CHAPTER 3

PERSPECTIVES ON GLOBAL REAL INTEREST RATES

Real interest rates worldwide have declined substantially since the 1980s and are now in slightly negative territory. Common factors account for much of these movements, highlighting the relevance of global patterns in saving and investment. Since the late 1990s, three factors appear to account for most of the decline. First, a steady increase in income growth in emerging market economies during 2000–07 led to substantially higher saving rates in these economies. Second, the demand for safe assets increased, largely reflecting the rapid reserve accumulation in some emerging market economies and increases in the riskiness of equity relative to bonds. Third, there has been a sharp and persistent decline in investment rates in advanced economies since the global financial crisis. This chapter argues that global real interest rates can be expected to rise in the medium term, but only moderately, since these three factors are unlikely to reverse substantially. The zero lower bound on nominal interest rates will remain a concern for some time: real interest rates will likely remain low enough for the zero lower bound to reemerge should risks of very low growth in advanced economies materialize.

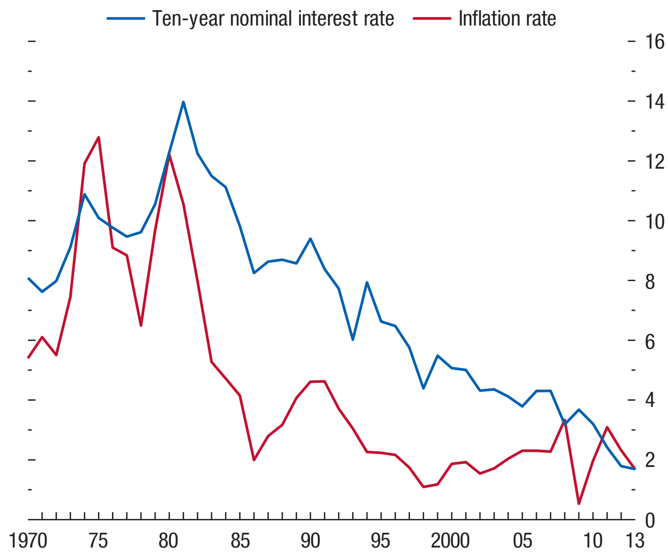
In the past few years, many borrowers with good credit ratings have enjoyed a cost of debt close to zero or even negative when it is adjusted for inflation. This is not just a consequence of the global financial crisis. Since the early 1980s, yields of all maturities have declined worldwide well beyond the decline in inflation (Figure 3.1).

However, because the recent interest rate declines reflect, to a large extent, weak economic conditions in advanced economies after the crisis, some reversal is likely as these economies return to a more normal state. But how much of a reversal? Certain factors suggest a substantial increase in interest rates in the medium term: high and rising debt levels in advanced economies; population aging; lower growth in emerging market economies, which might lower their saving rates; and further financial deepening in emerging market economies, which would reduce borrowing constraints and thereby net saving.[1] Other factors, however, would work in the opposite direction: long-lasting negative effects of the global financial crisis on economic activity (Cerra and Saxena, 2008; Reinhart and Rogoff, 2008), persistence of the "saving glut" in key emerging market economies, and renewed declines in the relative price of investment goods.

This chapter constructs global real interest rates at short and long maturities and reviews their evolution since 1980. It also traces the evolution of the cost of

Figure 3.1. Ten-Year Interest Rate on Government Bonds and Inflation

(Simple average across France, Germany, United Kingdom, and United States; percent a year)



Sources: Bloomberg, L.P.; Haver Analytics; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Inflation is calculated as the percent changes in the consumer price index.

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[1]For example, McKinsey Global Institute (2010) argues that worldwide real interest rates are set to increase substantially in the medium to long term, putting an end to cheap capital.

capital—a weighted average of the cost of debt and the cost of equity. It then analyzes key factors that could explain the observed patterns: shifts in private saving, changes to fiscal policy, shifts in investment demand, changes in the relative price of investment, monetary policy, and portfolio shifts between bonds and equity. It closes by considering how the main factors behind the decline in real rates might play out in the medium term. The analysis is largely qualitative. The effects of each factor are discussed in a general equilibrium context, but the quantitative effects may not be identified precisely.

The following questions arise:

- Is there a global trend in interest rates, or do country-specific dynamics dominate?
- What have been the main factors contributing to the decline in real interest rates since the 1980s?
- What have been the effects of the global financial crisis on real rates, and how long are these effects likely to last?
- What should we expect in the medium term?
- What are the implications for fiscal authorities in advanced economies and for fund and asset managers? What are the implications for monetary policy?

These are the main findings:

- Economic and financial integration has increased sufficiently during the past three decades or so for real rates to be determined largely by common factors. Thus, using a global measure of real interest rates and exploring global patterns of saving and investment are appropriate.
- Since the early 1980s, global real interest rates have strongly declined. The cost of capital has also fallen, but to a lesser extent because the required return on equity has increased since 2000.
- Monetary policy dominated the evolution of real rates and the cost of capital in the 1980s and early 1990s. Fiscal policy improvement in advanced economies was the main factor underlying the decline in real interest rates during the rest of the 1990s. In addition, the decline in the relative price of investment may have reduced the demand for loanable funds in both the 1980s and 1990s.
- Since the late 1990s, the following factors have largely driven the decline in real rates and the cost of capital:
    - *A large increase in the emerging market economy saving rate* between 2000 and 2007 more than offset a reduction in advanced economy public saving rates. Strikingly, increases in income growth seem to be the most relevant proximate cause behind the rise in emerging market economy saving rates during the same period.
    - *Portfolio shifts in the 2000s in favor of bonds* were due to higher demand for safe assets, mostly from the official sector in emerging market economies, and to an increase in the riskiness of equity relative to that of bonds. These shifts led to an increase in the real required return on equity and a decline in real rates—that is, an increase in the equity premium.[2]
    - *Scars from the global financial crisis* have resulted in a sharp and persistent decline in investment in advanced economies. Their effects on saving have been more muted.

Real interest rates and the cost of capital are likely to rise moderately in the medium term from current levels. Part of the reason is cyclical: the extremely low real rates of recent years reflect large negative output gaps in advanced economies—indeed, real rates might have declined even further in the absence of the zero lower bound on nominal interest rates. The analysis in this chapter suggests, however, that real rates and the cost of capital are likely to remain relatively low in the medium term, even when output gaps are eventually closed. The main reasons are as follows:

- The effects of the global financial crisis will persist. The findings of the chapter suggest that the investment-to-GDP ratios in many advanced economies are unlikely to recover to precrisis levels in the next five years.
- The portfolio shift in favor of bonds that started in the early 2000s is unlikely to be reversed. Although bond rates may rise again on account of a rising term premium when unconventional monetary policy is wound down, this will probably have a smaller effect on bond rates than will other forces. In particular, stronger financial regulation will further increase demand for safe assets. A reduction in emerging market economy saving and thus in the pace of official reserve accumulation would work the

[2]Between 2008 and 2012, quantitative easing, mainly in the United States and United Kingdom, may also have contributed to a portfolio shift by compressing term premiums on long-term bonds. There is, however, uncertainty about the magnitude of estimates of these premiums, and even upper-end estimates suggest that the long-term impact of quantitative easing over the period 2008–13 on the equity premium has probably been modest.

opposite way, and the net effect is therefore likely to be small.[3]

- Lower growth in emerging market economies compared with growth during the precrisis boom years is expected to result in somewhat lower saving rates. Based on the evidence of previous saving shifts, the magnitude of the effect on real rates is likely to be modest.

In summary, real rates are expected to rise. However, there are no compelling reasons to believe in a quick return to the average level observed during the mid-2000s (that is, about 2 percent). Within this global picture, however, there may well be some countries that will see higher real rates than in the early 2000s because of higher sovereign risk premiums. The conclusions here apply to the risk-free rate.

An important concern is the possibility of a prolonged period of very low growth ("secular stagnation") in advanced economies, especially if new shocks were to hit demand in these economies or if policies do not address crisis legacy issues as expected (see Chapter 1 of the October 2013 *World Economic Outlook,* WEO). As discussed in Chapter 1, with current low inflation, real interest rates will likely be low enough for the zero lower bound issue to reemerge if such risks of very low growth in advanced economies materialize. Real interest rates may then be unable to decline to the negative levels required to restore full employment.

The prospect that real interest rates could increase to relatively low levels in the medium term has important implications:

- Pension funds, insurance companies that provide defined benefits, and savers in general may suffer from a prolonged period of continued low real interest rates. An environment of continued low real (and nominal) interest rates may also induce financial institutions to search for higher real (and nominal) yields by taking on more risk.[4] This, in turn, may increase systemic financial sector risks, and appropriate macro- and microprudential oversight will be critical for maintaining financial stability.
- Symmetrically, borrowers would enjoy the benefits of low rates, all else equal.[5] For one thing, achieving fiscal sustainability would be less difficult. As an example, a 1 percentage point reduction in real rates in the next five years relative to the rate currently projected (October 2013 WEO) would reduce the average advanced economy debt-to-GDP ratio by about 4 percentage points. If real rates are expected to be close to or lower than real GDP growth rates for a long time, some increases in debt-financed government spending, especially public investment, may not lead to increases in public debt in the medium term.[6]
- With respect to monetary policy, a period of continued low real interest rates could mean that the neutral policy rate will be lower than it was in the 1990s or the early 2000s. It could also increase the probability that the nominal interest rate will hit the zero lower bound in the event of adverse shocks to demand with inflation targets of about 2 percent. This, in turn, could have implications for the appropriate monetary policy framework.

The rest of the chapter is structured as follows. The second section constructs the global real rate and cost of capital; the third section introduces the conceptual framework to analyze observed patterns in the global real rate and the cost of capital; the fourth section tests the hypotheses laid out in the third; the fifth section summarizes the findings and draws implications for fiscal policy in the medium term; and the final section concludes.

Stylized Facts: Measuring Real Rates and the Cost of Capital

Real interest rates are directly observable only from the yields on inflation-indexed bonds. Such bonds, however, are typically not issued at short maturities

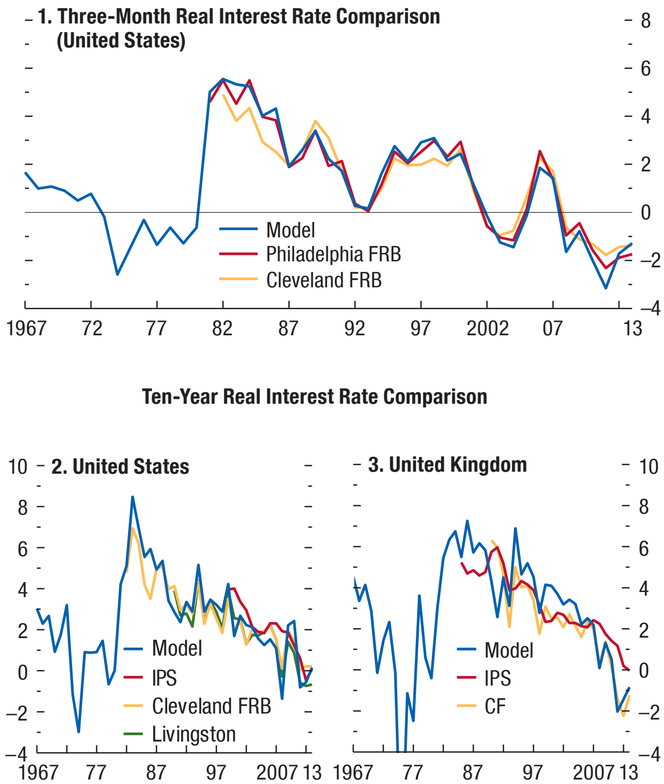
[3]Withdrawal from quantitative easing may also induce a modest reversal of the portfolio shifts observed between 2008 and 2013 by raising real term premiums to precrisis levels. Its effect on the global cost of capital, however, will probably be small.

[4]Maddaloni and Peydró (2011) find that periods of low short-term rates are associated with softening of bank lending standards in the euro area and the United States. Altunbas, Gambacorta, and Marqués-Ibañez (2012) also find that low interest rates over protracted periods lead to an increase in bank risk.

[5]To the extent that rates are lower than expected because of lower-than-expected activity, however, borrowers may well be worse off than under a scenario of higher growth and higher interest rates.

[6]If the real rate is permanently lower than real GDP growth, then a temporary debt-financed increase in government spending will lead to only a temporary increase in the public debt ratio. More generally, the debt-to-GDP ratio may not increase in the medium term if the increased spending permanently raises GDP (for example, by raising the productivity of private capital), generating an increase in annual tax revenue large enough to cover the increase in annual debt service, as argued by Delong and Summers (2012).

Figure 3.2. Real Interest Rate Comparison
(Percent a year)



Sources: Consensus Economics; Federal Reserve Bank of Cleveland; Federal Reserve Bank of Philadelphia, *Livingston Survey;* Federal Reserve Bank of Philadelphia, *Survey of Professional Forecasters;* Haver Analytics; and IMF staff calculations.
Note: CF = *Consensus Forecasts;* FRB = Federal Reserve Bank; IPS = inflation-protected securities.

