in total wealth. One advantage of the method is that it makes its assumptions explicit, and it explains how assumptions influence the estimates. If the economic environment were to change, the methodology developed here could provide a justification for updating the interest rate assumptions accordingly.

The baseline estimates for the real interest rate on 10-year U.S. government bonds are in the 1.5 to 2.0 percent range. This is lower than the intermediate-cost assumption of 2.5 percent in the 2015 TPAM report for two reasons. First, there is evidence that the intermediate assumption of 1.7 percent annual productivity growth is somewhat optimistic—recent studies lend support to lower estimates for future productivity growth. Second,

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global trends in productivity growth and population growth can bring about future interest rate declines across the world and prevent the rates on U.S. Treasury securities from rising.

Two main sources of uncertainty affect long-run interest rate projections. The first has to do with the future rate of productivity growth. A recent body of research supports annual labor productivity growth in the 1.0 to 1.4 percent range going forward, although some optimistic assessments envision future productivity growing at 1.8 percent. Assumptions underlying optimistic productivity growth projections of a few years ago do not seem to be widely supported in studies that have appeared since. What is more, estimates of the rate of technological progress — the ultimate driver of productivity growth — may be biased upward because of unmeasured investment in intangible capital. All other things equal, a source of growth decomposition that accounts for unmeasured intangible capital implies a 0.3 percent slower rate of long-run productivity growth than the same method using national accounts data. Nevertheless, intangible capital accumulation remains an important source of growth, having contributed annually more than 0.5 percent to productivity growth during 1995-2013. If intangible capital investment share in gross domestic product (GDP) does not go down, capital deepening would give productivity growth a boost in the medium run.

Demand for U.S. Treasury securities depends on the world interest rate that summarizes alternative investment opportunities. Accordingly, the second source of uncertainty has to do with international financial flows that contributed to recent high demand for U.S. government bonds and are thought to have contributed to interest rate declines after 2000. Several studies point out that a combination of slowing population growth and lower productivity growth would cause a slowdown in global investment demand. This paper uses United Nations country-level population projections and presents a range of simulations where slower growth of investment demand across the world causes the global interest rate to fall by 100 to 150 basis points in the next 25 years. It is unclear how much of this interest rate decline will be passed through to the U.S. Treasury securities — the answer will depend not only on the world interest rate level, but also on general global demand for safe assets.

Increased U.S. government borrowing over the next 30 years, as projected by the Congressional Budget Office, could push interest rates upward by 40 to 50 basis points, partially offsetting the effects of projected global developments on the world interest rate.

All told, long-run projections with intermediate assumptions show the real interest rate on 10-year U.S. government bonds in the 1.5 to 2.0 percent range, lower than its 2.3 percent historical average (1953-2015). This range can be justified as follows: If future productivity growth were 1.7 percent, as in the intermediate-cost TPAM report assumption, structural estimates would imply a 2.2 to 2.6 percent range for the real interest rate on bonds. Starting from this range, analysis shows that one should subtract 50 to 60 basis points due to lower baseline productivity growth, subtract a further 60 basis points due to projected world population growth slowdown and add 40 to 50 basis points due to projected rise in the U.S. debt-to-GDP ratio.

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