(that is, less than one year), and even at longer maturities few countries have good data coverage (King and Low, 2014).[7] In the absence of inflation-protected securities, real rates can be approximated by the difference between the nominal interest rate and inflation expectations over the relevant time horizon:

$$r_t^{[n]} = i_t^{[n]} - E_t\pi_{t,t+n}, \tag{3.1}$$

in which $i_t^{[n]}$ is the nominal yield of a zero coupon bond of maturity n at time t, and $E_t\pi_{t,t+n}$ is the expected consumer price inflation over the life of the bond. Bond yields are observable, but inflation expectations are not (at least not directly). For estimates of expected inflation, the analysis relies on survey information and on forecasts from an estimated autoregressive process. Because the parameters of this autoregressive process are likely to change over time, rolling windows are used. To maximize sample coverage, three-month and ten-year maturities are used to represent short- and long-term real rates, respectively.[8]

Estimated three-month real rates for the United States and ten-year real rates for the United States and the United Kingdom are shown in Figure 3.2. The model- and survey-based approaches give very similar estimates. The figure suggests that real rates in the two countries have declined sharply since the early 1980s. Moreover, the rate decline has been global (Figure 3.3). The average global ten-year real rate declined from a high of 6 percent in 1983 to approximately zero in 2012.[9]

The relevance of common forces driving the worldwide decline in real rates is confirmed by a principal component analysis. The results show that the contribution of the first common factor to the variation in real rates increased from about 55 percent in 1980–95 to almost 75 percent in 1995–2012 (Figure 3.4, panel 1).[10] The greater relevance of common factors can also be seen in the evolution of the cross-country dispersion in real rates over time.

Figure 3.4 (panel 2) shows that the cross-sectional standard deviation of ten-year real rates declined from about 400 basis points in the early 1980s to 100 basis points in the most recent years.[11] This decline is consistent with the view that within-country factors driving rates away from the common global mean have become

[7]Markets for indexed bonds are not deep and are susceptible to changes in the liquidity premium and to technical factors. Following Blanchard (1993), because of tax considerations, for the United Kingdom, the real rate is adjusted by adding $\tau/(1 - \tau) \times \pi$, in which τ denotes the income tax rate on coupon payments and is set at 20 percent (see Blanchard, 1993) and π denotes the expected inflation rate over the life of the security.

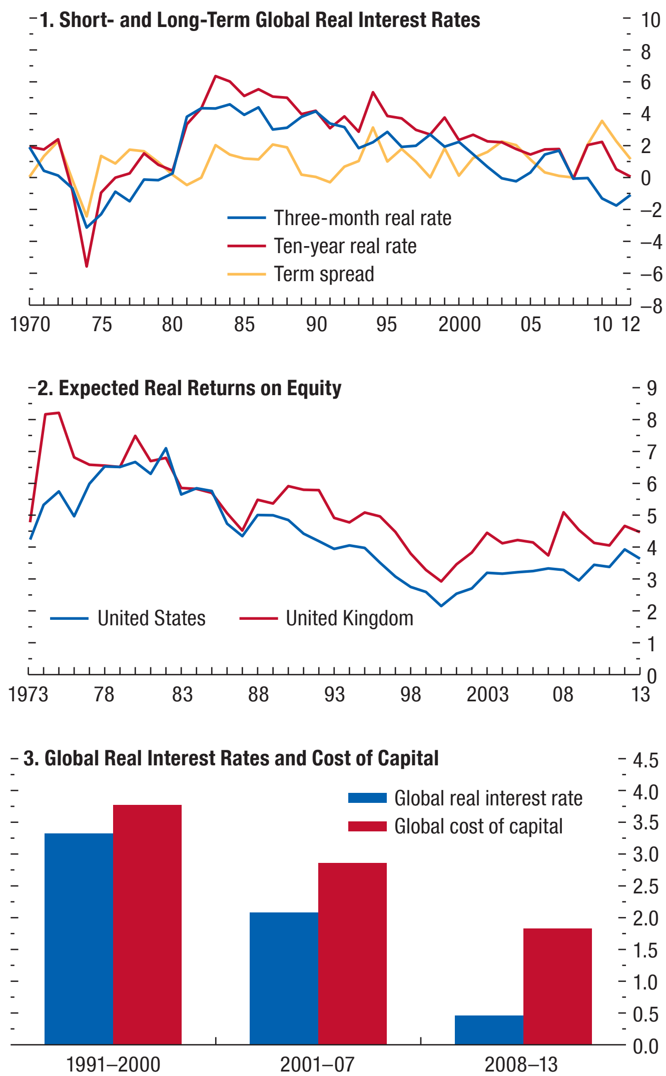
[8]See Appendix 3.1 for details. The sample comprises 40 countries: 25 advanced economies and 15 emerging market economies. The interest rates used are those on government securities, where available; otherwise interbank rates are used.

[9]These are GDP-weighted averages. A similar pattern emerges from simple averages for Group of Seven (G7) countries (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and for GDP-weighted averages excluding the United States (see Appendix 3.7).

[10]Similar results are obtained when changes in real interest rates are used.

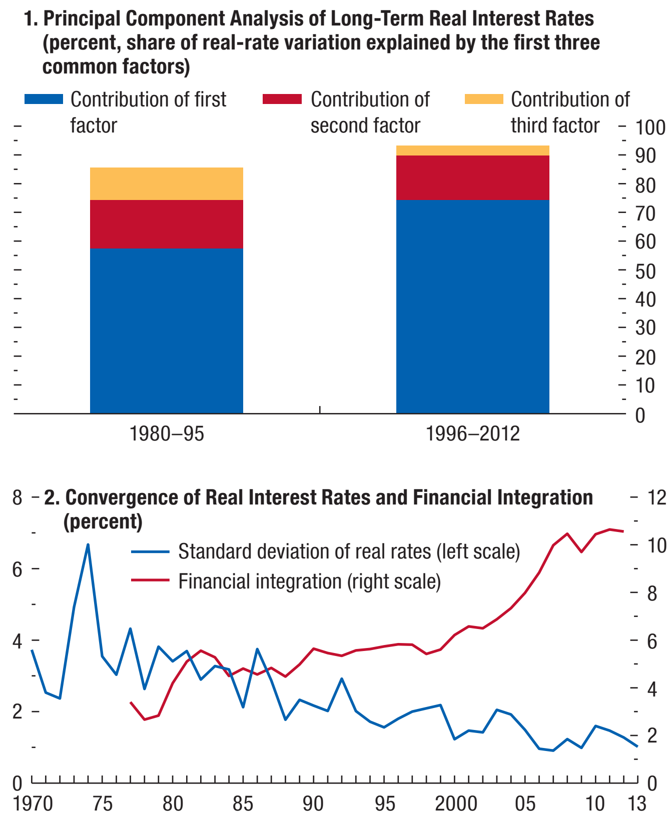
[11]Similar results can be found for short-term emerging market economy securities using a sample starting in 1990 (the data for long-term rates are scant for emerging market economies). These results show that the contribution of emerging market economies to overall real rate dispersion has declined markedly. The analysis excludes those countries that have experienced a significant increase in default risk in the aftermath of the global financial crisis (that is, some noncore euro area countries), because analyzing the determinants of default risks goes beyond the scope of the chapter. It is possible to observe, in regard to the euro area, that whereas the

Figure 3.3. Real Interest Rates, Real Returns on Equity, and Cost of Capital
(Percent a year)



Sources: Bloomberg, L.P.; Haver Analytics; IMF, International Financial Statistics database; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Term spread is defined as the difference between short- and long-term real rates.

Figure 3.4. Common Factors in Real Interest Rates



Sources: Bank for International Settlements; Bloomberg, L.P.; Haver Analytics; IMF, International Financial Statistics database; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Financial integration is constructed as banks' bilateral assets and liabilities as a share of countries' GDP.

less important. However, even though the fraction of the total variance explained by the *first factor* has increased for both three-month and ten-year real rates, it remains significantly lower at the shorter maturity. This is consistent with continued scope for monetary policy in individual countries to play an important countercyclical role in smoothing domestic output fluctuations.

The greater weight of the common factors may be attributable to a variety of reasons. Because inflation risk affects the term premium, a common decline in long-term real rates may be due to simultaneous adoption of

standard deviation of long-term real rates has steadily declined for core euro area countries, it has recently increased for noncore euro area countries (see Appendix 3.7). In contrast, the standard deviation of short-term real rates has decreased for both core and noncore countries.

monetary policy frameworks that ensure low and stable inflation. However, such simultaneous adoption would not explain the trend decline in short-term real rates, because such rates are little affected by inflation risk. In other words, a worldwide decline in the inflation risk premium would have caused a similar decline in the term spread, which has not happened (Figure 3.3, panel 1).[12] An alternative hypothesis for the increased relevance of common factors is increased financial market integration. Figure 3.4 (panel 2) shows the evolution of cross-holdings of banks' assets and liabilities (a measure of financial market integration). According to this measure, financial integration has steadily and substantially increased during the past three decades. The correlation between the financial integration and real-rate dispersion variables is –0.74, supporting the hypothesis.

Financing decisions are not limited to short-term borrowing or the fixed-income market. A firm's evaluation of whether it is worthwhile to undertake a given investment project requires that the expected return on the project be greater than the overall cost of capital, which includes the cost of equity finance as well as that of borrowing.

For the cost of equity, a measure of expected real return on major stock markets is constructed.[13] Stated roughly, the expected return on equity is equal to the dividend yield plus the expected long-term growth rate of real dividends. Expected dividend growth is estimated through a vector autoregressive process of dividend and GDP growth. Figure 3.3 (panel 2) shows the expected long-term real return on equity constructed for the U.S. and U.K. stock markets.

The estimated cost of capital is a weighted average of the estimates for the real long-term interest rate and the required return on equity.[14] The ex ante real returns on both bonds and equity declined between the 1980s and the late 1990s, but after the dot-com bubble burst in 2000–01, the expected return on equity increased. The decline in the overall cost of capital was therefore less than the decline in the real interest rate.[15] Thus, although the estimated global real interest rate in the first part of the 2000s was 1.15 percentage points lower than in the 1990s, the estimated global cost of capital was only 0.62 percentage point lower (Figure 3.3, panel 3).

Determinants of Real Rates: A Saving-Investment Framework

The equilibrium real interest rate is the price that equilibrates the desired demand for and supply of funds. Factors affecting the equilibrium real rate shift or tilt the demand or supply schedules (Figure 3.5). A reduction in the equilibrium real rate would be produced by an outward shift in the supply schedule of funds or an inward shift in the demand schedule. The supply of funds may come from private saving, public saving (the budget surplus), or monetary policy actions.

Changes in expected investment profitability and in the relative price of investment goods (for example, machinery, equipment, information technology) may shift the demand for funds. A decrease in the profitability of investment reduces investment and real rates, and the economy converges to a smaller capital stock. A reduction in the relative price of investment, for a given investment volume, reduces the value of loan demand. At the same time, it is likely to increase the volume of investment. Thus, in theory, the net effect on the value of global investment, and on real interest rates, depends on the elasticity of the volume of investment to its relative price.

Shifts in private saving can be induced by several factors: changes in current and expected income, social safety nets, and demographics, as well as financial innovations, among others. For example, the permanent income hypothesis predicts a decrease in the saving rate whenever a new development increases expected future income growth. A different result may arise, however, in the presence of consumption habits: an increase in GDP

[12]The average real term spread (the difference between long- and short-term real rates) for the entire period is about 100 basis points. The absence of a trend suggests a stable term premium (at short and medium frequency, the term spread varies because of the business cycle). More recently, default risk has been a factor in the euro area. The evolution of default risk, however, is beyond the scope of this chapter.

[13]The real required (internal) rate of return on equity in period t for a horizon n, $R_{e,t}^{[n]}$, is estimated from the following equation:

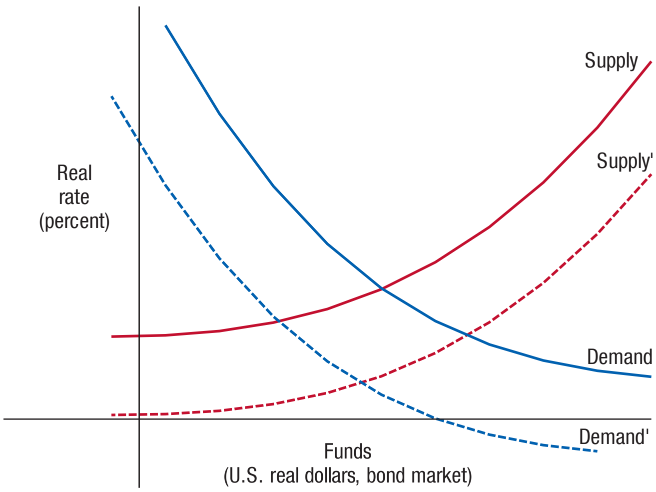
$$S_t/D_t = \Sigma_{j=0}^{n}(1 + R_{e,t}^{[n]})^{-j}E_t g_{t,t+1+j},$$

in which S is a stock price index, D denotes dividends consistent with the stock index chosen, and $E_t g_{t,t+j} = D_{t+j}/D_t$ is the expected cumulated dividend growth.

[14]Equal weights for the two variables are assumed for the United States, and two-thirds (cost of debt) and one-third (cost of equity) for all the other countries. Weights are chosen based on average values of corporate bond and stock market capitalization in the United States and in other countries, and tax corrections are not included. Nevertheless, since 2000, for any possible choice of weights, the cost of capital has declined less than the real rate.

[15]Similar results are obtained when the cost of debt is measured using real corporate yields.

Figure 3.5. Real Interest Rate and Shifts in Demand for and Supply of Funds



Source: IMF staff illustration.

growth can raise the saving rate (see Appendix 3.6). All else equal, such a shift in the saving schedule would reduce real interest rates, increasing the equilibrium level of global investment. Population aging reduces saving under the life cycle model, which predicts that saving rates are the highest for age groups in the middle. Overall, aging should increase real interest rates and reduce global investment.

Changes in public saving (that is, fiscal policy) affect the aggregate saving schedule similarly to those in private saving. Because long-term rates are a weighted average of expected future short-term rates, expectations of future deficits will tend to increase today's long-term real bond rate. In addition, the overall effect of fiscal policy on real rates includes an effect from the stock of public debt. Given that saving decisions depend partly on wealth, of which public debt is a part, a high level of debt tends to depress private saving and, in turn, increase real interest rates.[16]

A neutral monetary policy (that is, keeping output at its potential) does not contribute to the determination of the real interest rate, which is then at its *natural* level. However, deviations of monetary policy from a neutral stance should lead the real rate to move away from its natural level. Loosely speaking, monetary policy easing (tightening) can be represented as an outward (inward) shift in the supply of funds.[17]

In the absence of portfolio shifts, the equity premium is constant, implying that movements in the cost of capital can be summarized by movements in real rates. The equity premium, however, varies over time. Specifically, two factors can affect the equity premium: (1) a shift in the relative supply of (demand for) bonds and equities and (2) a change in the relative risks of holding bonds and equities.[18]

The hypotheses outlined above, and their implications for real rates, returns on equities, and global investment and saving schedules, are summarized in Table 3.1.

[16]Appendix 3.3 shows the negative effect of the stock of public debt on private saving in an overlapping-generations model in which Ricardian equivalence does not hold.

[17]In the standard Investment Saving–Liquidity Preference Money Supply (IS-LM) model, a decrease in money supply (a leftward shift in the LM curve) increases the real rate, which, in turn, reduces output and investment. The decline in output would shift the saving curve until saving and investment are in equilibrium.

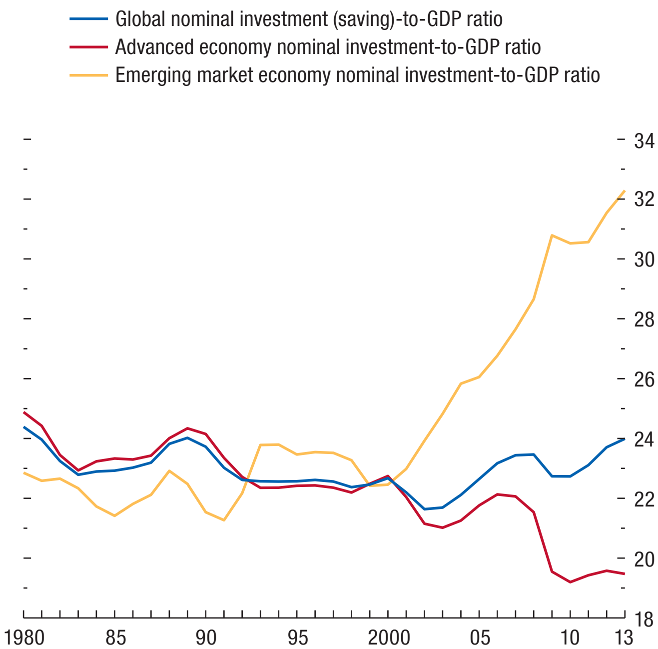
[18]More technically, a change in the relative risk of holding bonds and equities is a change in the covariance of long-term bonds or equity with households' marginal utility of consumption, making one of the two asset classes relatively riskier (or safer) as a financial investment.

Table 3.1. Alternative Hypotheses Explaining a Decline in Real Interest Rates

		Predicted Effect		
	Hypothesis	Real Interest Rates	Expected Return on Equity	Global Investment Ratio
Investment Shift	Decrease in the Relative Price of Investment	?	?	?
	Decrease in Investment Profitability	↓	↓	↓
Saving Shift	Tight Fiscal Policy	↓	↓	?
	GDP Growth Increase (habit)	↓	↓	↑
	Demographics (aging)	↑	↑	↓
Monetary Policy	Easing	↓	↓	↑
Portfolio Shift	Increase in Relative Risk of Equities	↓	↑	?
	Increase in Relative Demand for Bonds	↓	↑	=

Source: IMF staff illustration.

Figure 3.6. Investment-to-GDP Ratios
(Percent of GDP)



Sources: Haver Analytics; Organization for Economic Cooperation and Development; and IMF staff calculations.

Which Factors Contributed to the Decline in Real Interest Rates?

This section assesses various hypotheses for explaining the observed decline in real interest rates.

Shifts in the Demand for Funds

The investment-to-GDP ratio in advanced economies shows a marked decline since 1980, particularly since 2000 (Figure 3.6). This decline may reflect two factors: a lower price of investment and a reduction in the profitability of investment.

Decline in the relative price of investment

Figure 3.7 (panel 1) shows the evolution of the relative price of investment and of the value and volume of investment as a share of GDP. The figure shows that although the relative price of investment did not decline meaningfully after 2002, it fell steadily from 1980 to the beginning of the 2000s.[19] This reduction, in turn, led to a decline in the value of investment as a share of GDP.[20]

Reduced investment profitability

Figure 3.7 also presents the evolution of real corporate profit growth (panel 2) and of corporate profit rates (panel 3). It shows that although no negative shifts in investment profitability are observable up to the early to mid-2000s, investment profitability has markedly declined in the aftermath of the global financial crisis, particularly in the euro area, Japan, and the United Kingdom. Therefore, the hypothesis that a decline in investment profitability in advanced economies has contributed to the decline in real rates does not find empirical support up to the crisis, after which it becomes a key factor.[21]

Another way to examine the evolution of the attractiveness of investment is to look at the dynamic of Tobin's q (Hayashi, 1982). A q value greater than one for a company means that the market value of the company is greater than the value of its recorded assets and that firms have an incentive to invest in it. Likewise, a decline in the value of q implies that investment becomes less attractive. Using Thomson Reuters Worldscope data for a sample of more than 30,000 firms for 74 countries for 1990–2013 (Brooks and Ueda, 2011), the analysis finds that the dynamic of q seems to follow the evolution of investment profitability presented above (Figure 3.7, panel 4).[22] In particular, no negative shifts in the attractiveness of investment are observable in the 1990s and early to mid-2000s, but q slumped in the aftermath of the global financial crisis.

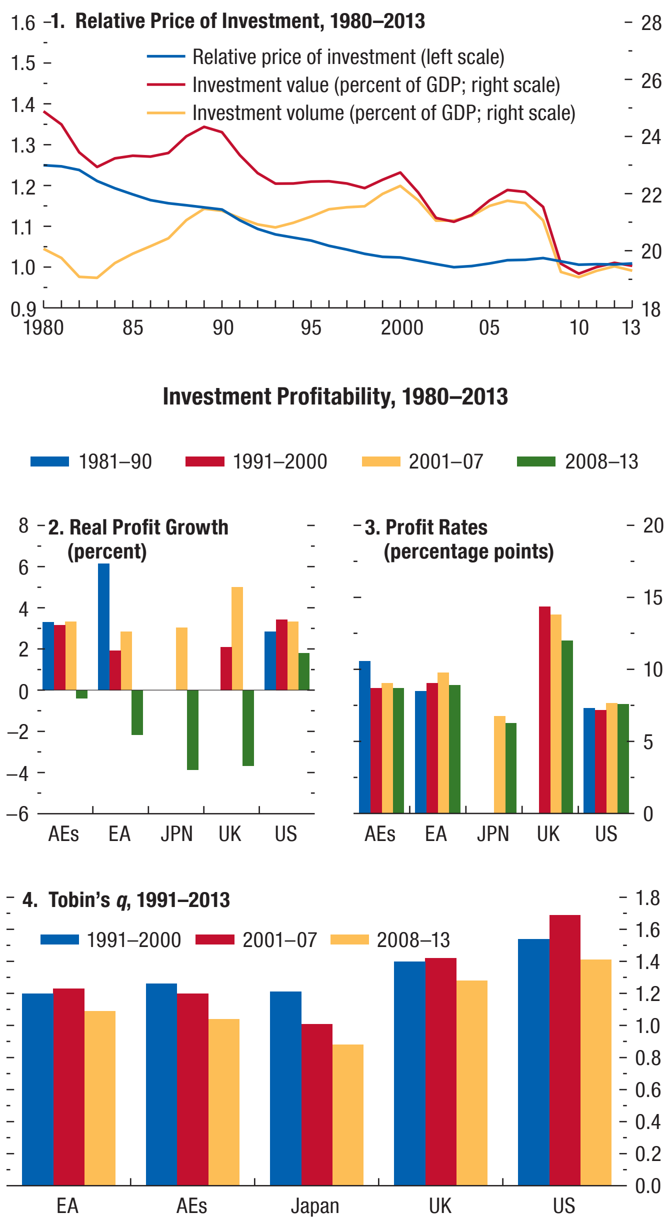
[19]The decline in the relative price of investment has been extensively documented in previous studies (for example, Gordon, 1990). These studies typically associate the decline in investment price with better research and development, embodied in new, more efficient investment goods (for example, Fisher, 2006). In addition, falling commodity prices (such as that for steel) also may have contributed to the decline in the relative price of investment in the 1980s and 1990s.

[20]Although the volume of investment increased during this period, it could not compensate for the reduction in the relative price of the value of investment.

[21]The decline in investment profitability in advanced economies is confirmed by an estimated measure of profitability (see Appendix 3.2). Furthermore, it coincides with the decline in productivity growth observed in many advanced economies in the aftermath of the crisis.

[22]The calculations in this analysis assume that the marginal q value is equal to the average q value.

Figure 3.7. Investment Shifts in Advanced Economies



Sources: Brooks and Ueda (2011); Haver Analytics; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Real profit growth is the rate of growth of real corporate gross operational surplus. Profit rate is the ratio of corporate gross operational surplus to the capital stock. AEs = advanced economies, EA = euro area, JPN = Japan, UK = United Kingdom, US = United States.

In summary, both of these factors contributed to the decline in advanced economy investment ratios, but during different periods: (1) from 1980 to early in the first decade of the 2000s, the substantial decline in the relative price of investment was important, and (2) in the aftermath of the global financial crisis, the negative shift in investment profitability was important.

Shifts in Saving: The Role of Emerging Market Economies

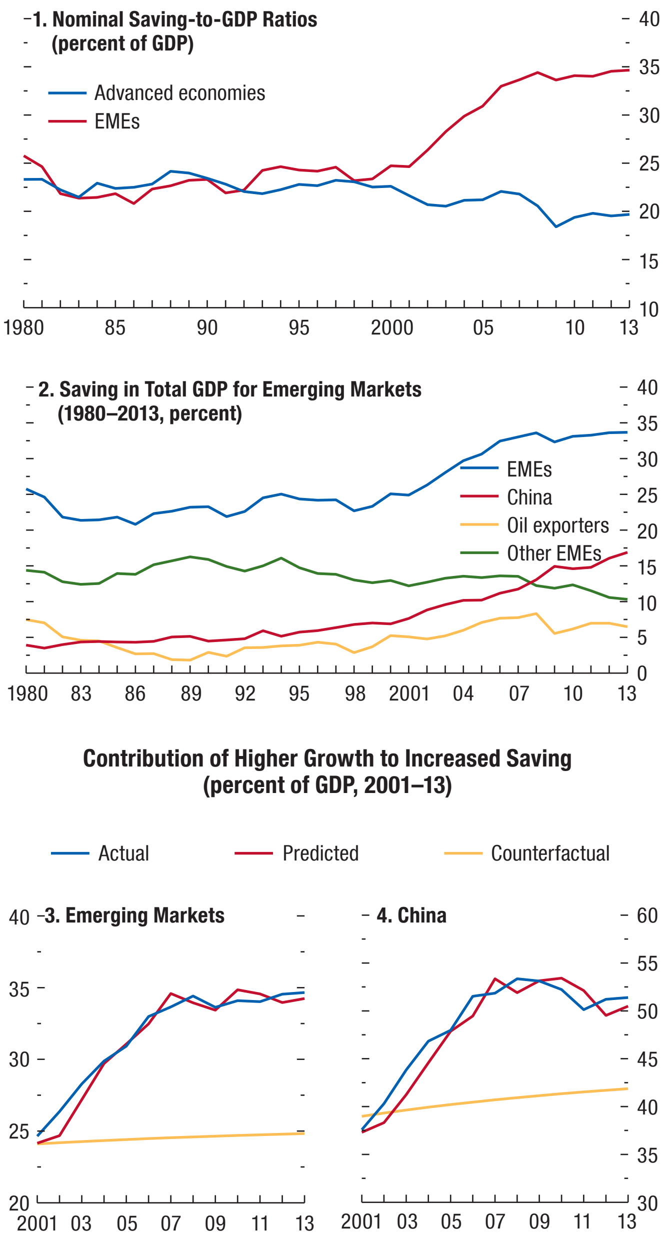
The saving-to-GDP ratio in emerging market economies increased markedly after 2000 (Figure 3.8, panel 1). As a result, the global saving rate between 2000 and 2007 increased by 1.7 percentage points (of which 1.5 percentage points can be attributed to increased saving rates in emerging market economies and a further 0.8 percentage point to the increased weight of emerging market economies in world GDP, with a subtraction of 0.6 percentage point resulting from the decline of advanced economy saving rates). Within the emerging market economies, China's saving accounted for an ever-increasing share—approaching 18 percent of total emerging market economy GDP by 2013, about half of total emerging market economy saving (Figure 3.8, panel 2). The increased supply of saving from emerging market economies, in particular from China, must have contributed significantly to the decline in real interest rates.

What factors explain this increase in emerging market economy saving? Higher oil prices contributed to the increase in saving in the oil exporters in this group between 2004 and 2008 (Figure 3.8, panel 2). In addition to rising oil prices, various causes have been proposed, including the erosion of the social safety net in China, financial constraints, demographic factors, and the desire to accumulate a substantial buffer in official reserves (see next section).[23] However, in many emerging market economies, financial constraints have decreased (Abiad, Detragiache, and Tressel, 2010), and safety nets have generally been strengthened, which would result in lower saving rates.[24] For China, Wu (2011) finds that developments in demographics, safety nets, and financial

[23]See, for example, Chamon and Prasad (2010), Song and Yang (2010), Curtis, Lugauer, and Mark (2011), Wei and Zhang (2011), and G20 (2011, 2012).

[24]For example, between 2000 and 2007, the ratio of public health expenditure to GDP increased to 3.0 percent from 2.7 percent in emerging market economies and to 0.75 percent from 0.49 percent in China.

Figure 3.8. Saving Shifts in Emerging Markets



Sources: Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: EMEs = emerging market economies; Actual = actual saving-to-GDP ratio; Predicted = predicted saving-to-GDP ratio obtained by regressing the EME saving rate on its lagged value and EME real GDP growth; Counterfactual = conditional forecast of the saving rate assuming real GDP growth is constant at the average value of the late 1990s.

constraints have contributed only modestly to the increase in saving rates. Empirical research performed for this chapter confirms this result (Box 3.1).

Demographic factors and financial constraints seem important in explaining long-term saving trends and sustained cross-country differences (IMF, 2013). As discussed in Box 3.1, however, they cannot explain the rapid increase in emerging market economy saving rates during 2000–07. A more relevant explanation is that saving rates increased because growth steadily increased (see also Carroll and Weil, 1994). This hypothesis is investigated in Box 3.1. A time-series model, in which saving rates are a function of lagged saving rates and contemporaneous real GDP growth, explains most of the time-series variation in emerging market economy saving rates (Figure 3.8, panels 3 and 4).[25] The model suggests that the steady increase in emerging market economy growth in the past decade contributed to a shift in saving rates of about 10 percentage points between 2000 and 2007 (panel 3 of the figure), mainly accounted for by the effect of the acceleration in China (panel 4). These results strongly support the hypothesis that increased emerging market economy growth in the first decade of the 2000s contributed to the rise in emerging market economy saving rates above and beyond the increase in investment rates (that is, net saving increased).[26]

Shifts in Saving: The Role of Fiscal Policy

Theory suggests three main channels through which fiscal policy may affect long-term real rates. The first is by reducing public sector saving, thereby raising contemporaneous short-term real rates. The second is through anticipated future deficits, which affect expected short-term real rates. The third is via the stock of public debt and future taxes, which can affect private wealth and thus current saving and consumption decisions. Each of these is examined in turn.

[25]The model also fits the evolution of saving rates in advanced economies remarkably well, explaining about 90 percent of the variation.

[26]The relationship between growth and saving is complex and difficult to pin down with great confidence. To the extent Box 3.1 can do so, it finds that the positive relationship between growth and saving in the short to medium term is determined by the effect of growth on saving, rather than the effect of saving on growth. Similarly, strong evidence is found that a steady reduction in growth in many advanced economies (notably Japan) has contributed significantly to the decline in their saving rates.

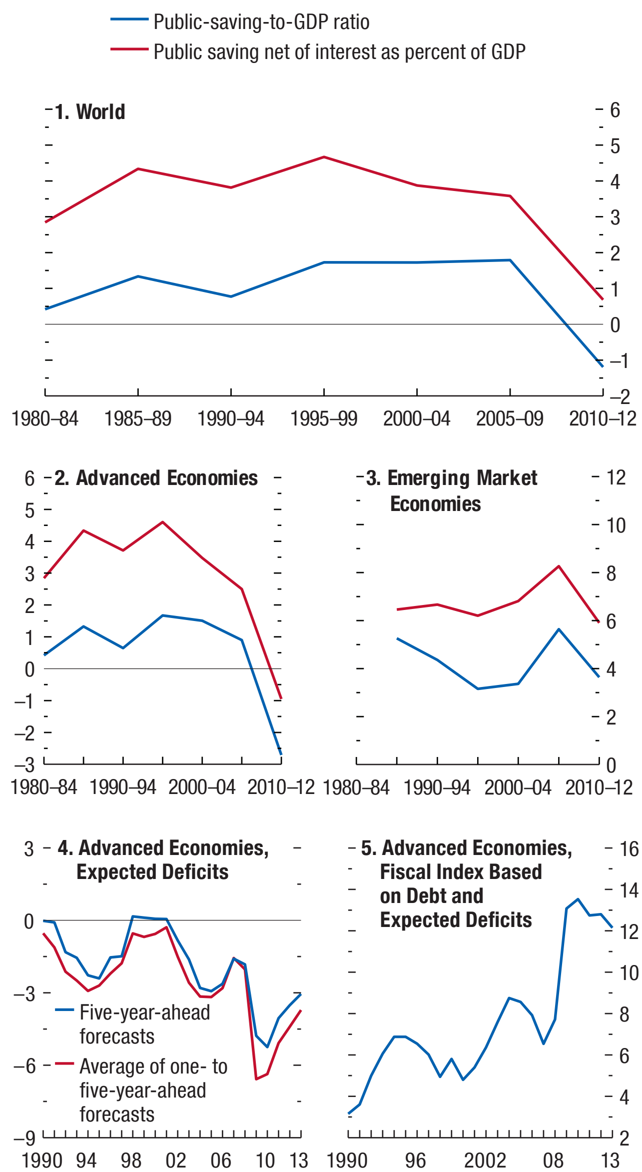
- Panel 1 of Figure 3.9 shows the historical evolution of world public sector saving as a percentage of world GDP. The global public saving ratio rose during the mid- to late 1980s and mid- to late 1990s, broadly reflecting the profile of the advanced economy ratio (Figure 3.9, panels 2 and 3).
- Figure 3.9 (panel 4) shows expected fiscal positions, as represented by WEO forecasts. These, too, improved considerably in the second part of the 1990s.[27]
- Finally, following Blanchard and Summers (1984) and Blanchard (1985), a forward-looking index is constructed that depends on the current level of debt and ten-year forecasts of primary deficits. A decrease in the index over time indicates a reduction in private wealth due to fiscal policy and, thus, a positive shift in total saving.[28] The evolution of the aggregate index for advanced economies shows a decline of 2.1 percentage points from 1994 to 2000 (Figure 3.9, panel 5).[29]

Thus, the evidence regarding all three channels indicates that advanced economy fiscal policies contributed significantly to the decline in real interest rates in the 1990s. Outside of that decade, however, they had the opposite effect. The fact that real rates nevertheless continued to decline during the 2000s means that other factors more than offset the effect of fiscal policy.

Monetary Policy

To the extent that monetary policy is neutral (that is, keeping output at its potential), it does not contribute to the determination of the real interest rate, which is then anchored at its natural level. In practice, it is reasonable to assume that whenever a central bank does not deviate from the systematic behavior implied by its long-standing monetary policy rule, its stance is approximately neutral across business cycles.[30] In

Figure 3.9. Effect of Fiscal Policy on Real Interest Rates
(Percent of GDP)



Sources: Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.

[27]These forecasts are available beginning in 1990, but unfortunately only for advanced economies.

[28]The index is constructed as $x_t = 0.1[b_t + \sum_{i=0}^{\infty}(1.1)^{-i} pd_{t,t+i}]$, in which $pd_{t,t+i}$ is the WEO forecast for the primary-deficit-to-GDP ratio in year $t + i$, and b_t is the debt-to-GDP ratio at time t. See Appendix 3.3 for details.

[29]This suggests an arc elasticity of about 0.21. In all other periods, the index has increased, putting upward pressure on real rates.

[30]This is clearly an approximation. For example, over the business cycle, whenever there is a trade-off between output gap and inflation stabilization, the monetary authority has too few instruments to achieve the first-best allocation. This, in turn, implies that over the cycle, the actual real rate cannot be equal to the natural (Wicksellian) rate.

contrast, monetary policy shocks, defined as deviations from the policy rule, should lead to deviations from the neutral stance. For example, a series of tightening shocks should lead to a real rate above the natural rate for some time.

To assess the role played by monetary policy, the analysis uses a measure of U.S. monetary policy shocks. The United States is interesting in itself because of its prominent role in the global financial system. Moreover, it is the only country for which a reliable measure of monetary policy shocks that dates back to the 1980s is available (Coibion, 2012).[31] In essence, the estimated shocks are exogenous innovations in the policy rate—that is, changes in the rate that are not related to current or expected inflation and economic conditions. Following the approach proposed by Romer and Romer (2004), the effect of monetary policy is estimated as follows:

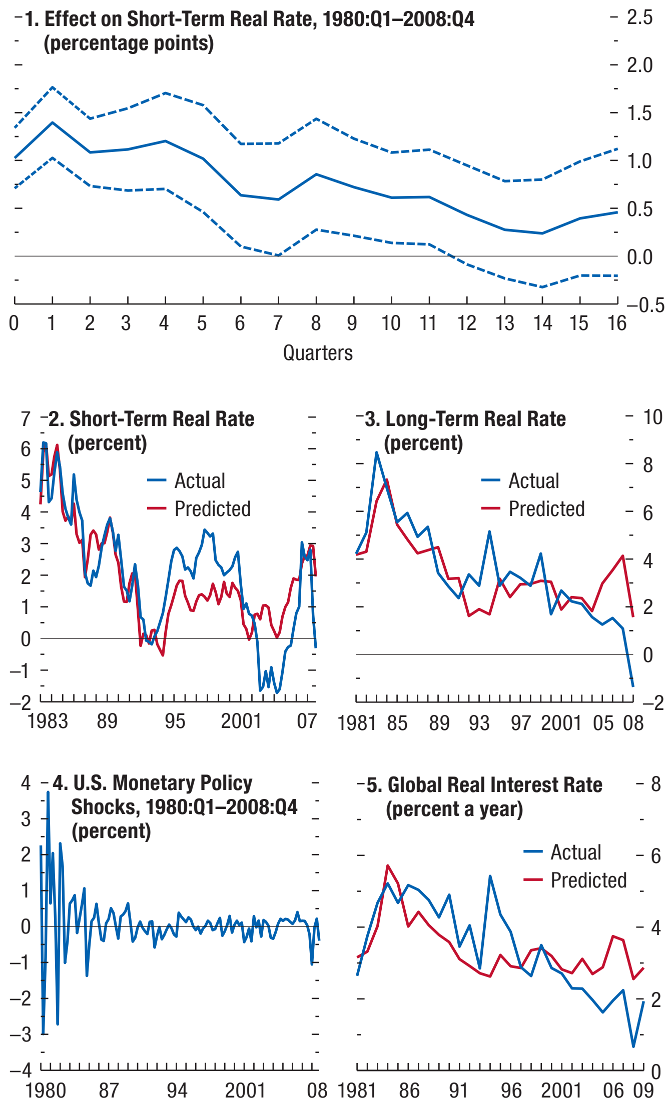
$$\Delta r_t = a + b(l)mps_t + \varepsilon_t, \tag{3.2}$$

in which r is a real rate, and mps is a monetary policy shock.

The results, depicted in Figure 3.10 (panel 1), show that monetary policy shocks have significant and long-lasting effects on short-term real interest rates.[32] To what extent does monetary policy explain the actual decline in real interest rates? Panel 2 of Figure 3.10 plots the actual evolution of short-term real rates as well as the evolution that can be explained by monetary policy shocks. Until 1992, about 88 percent of the variance in short-term real rates is explained by monetary policy shocks alone; afterward, the percentage of the variance explained is much lower. The story is similar for long-term real rates (panel 3 of the figure), although, as one would expect, monetary policy shocks explain less of the variation.

Large tightening policy shocks mostly occurred in the 1980s: between 1980 and 1989, the average policy shock was *positive* at about 24 basis points a quarter. These positive shocks are consistent with the dramatic change in the conduct of U.S. monetary policy

Figure 3.10. Effect of U.S. Monetary Policy Shocks on Real Interest Rates



Sources: Bloomberg, L.P.; Coibion (2012); Organization for Economic Cooperation and Development; and IMF staff calculations.
Note: In the first panel, the solid line denotes estimated effect; dashed lines denote 90 percent confidence bands. $t = 0$ is the year of the monetary policy shock. In panel 5, global real rates exclude U.S. real rates.

[31]The estimated monetary policy shocks are the residuals from an estimated monetary rule based on the Federal Reserve's Greenbook forecasts. The approach is similar to the one originally proposed by Romer and Romer (2004), but by introducing time-varying parameters, Coibion (2012) allows a distinction to be made between innovations to the central bank's rule and changes in the rule itself. This distinction is particularly useful for an analysis of a long time span.

[32]This finding is not novel, and it is consistent with the hypothesis of price rigidities (Christiano, Eichenbaum, and Evans, 1999).

inaugurated at the Federal Reserve by Chairman Paul Volcker on October 6, 1979, which eventually led to successful disinflation (Bernanke and Mishkin, 1992). After 1990 the size of monetary policy shocks declined markedly because the low-inflation regime was by then solidly established (Figure 3.10, panel 4).[33]

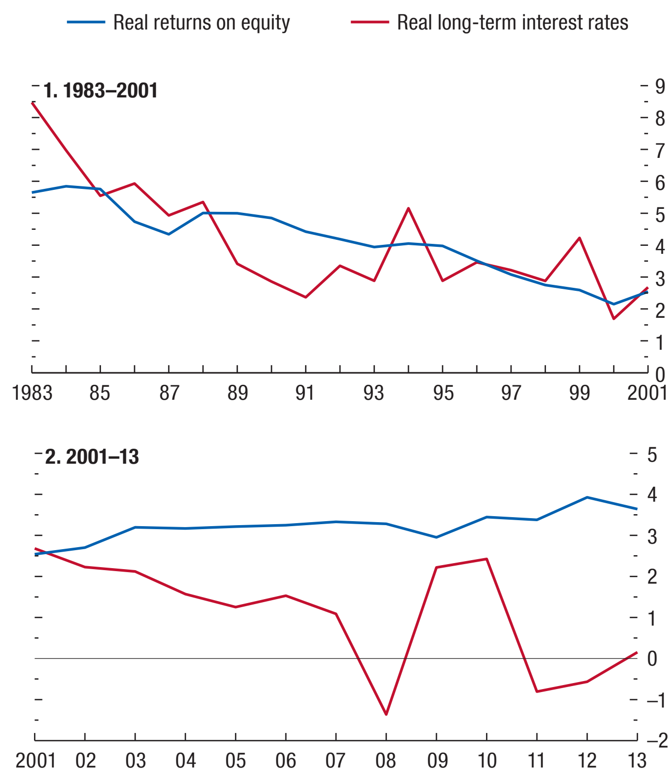
If there is little doubt that the fluctuations in U.S. real interest rates in the 1980s were driven mainly by U.S. monetary policy, it is also clear that U.S. monetary policy shocks explained a substantial part of the fluctuations in the global rate (excluding the U.S. real rate) in that decade (Figure 3.10, panel 5). There are two economic explanations for this result. First, U.S. monetary shocks have substantial spillover effects on other countries' short-term interest rates, especially for those countries that attempt to stabilize their exchange rates with the U.S. dollar (October 2013 WEO).[34] Second, during the 1980s and early 1990s, central banks around the world adopted inflation reduction policies that initially required tighter monetary policy stances, similar to the U.S. Federal Reserve's.[35]

Portfolio Shifts

The hypotheses evaluated so far predict a decline in the real return on a wide spectrum of assets. However, although trends in the returns on bonds and equity were both declining between the 1980s and the late 1990s, after the bursting of the dot-com bubble in 2000–01, the equity premium increased sharply (Figure 3.11).[36] There are three explanations for the divergent trend.

First, the surge in excess saving (that is, current account surpluses) in emerging market economies led to a steep increase in their foreign exchange reserves in the 2000s (Figure 3.12, panel 1), which were invested mainly in government or government-guaranteed fixed-income liabilities. Indeed, foreign holdings of U.S. Treasury securities increased considerably after 2000, and foreign official holdings in China and other emerging market economies accounted for the largest part of this increase (Figure 3.12, panels 2 and 3). Conversely, the share of foreign private holdings of U.S. equities and other assets remained relatively stable (Figure 3.12, panel 4). Empirical evidence suggests that these foreign official purchases of U.S. Treasuries significantly contributed to the decline in real interest rates in the first decade of the 2000s (Warnock and Warnock, 2009; Bernanke, Reinhart, and Sack, 2004; Beltran and others, 2013).[37]

Figure 3.11. Real Long-Term Interest Rates and Real Returns on Equity
(Percent a year)



Sources: Bloomberg, L.P.; Organization for Economic Cooperation and Development; and IMF staff calculations.

[33]Various authors have attributed a prominent role to better monetary policy in explaining the reduction in output volatility (see, among others, Galí and Gambetti, 2009; Nakov and Pescatori, 2010).

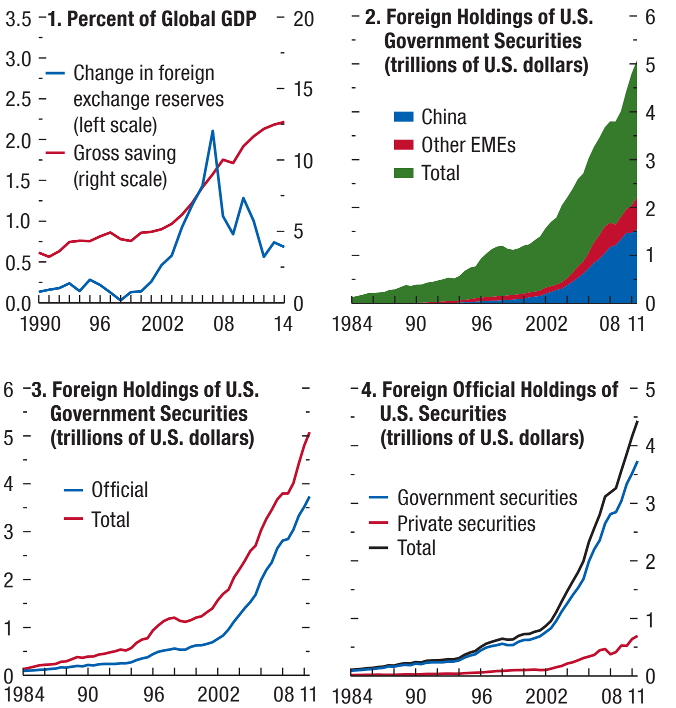
[34]In the 1980s, various inflation-prone countries adopted exchange rate targeting as a way of finding a nominal anchor.

[35]Many advanced economies had reduced inflation and inflation volatility substantially by the early 1990s. Most emerging market economies substantially reduced inflation between the second half of the 1990s and the beginning of the 2000s. In an increasing number of countries, the policy shift was embodied in the adoption of inflation targeting.

[36]Although the analysis focuses on the United States because of the availability of longer time series for the equity premium, most advanced and emerging market economies follow a similar pattern. U.S. stock market capitalization accounts for more than 35 percent of global stock market capitalization.

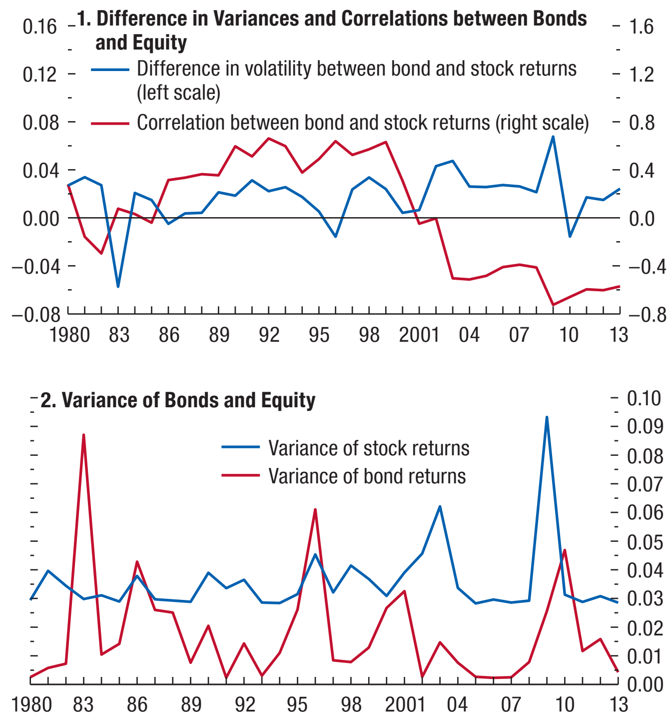
[37]A comparison of previous studies' estimates of the effects of purchases on Treasury yields suggests that if foreign official inflows into U.S. Treasuries were to decrease in a given month by $100 billion, Treasury rates would rise by 46 to 100 basis points in the short term and by 4 to 20 basis points in the long term (Beltran and others, 2013).

Figure 3.12. Portfolio Shifts and Relative Demand for Bonds versus Equity



Sources: Beltran and others (2013); and IMF staff calculations.
Note: EMEs = emerging market economies.

Figure 3.13. Portfolio Shifts and Relative Riskiness of Bonds versus Equity, 1980–2013
(Percent)



Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: Based on autoregressive (ARCH(1)) and generalized autoregressive (GARCH(1)) conditional heteroscedasticity models of bond and stock returns.

Second, a change in the relative riskiness of bonds and equities has made bonds relatively more attractive. In particular, the evidence summarized in Figure 3.13 (panel 1) shows that the correlation between bond and equity returns has steadily declined (similar results have been found in Campbell, Sunderam, and Viceira, 2013), whereas the correlation between consumption growth and equity returns has dramatically increased since 2000.[38]

Panel 2 of Figure 3.13 shows that the volatility of equity holdings markedly increased in the aftermaths of the bursting of the dot-com bubble and of the global financial crisis.[39]

Finally, between 2008 and 2013 some central banks in advanced economies embarked on unconventional monetary policies aimed at stimulating the economy. In particular, some empirical studies (D'Amico and others, 2012; Joyce and others, 2011) provide evidence that *quantitative easing*, in the form of long-term asset purchases, may have compressed real term premiums on long-term government bonds in the United States and United Kingdom between 2008 and 2012. A reduction in the real term premium, in turn, may explain part of the increase in the equity premium.[40] Even though the estimates of the effect of quantitative easing on the term premium are surrounded by wide uncertainty, it is possible that quantitative easing contributed moderately to the observed increase in the equity premium between 2008 and 2013.[41]

[38]The correlation between annual consumption growth and equity returns increased from –0.27 in the 1970–99 sample to more than 0.50 in the period 2000–13. An asset with high returns when consumption is low provides a hedge and therefore yields a low expected return, a negative risk premium. In general, the more procyclical an asset's return, the higher the risk premium associated with that asset.

[39]Figure 3.13 also suggests that the increase in the variance of bond returns relative to those of equities may explain the short-lived increase in U.S. real interest rates in the early 1980s (Blanchard, 1993).

[40]D'Amico and others (2012) estimate a cumulated effect of Federal Reserve long-term asset purchases on ten-year U.S. government bond yields of about 80 basis points (a similar result is found by Joyce and others, 2011, for the United Kingdom). They claim that most of this effect is attributable to the compression of the real term premium. There is substantial uncertainty, however, about the *persistence* of the effect.

[41]It is possible, however, that in the absence of quantitative easing, the increase in the expected real return on equity would have been greater.

Scars from the Global Financial Crisis

Investment-to-GDP ratios in many advanced economies have not yet recovered to precrisis levels. What should we expect in the medium term? A look at previous financial crises helps answer this question. Two sets of episodes provide the basis for the examination: (1) the entire sample of advanced economy financial crises between 1970 and 2007 identified by Laeven and Valencia (2012) and (2) the "Big 5" financial crises (Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991; and Japan, 1992) identified by Reinhart and Rogoff (2008) as the most comparable in severity to the recent one. Looking at financial crises in individual countries allows investment and saving to be analyzed separately.[42]

The econometric estimates imply that financial crises cause significant and long-lasting declines in the investment-to-GDP ratio (Figure 3.14, panels 1 and 2).[43] Financial crises have typically reduced this ratio by about 1 percentage point in the short term (one year after the occurrence of the crisis), with a peak effect of 3 to 3½ percentage points three years after the crisis. The estimated effect matches the 2½ percentage point decline in the investment-to-GDP ratio between 2008 and 2013 remarkably well. Moreover, it is in line with the effect, found in previous studies (Furceri and Mourougane, 2012; Chapter 4 of the October 2009 WEO), of financial crises on the capital-to-labor ratio.

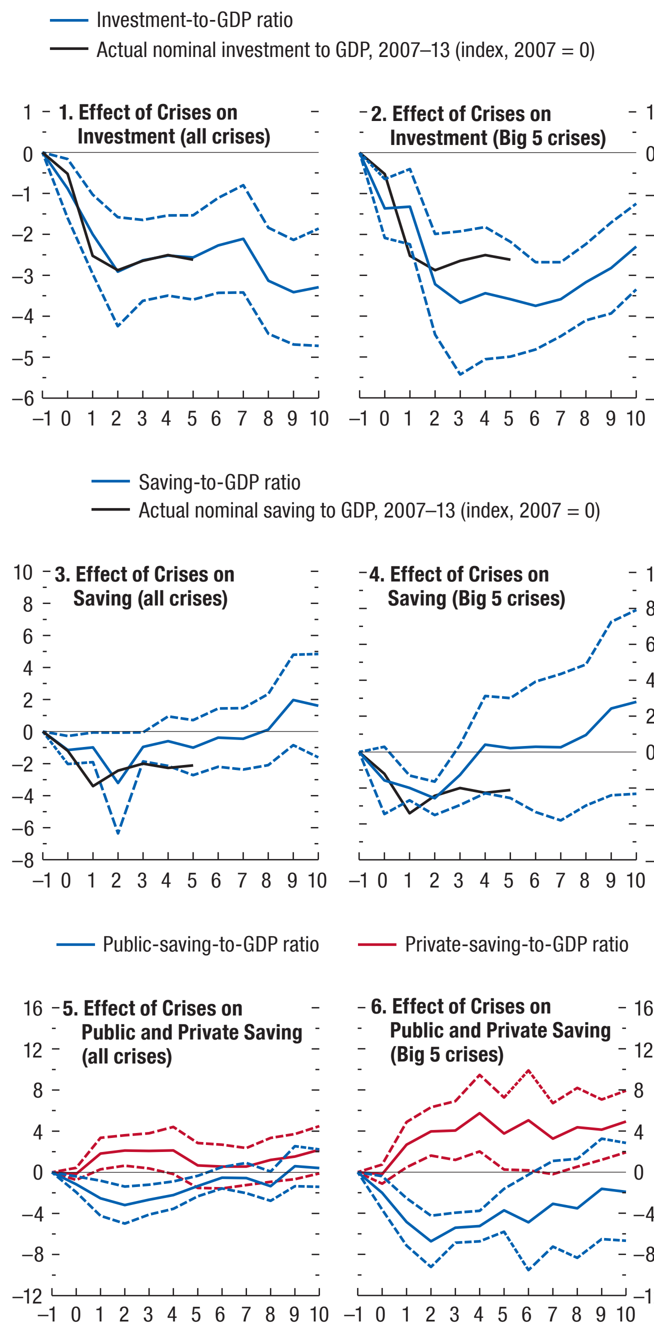
With respect to saving, previous financial crises have typically reduced the saving-to-GDP ratio by about 2 percentage points over a two-year horizon. This reduction tapers off to nothing in the medium term (Figure 3.14, panels 3 and 4). The reason financial crises do not have a persistent impact on the total saving rate is that the decline in public saving rates—which typically occurs in the aftermath of financial crises (Reinhart and Rogoff, 2011; Furceri and Zdzienicka, 2012)—is offset by a persistent increase in private saving rates (Figure 3.14, panels 5 and 6).

Based on this evidence, the global financial crisis can be expected to leave significant scars in the medium term on investment but not on saving, which will contribute to continued low real interest rates for some time.

[42]A similar exercise cannot be performed for a global crisis, since investment and saving are equal at the global level.

[43]See Appendix 3.4 for a description of the methodology used to assess the impact of financial crises on investment and saving as shares of GDP.

Figure 3.14. Effect of Financial Crises on Saving- and Investment-to-GDP Ratios
(Percent of GDP)



Sources: Organization for Economic Cooperation and Development; and IMF staff calculations.
Note: Big 5 financial crises are those in Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991; and Japan, 1992. Solid blue (red) line denotes estimated effect; dashed blue (red) lines denote 90 percent confidence bands; and black line denotes the actual evolution of the investment-to-GDP ratio in advanced economies from 2007 to 2013. *X*-axis units are years; $t = 0$ denotes the year of the financial crisis.

Table 3.2. Factors Affecting Real Interest Rates

	Real Interest Rate (percent)	Cost of Capital (percent)	Saving Shifts	Investment Shifts	Portfolio Shifts
1996–2000	3.3	3.5			
2001–07	2.1	2.9	↑↑	—	↑↑
2008–12	0.6	2.2	—	↓↓	↑↑
Future, Medium Term	<2.1	<2.9	↓	—	—

Source: IMF staff calculations.
Note: Arrows denote changes relative to preceding periods. ↑(↓) denotes outward (inward) shifts in the saving (investment) schedule or an increase (decrease) in the demand for bonds relative to equity. Multiple arrows indicate larger shifts. Dash equals no change.

Should We Expect a Large Reversal in Real Rates?

The past 15-year period is divided by the global financial crisis. Before the crisis real interest rates declined even as the global investment-to-GDP ratio increased, suggesting that a shift in the global saving schedule took place. However, if the outward shift in global saving was the only factor driving the decline in the real rate, a similar decline in the cost of capital should have been observed, but it was not. More precisely, whereas real interest rates declined by about 1.2 percentage points, the cost of capital decreased only by 0.6 percentage point. This difference in declines suggests that portfolio shifts contributed about 0.6 percentage point to decreases in real bond yields (Table 3.2).[44]

In the aftermath of the global financial crisis, real rates have continued to decline, but equilibrium saving and investment have decreased. The analysis above suggests that an inward shift in the global investment schedule (of about 2 percentage points) was the primary factor—while saving responded to the change in yield. Again, there was a difference in declines between the real rate and the cost of capital. The former declined by about 1½ percentage points, whereas the latter declined only by 0.7 percentage point, suggesting that portfolio shifts contributed about 0.8 percentage point to decreases in real bond yields. Quantitative easing (in the form of long-term asset purchases), by compressing the term premium on long-term government bonds, may explain part of the observed portfolio shift.[45] Moreover, high elasticity of real rates to investment shifts (that is, of about 1.5) implies that real rates would have declined considerably more (that is, by about 3 percentage points) in the absence of the zero lower bound on nominal interest rates.[46] Unconventional monetary policy in the advanced economies has only mitigated the effects of the zero lower bound, suggesting that *natural* real rates likely are negative now.

Should an increase in real rates be expected in the medium term? Answering this question requires some conjecture about the future evolution of the main determinants of the real rates since 2000:

- Investment shifts: The evidence on the effect of severe financial crises suggests that a full reversal of the downward investment shift in advanced economies is unlikely. In emerging market economies, growth is expected to be about 1 percentage point a year less than that in the first decade of the 2000s. Such a deceleration would reduce machinery and equipment investment in the medium term. In the case of China, the reduction would be amplified by the rebalancing of growth away from investment and toward consumption.
- Saving shifts: The empirical evidence suggests that the lower projected growth would lead to a medium-term negative shift in emerging market economy saving rates of about 3.5 percentage points.[47] Such a reduction would be significantly smaller in absolute terms than the upward shift during the first decade of the 2000s. In advanced economies, the effect of high

[44]It is possible that looser fiscal policy in advanced economies moderated the real-rate decline.

[45]An *upper-bound* estimate of the cumulated effect of quantitative easing between 2009 and 2012 in the United States and United Kingdom on the term premium of ten-year government bonds is 80 basis points (D'Amico and others, 2012; Joyce and others, 2011). Since the fixed-income market in those countries is about the same size as the equity market, the impact of quantitative easing would be at most 40 basis points on both the U.S. and U.K. cost of capital. Because these countries contribute to the global cost of capital by no more than half, the contribution of unconventional monetary policy to portfolio shifts was 0.2 at most.

[46]A 1 percentage point shift in investment is estimated in this analysis to reduce the real interest rate (the cost of capital) by about 1.5 percentage points (see Appendix 3.5). This estimate implies that the investment shift that took place (of about 2 percentage points) may have reduced the equilibrium real rate by about 3 percentage points.

[47]Simulations based on the IMF's Global Integrated Monetary and Fiscal model suggest that the impact of a 3.5 percentage point reduction in emerging market economy saving rates on the global real rate is between 0.25 and 1.25 percentage points in the long term.

stocks of public debt on real rates would probably be more than offset by projected improvements in those economies' fiscal positions.[48]

- Portfolio shifts: To the extent that the high demand for safe assets continues in the medium term—as a result of strengthened financial regulation—a reversal of the portfolio shift out of equities is unlikely to occur.[49]
- Monetary policy: While output is below potential in advanced economies, monetary policy will probably not contribute to increasing real rates.[50] In the medium term, once output gaps are closed, monetary policy is expected to be neutral.

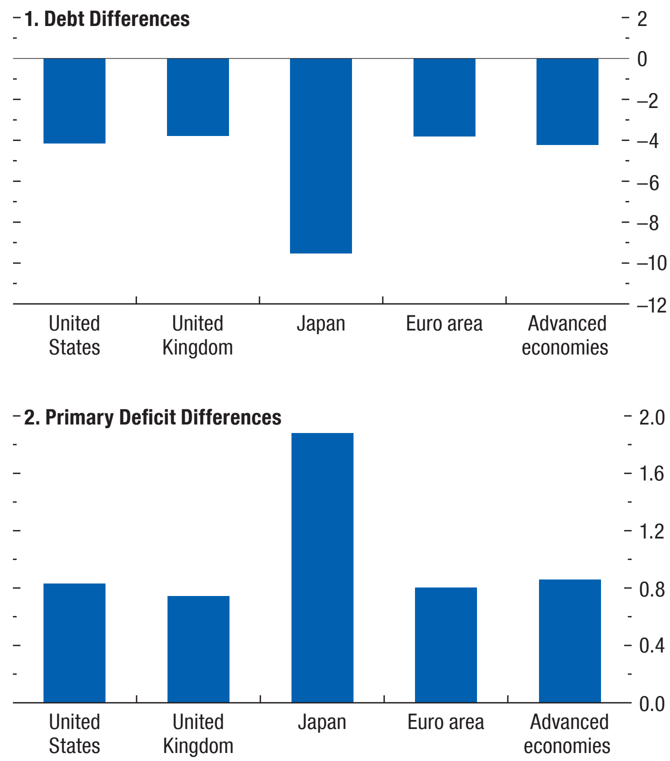
In summary, although real interest rates are likely to increase in the medium term, there are no compelling reasons to believe that rates will return to the levels of the early 2000s.

Implications of Persistent Low Real Interest Rates for Debt Sustainability

Given the high levels of public debt in advanced economies, even small differences in real interest rates during the coming decades will have major implications for fiscal policy. For a given level of economic activity, if interest rates are higher than expected, current fiscal consolidation targets may not be sufficient to ensure debt sustainability. If they are lower, the debt decline could be faster.

The results presented in Figure 3.15 show that if real rates were to remain, for example, about 1.5 percent, which is about 1 percentage point lower than the October 2013 WEO projection, all else equal, this would reduce the advanced economy debt-to-GDP ratio five years ahead by about 4 percentage points. The impact would be larger for countries with higher initial stocks

Figure 3.15. Implications of Lower Real Interest Rates for Debt Sustainability
(Percent of GDP)



Sources: Bloomberg, L.P.; Organization for Economic Cooperation and Development; and IMF staff calculations.
Note: Panel 1 shows the differences in the five-year-ahead debt-to-GDP ratio implied by lower real rates. Panel 2 shows the increase in the primary deficit that would need to be sustained each year from 2014 to 2018 to reach the same debt-to-GDP ratio, under the same lower real rates as in panel 1.

of debt (notably Japan). To achieve the same reduction in the debt path with fiscal policy, the primary-surplus-to-GDP ratio would have to be higher by about 0.8 percentage point a year.[51]

Summary and Policy Conclusions

Movements in domestic real interest rates have a major common, global component. Therefore, examining shifts in the global supply of and demand for funds is necessary to understand the behavior of interest rates within any region.

[48]The projected evolution of the fiscal index derived in the previous section suggests that fiscal policy in advanced economies may contribute to maintaining low real rates in the medium term. In particular, the fiscal index is projected to decline from about 1.3 in 2013 to about 1.1 in 2018.

[49]Withdrawal from quantitative easing may induce a modest reversal of the portfolio shifts observed between 2008 and 2013 by raising real term premiums to precrisis levels.

[50]To the extent that the zero lower bound constrains the reduction of nominal rates and thus prevents real rates from being reduced as desired, actual real rates are likely to be higher than the *natural* rate. The monetary policy stance is thus involuntarily tight—although unconventional monetary policy can partly mitigate this problem. Once the recovery is sufficiently strong, the natural rate will start rising. Monetary policy, however, is expected to be accommodative until output gaps are closed, by keeping policy rates below the natural level.

[51]These figures are illustrative examples. They do not take into account all the details (for example, the maturity structure of debt) needed for a precise calculation. In addition, the exercise assumes that GDP growth is the same in the two scenarios.

Global real interest rates have declined substantially since the 1980s. The cost of capital has fallen to a lesser extent, because the return on equity has increased since 2000. Since the early 2000s, three factors have contributed to the declines in real rates and in the cost of capital:

- Saving shifts: The substantial increase in saving in emerging market economies, especially China, in the middle of the first decade of the 2000s contributed to a modest decline in the cost of capital. High income growth in emerging market economies during this period seems to have been the most important factor behind the saving shift.
- Portfolio shifts: About half of the reduction in real rates in the first decade of the 2000s can be attributed to an increase in the *relative* demand for bonds, which, in turn, reflected an increase in the riskiness of equity and the resulting higher demand for safe assets among emerging market economies to increase official foreign reserves accumulation.[52] In the aftermath of the global financial crisis, these factors, though more moderate, have continued to contribute to the decline in real rates.
- Investment shifts: The postcrisis reduction in the cost of capital has been driven mainly by a collapse in the demand for funds for investment in advanced economies.

The evidence presented here does not suggest a quick recovery in the investment-to-output ratio for advanced economies in the medium term. The monetary policy stance is expected to be neutral in the medium term once output gaps are closed. A full reversal of the portfolio shift favoring bonds observed in the 2000s is unlikely: although a reduction in surplus emerging market economy saving, and thus in the pace of official reserves accumulation, might reduce the demand for safe assets, strengthened financial regulation will have the opposite effect. The net effect on real interest rates is likely to be small, unless there is a major unexpected change in policies. In advanced economies the effect of high stocks of public debt on real rates is likely to be more than offset by the projected improvements in fiscal balances. The projected reduction in GDP growth in emerging market economies would probably reduce their net saving rate—and this could be amplified by the rebalancing of growth away from investment in China.[53] In summary, it is likely that real interest rates will rise, but no compelling reasons suggest a return to the average level observed during the mid-2000s (that is, about 2 percent). Within this global picture, however, there may be some countries that will see higher real rates because of higher sovereign risk premiums. The conclusions here apply to the risk-free rate.

A protracted period of low real interest rates would have negative implications for pension funds and insurance companies with defined-benefit obligations. An environment of continued low real (and nominal) interest rates might also induce investors and financial institutions more broadly to search for higher real (and nominal) yields by taking on more risk. Increased risk taking, in turn, might increase systemic financial sector risks, and appropriate macro- and microprudential oversight would therefore be critical for maintaining financial stability.

If real interest rates were to be lower than currently projected in the WEO, achieving fiscal sustainability would be somewhat easier. For example, with real interest rates 1 percentage point lower than projected, the average medium-term debt-to-GDP ratio in advanced economies would be about 4 percentage points lower. Moreover, if real rates are expected to be close to or below the real GDP growth rate for some time, some increases in debt-financed government spending, especially public investment, may not lead to increases in public debt in the medium term.

Lower natural real rates also have important implications for monetary policy. For example, with an inflation target of 2 percent, if the equilibrium real interest rate is substantially less than 2 percent as anticipated, the typical neutral policy rate would be significantly less than 4 percent.[54] A lower natural rate does not reduce the effectiveness of monetary policy during normal times. However, for a given inflation target, it raises the probability that nominal interest rates will hit the zero lower bound. The higher risk of potential monetary policy ineffectiveness in times of recessions, in turn, may be an important consideration in the choice of an appropriate monetary policy framework.

[52]Higher demand for safe assets was only partly satisfied by the deterioration in advanced economies' public finances. The 2000s also saw a vast expansion in holdings of government-guaranteed debt, in particular, mortgage-backed securities. The securitization boom preceding the global financial crisis can be seen as a market response to higher demand for safe assets.

[53]The effect would be reduced by a composition effect. The countries with the highest GDP growth rates are the ones with the highest saving rates. Their rapid growth would continue to raise the global saving rate even if their own rate were to decline slightly.

[54]In the United States, the average policy rate between 1990 and 2007 was 4.4 percent.

Appendix 3.1. Model-Based Inflation and Dividend Growth Expectations

This appendix describes the empirical methodology used to construct real interest rates and real returns on equity for an unbalanced sample of 25 advanced economies and 15 emerging market economies from 1970 through 2013.

Real Interest Rates

Real rates can be approximated by computing the difference between the nominal bond yield and the relevant inflation expectations. Survey information and forecasts from an estimated autoregressive process for inflation are used to obtain inflation expectations (model-based inflation expectations).

In particular, model-based inflation expectations over any horizon j are estimated using a monthly autoregressive process $AR(p)$ for the variable $\gamma_t = \ln P_t - \ln P_{t-12}$, in which P is the consumer price index and $p = 12$ is the order of the process. The $AR(p)$ process is estimated on a rolling window of 60 months to minimize the effect of parameter instability. Using out-of-sample forecasts of γ_t, $E_t \ln P_{t+j} - \ln P_t$, which is the inflation expectation at time t for the period $t + j$, is calculated.[55]

Real rates are then constructed as

$$r_t^{[n]} = i_t^{[n]} - \frac{(1-g)}{(1-g^n)} \Sigma_{i=1}^{n} g^i E_t \pi_{t,t+i}, \tag{3.3}$$

with $g = (1 + \bar{I})^{-i}$, in which $r_t^{[n]}$ and $i_t^{[n]}$ are the real and nominal rates, respectively, on a bond of maturity n; $E_t\pi_{t,t+i}$ is the inflation expectation at time t for period $t + i$; and $\bar{I}$ is the average nominal rate for the period examined. In sum, the real rate is defined as the nominal rate minus the weighted average inflation expectation over the entire life of the bond.

Real Returns on Equity

The real required internal rate of return on equity in period t for horizon n is estimated as

$$S_t/D_t = \Sigma_{j=0}^{n} (1 + R_{e,t}^{[n]})^{-j} E_t g_{t,t+1+j}, \tag{3.4}$$

in which S is an equity price index and $g_{t,t+j} = D_{t+j}/D_t$ is cumulated dividend growth, consistent with the equity index chosen. Stated roughly, the expected return on equity ($R_{e,t}^{[n]}$) is equal to the dividend yield plus the expected long-term growth rate of real dividends. Expected dividend growth rates are constructed by estimating a quarterly bivariate VAR(p) of dividend and GDP growth, with $p = 4$. The VAR(p) process is estimated on a rolling window of 60 months to minimize the effect of parameter instability.

Appendix 3.2. Investment Profitability

One possible explanation for the decrease in investment-to-GDP ratios in many advanced economies is that investment profitability has declined. Various factors can explain shifts in investment profitability (including changes in business taxation, factor prices, productivity, and uncertainty), and quantifying them is difficult. As an alternative, the analysis assesses whether the reduction in the investment-to-GDP ratio can be attributed to the unexpected strengthening of GDP or instead to an anticipated decline in profitability. To discriminate between these two factors, following Blanchard and Summers (1984), the following regression is estimated for each country in the sample:

$$\ln I_t = \alpha + \Sigma_{i=0}^{2} \beta_i \ln Y_{t-i} + u_t, \tag{3.5}$$

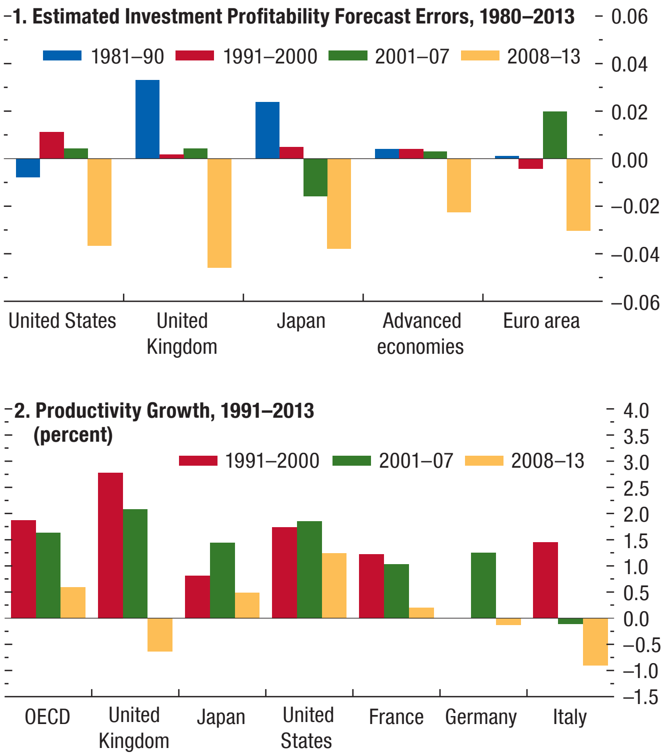
in which

$$u_t = \rho u_{t-1} + \varepsilon_t, \tag{3.6}$$

with I denoting real private investment and Y real GDP. Under the hypothesis that there has been a negative shift in expected profitability, investment should have declined more than predicted by the evolution in output, thus implying a negative forecast error $\hat{\varepsilon}_t$. Panel 1 of Figure 3.16 presents the aggregated forecast errors for advanced economies. The figure suggests that the hypothesis that a decline in investment profitability has contributed to the decline in real interest rates does not find empirical support up to the global financial crisis, after which it becomes a key factor. A similar conclusion can be reached by looking at the evolution of total factor productivity (Figure 3.16, panel 2).

[55] This methodology produces smaller forecast errors, and matches survey expectations better, than an autoregressive process with consumer price index log differences over the previous month, a vector autoregression (VAR) with commodity prices, and a VAR with GDP growth.

Figure 3.16. Investment Shifts in Advanced Economies



Sources: Haver Analytics; Organization for Economic Cooperation and Development (OECD); World Bank, World Development Indicators database; and IMF staff calculations.
Note: Investment profitability is computed as described in the appendix text.

Appendix 3.3. Fiscal Indicator

This appendix describes the framework for assessing the impact of debt on total saving and real interest rates. As noted in the chapter text, measuring the impact of fiscal policy on real rates requires looking not only at current and future anticipated deficits, but also at the level of the stock of public debt. Following Blanchard and Summers (1984) and Blanchard (1985), a fiscal index is derived.

In a standard life cycle model, consumption is related to wealth. Formally, this can be formulated as

$$C = \omega[K + B + \pi(W - T; r + p)], \tag{3.7}$$

in which C denotes consumption, $K + B$ financial wealth, ω the marginal propensity to consume out of wealth, and $\pi(W - T; r + p)$ the present value of after-tax labor income discounted at rate $r + p$. The term r is the real interest rate, and p is a myopia coefficient, reflecting the mortality of current consumers or their myopia about the future. Focusing on the share of aggregate demand (X) that depends directly on fiscal policy and subtracting the present value of government spending yields

$$X = \omega[B + \pi(D; r + p)] + [G - \omega\pi(G; r + p)], \tag{3.8}$$

in which G is government spending, and D denotes primary deficits. The first term of equation (3.8) represents the effect of debt and government finance on demand; the second term represents the effect of government spending financed by current taxes.

If consumers are not myopic ($p = 0$), the first term of equation (3.8) is equal to zero, because consumers fully anticipate the fiscal implications of the government's budget constraint: if consumers discount future taxes at the interest rate, the timing of a change in taxes does not affect their level of spending (Ricardian equivalence). If consumers are myopic, however, the first term is positive, because they do not fully anticipate that taxes will go up to finance higher interest payments on the stock of public debt.

To construct an empirical counterpart of X, given the more limited reliability of forecasts for G, the focus is on the first term of equation (3.8). Dividing each term of equation (3.8) by GDP and focusing on the first term of the equation, equation (3.8) can be rewritten as

$$x = \omega[b + \pi(d; r + p - g)], \tag{3.9}$$

in which lowercase letters indicate shares of GDP, and g is the rate of GDP growth. Assuming a value for ω equal to 0.1, and a value of $r + p - g$ equal to 10 percent a year,[56] the empirical index is determined as

$$x_t = 0.1[b_t + \Sigma_{i=0}^{\infty}(1.1)^{-i}pd_{t,t+i}], \tag{3.10}$$

in which b_t is the stock of public debt at time t, and $pd_{t,t+i}$ is the forecast of primary deficits at time t for the period $t + i$. In particular, anticipated deficits are constructed using WEO forecasts. These forecasts are available beginning only in 1990, and they should, in principle, incorporate changes in current policies, as well as forecasts of output growth and the evolution of debt and interest payments over time. However, because the forecasts are available only for a time horizon of five years, the ratio of deficits to GDP for year

[56]The value is chosen as in Blanchard and Summers (1984) and is based on Hayashi's (1982) estimates. Although choosing a different value would affect the level of the index, it would not affect its evolution, which is the main interest in this analysis.

$t + i > 5$ is assumed to be equal to the ratio forecast for year $t + 5$.

Appendix 3.4. The Effect of Financial Crises on Investment and Saving

This appendix describes the statistical technique used to assess the impact of financial crises on investment and saving as shares of GDP. The statistical method follows the approach proposed by Jordà (2005) to estimate robust impulse response functions. This approach has been advocated by, among others, Stock and Watson (2007) and Auerbach and Gorodnichenko (2013) as a flexible alternative that does not impose dynamic restrictions embedded in vector autoregression (autoregressive distributed lag) specifications. The model is particularly suitable when the dependent variable is highly persistent, as in the analysis in this chapter.

More formally, the following econometric specification is estimated:

$$y_{i,t+k} - y_{i,t-1} = \alpha_i^k + \gamma_t^k + \Sigma_{j=2}^{l} \gamma_j^k \Delta y_{i,t-j} + \beta_k D_{i,t} + \varepsilon_{i,t}^k, \tag{3.11}$$

in which y denotes the investment- (saving-)to-GDP ratio, D is a dummy that takes the value one for the starting date of the occurrence of the crisis and zero otherwise, and α_i and γ_t are country and time fixed effects, respectively.

The sample consists of an unbalanced panel of 35 advanced economies from 1970 through 2007. Crisis episodes are taken from Laeven and Valencia (2012). Two sets of crisis episodes are of particular interest: (1) the entire sample of financial crisis episodes in advanced economies (1970–2007) and (2) the “Big 5” financial crises (Spain, 1977; Norway, 1987; Finland, 1991; Sweden, 1991; and Japan, 1992) identified by Reinhart and Rogoff (2008) as the most comparable in severity to the recent one.

The model is estimated for each $k = 0, \ldots, 10$. Impulse response functions are computed using the estimated coefficients β_k. The confidence bands associated with the estimated impulse response functions are obtained using the estimated standard deviations of the coefficients β_k. The number of lags (l) has been tested, and the results suggest that inclusion of two lags produces the best specification. Corrections for heteroscedasticity, when appropriate, are applied using robust standard errors; the problem of autocorrelation is solved using the two lags of the change in the investment- (saving-)to-GDP ratio as control variables.[57] Although the presence of a lagged dependent variable and country fixed effects may, in principle, bias the estimation of γ_j^k and β_k in small samples (Nickell, 1981), the length of the time dimension mitigates this concern.[58] In theory, another potential concern could be reverse causality, because changes in the investment- (saving-)to-GDP ratio may affect the probability of occurrence of financial crises. However, this empirical strategy addresses the issue by estimating changes in the investment- (saving-)to-GDP ratio in the years that *follow* a crisis.[59]

Appendix 3.5. Sensitivity of Saving and Investment to Real Rates

This appendix presents a framework for assessing the sensitivity of global saving and investment to the real interest rate. The demand for funds (that is, the elasticity of investment to the real rate) is identified using changes in safety nets (proxied by social expenditure) that give rise to exogenous shifts in the supply of funds (saving); the supply of funds is identified using changes in the relative price of investment, which shifts the demand for funds.

In particular, the following system of equations is estimated on annual data from 1980 through 2013:

$$s_t = a_0 + a_1 r_t + a_2 n_t + \epsilon_t, \tag{3.12}$$

$$i_t = b_0 + b_1 r_t + b_2 p_t + \varepsilon_t, \tag{3.13}$$

$$s_t = i_t, \tag{3.14}$$

in which s denotes global saving as a percent of GDP, i is global investment as a percent of GDP, n is advanced economy social expenditure as a percent of GDP, and p is the advanced economy relative price of investment.

The inclusion of the variables n and p allows the exercise to identify the coefficients of the structural equations (3.12 and 3.13) from a linear combination of the reduced-form coefficients. In particular, the estimates of reduced-form coefficients presented in Table 3.3 give an elasticity of investment to the real rate of

[57]Tests for autocorrelation of the residuals have been performed and have rejected the hypothesis of serial correlation.

[58]The finite sample bias is on the order of $1/T$, where T in the sample is 38.

[59]In addition, robustness checks for endogeneity confirm the validity of the results.

Table 3.3. Investment (Saving) and the Real Interest Rate, Reduced-Form Equations

	Investment (Saving) Equation	Real Interest Rate Equation
Safety Nets	–0.553***	0.106***
	(0.016)	(0.042)
Relative Price of Investment	3.334***	21.369***
	(1.121)	(2.978)
R Squared	0.400	0.660

Source: IMF staff calculations.
Note: Robust standard errors are in parentheses. *** denotes significance at the 1 percent level.

about –0.5, and an elasticity of saving to the real rate of about 0.15.[60] This also implies that the impact of exogenous shifts in saving and investment on the real rate can be quantified as $\Delta r = 1.5$(*Saving shifts – Investment shifts*).

Appendix 3.6. Saving and Growth with Consumption Habit

This appendix derives a simple closed-form solution for both consumption and the saving rate in a rational-expectations permanent income model.

Assume households in each period t enjoy a utility flow from $u(c_t^*)$ in which $c_t^* = c_t - \gamma c_{t-1}$ and the utility function is quadratic. The role of habit formation is captured by the parameter γ; when $\gamma = 0$, there is no habit. Denote household income as y_t and financial wealth as A_{t-1}. Households discount the future at a rate r, which is also the return on wealth. Saving is defined as $S_t = rA_{t-1} + y_t - c_t$. It is then possible to derive the following relationship (Alessie and Lusardi, 1997):

$$S_t = \gamma S_{t+1} + \Delta y_t - \left[1 - \frac{\gamma}{1+r}\right] E_t \, \Sigma_{j=0}^{\infty}(1+r)^{-j}\Delta y_{t+j}. \tag{3.15}$$

Dividing both sides of equation (3.15) by y_t, we get

$$s_t(1+g_t) = \gamma s_{t-1} + g_t - \left[1 - \frac{\gamma}{1+r}\right] \times E_t \, \Sigma_{j=0}^{\infty}(1+r)^{-j}\Delta y_{t+j}/y_{t-1}, \tag{3.16}$$

in which $s_t = S_t/y_t$ and $g_t = \Delta y_t/y_{t-1}$. When g_t is sufficiently small, equation (3.16) can be approximated as

$$s_t \cong \text{const} + \gamma s_{t-1} + g_t - \left[1 - \frac{\gamma}{1+r}\right] E_t \, \Sigma_{j=0}^{\infty}(1+r)^{-j} g_{t+j}. \tag{3.17}$$

Assume that output growth follows a stochastic process $E_t g_{t+j} = \rho^j g_t$, with $|\rho| < 1$; then equation (3.17) can be written as

$$s_t \cong \text{const} + \gamma s_{t-1} + \frac{\gamma - \rho}{1 + r - \rho} g_t. \tag{3.18}$$

If the habit parameter is higher than the persistence parameter of the growth process, an increase in GDP growth leads to a rise in the saving rate.

Appendix 3.7. Sample of Countries Used in Tables and Figures

This appendix describes the sample used to estimate global real interest rates, global investment, global saving, the standard deviation of the real interest rates, and the financial integration indicator. In general, the sample was chosen based on the availability of the data. The coverage period and the full list of countries used to estimate short- and long-term global real interest rates, global nominal investment, and the nominal saving-to-GDP ratio are presented in Table 3.4. The countries in the samples used for some specific figures are also presented in the following paragraphs.

Figure 3.3, panel 1, uses a balanced sample of countries for which real interest rates are available since 1970. The global short-term real rate includes data for Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Japan, Luxembourg, the Netherlands, Norway, Portugal, South Africa, Spain, Sweden, the United Kingdom, and the United States. The global long-term real rate includes data for Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the

[60]The estimated elasticity of investment to the real rate is similar to that found in previous studies. For example, Gilchrist and Zakrajsek (2007), using a panel of 926 publicly traded U.S. nonfarm firms from 1973 to 2005, find that a 1 percentage point increase in the cost of capital implies a reduction in the rate of investment of ½ percentage point.

Table 3.4. Data Coverage for Global Interest Rates, Investment, and Saving

	Period			
Country	Short-Term Interest Rate	Long-Term Interest Rate	Investment	Saving
Albania	n.a.	n.a.	1960–2013	1960–2013
Algeria	n.a.	n.a.	1963–2013	1966–2013
Angola	n.a.	n.a.	1980–2013	1970–2013
Antigua and Barbuda	n.a.	n.a.	1977–2013	1977–2013
Argentina	2000–13	2003–13	1960–2013	1967–2013
Australia	1968–2013	1967–2013	1960–2013	1960–2013
Austria	1967–2013	1967–2013	1960–2013	1965–2013
The Bahamas	n.a.	n.a.	1962–2013	1968–2013
Bahrain	n.a.	n.a.	1969–2013	1969–2013
Bangladesh	n.a.	n.a.	1963–2013	1968–2013
Barbados	n.a.	n.a.	1965–2013	1967–2013
Belgium	1967–2013	1967–2013	1960–2013	1980–2013
Belize	n.a.	n.a.	1963–2013	1968–2013
Benin	n.a.	n.a.	1969–2013	1969–2013
Bhutan	n.a.	n.a.	1979–2013	1980–2013
Bolivia	n.a.	n.a.	1970–2013	1967–2013
Botswana	n.a.	n.a.	1963–2013	1968–2013
Brazil	2001–13	2001–13	1963–2013	1967–2013
Bulgaria	n.a.	n.a.	1969–2013	1969–2013
Burkina Faso	n.a.	n.a.	1963–2013	1968–2013
Burundi	n.a.	n.a.	1960–2013	1968–2013
Cabo Verde	n.a.	n.a.	1963–2013	n.a.
Cameroon	n.a.	n.a.	1963–2013	1963–2013
Canada	1967–2013	1967–2013	1960–2013	1960–2013
Central African Republic	n.a.	n.a.	1969–2013	1969–2013
Chad	n.a.	n.a.	1969–2013	n.a.
Chile	1990–2012	2004–13	1960–2013	1960–2013
China	1991–2013	2002–13	1963–2013	1968–2013
Colombia	n.a.	2009–12	1960–2013	1968–2013
Comoros	n.a.	n.a.	1969–2013	1969–2013
Democratic Rep. of the Congo	n.a.	n.a.	1960–2013	1978–2013
Republic of Congo	n.a.	n.a.	1963–2013	1968–2013
Costa Rica	n.a.	n.a.	1960–2013	1967–2013
Côte d'Ivoire	n.a.	n.a.	1963–2013	1968–2013
Cuba	n.a.	n.a.	1970–2010	n.a.
Cyprus	n.a.	n.a.	1963–2013	1967–2013
Czech Republic	1998–2013	2000–13	n.a.	n.a.
Denmark	1974–2013	1974–2013	1966–2013	1969–2013
Dominica	n.a.	n.a.	1963–2013	1968–2013
Dominican Republic	n.a.	n.a.	1960–2013	1967–2013
Ecuador	n.a.	n.a.	1965–2013	1976–2013
Egypt	n.a.	n.a.	1963–2013	1967–2013
Equatorial Guinea	n.a.	n.a.	1969–2013	n.a.
Estonia	1999–2012	n.a.	n.a.	n.a.
Ethiopia	n.a.	n.a.	1963–2013	1967–2013
Fiji	n.a.	n.a.	1963–2013	1979–2008
Finland	1970–2013	1967–2013	1960–2013	1969–2013
France	1970–2013	1967–2013	1960–2013	1965–2013
Gabon	n.a.	n.a.	1963–2013	1968–2013
The Gambia	n.a.	n.a.	1963–2013	1968–2013
Germany	1967–2013	1967–2013	1960–2013	1960–2013
Ghana	n.a.	n.a.	1963–2013	1967–2013
Greece	1967–2013	1967–2013	1960–2013	1960–2013
Grenada	n.a.	n.a.	1977–2013	1980–2013
Guatemala	n.a.	n.a.	1960–2013	1967–2013
Guinea	n.a.	n.a.	1969–2013	1969–2013
Guinea-Bissau	n.a.	n.a.	1979–2013	n.a.
Guyana	n.a.	n.a.	1960–2013	1967–2013
Haiti	n.a.	n.a.	1963–2013	n.a.
Honduras	n.a.	n.a.	1963–2013	1967–2013

Table 3.4. Data Coverage for Global Interest Rates, Investment, and Saving *(continued)*

	Period			
Country	Short-Term Interest Rate	Long-Term Interest Rate	Investment	Saving
Hong Kong SAR	1987–2013	1991–2013	1961–2013	1961–2013
Hungary	1988–2013	1999–2013	1960–2013	1968–2013
Iceland	1983–2013	1983–2013	1960–2013	1960–2013
India	1996–2012	1990–2013	1960–2013	1967–2013
Indonesia	1990–2013	2003–13	1963–2013	1967–2013
Iran	n.a.	n.a.	1963–2013	1963–2013
Ireland	1983–2013	1982–2013	1960–2013	1960–2013
Israel	1992–2013	1997–2013	1963–2013	1963–2013
Italy	1971–2013	1967–2013	1960–2013	1965–2013
Jamaica	n.a.	n.a.	1963–2013	1967–2013
Japan	1967–2013	1967–2013	1960–2013	1960–2013
Jordan	n.a.	n.a.	1963–2013	n.a.
Kenya	n.a.	n.a.	1963–2013	1963–2013
Kiribati	n.a.	n.a.	1977–1992	1979–1992
Korea	1980–2013	1982–2013	1960–2013	1965–2013
Kuwait	n.a.	n.a.	1963–2013	n.a.
Latvia	n.a.	n.a.	1980–2013	n.a.
Lebanon	n.a.	n.a.	1963–2013	1967–2013
Lesotho	n.a.	n.a.	1963–2013	1968–2013
Libya	n.a.	n.a.	1976–2013	1969–2013
Luxembourg	1967–2013	1985–2013	1960–2013	1970–2013
Madagascar	n.a.	n.a.	1963–2013	1968–2013
Malawi	n.a.	n.a.	1963–2013	1967–2013
Malaysia	1976–2013	1992–2013	1960–2013	1966–2013
Maldives	n.a.	n.a.	1980–2013	1968–2013
Mali	n.a.	n.a.	1967–2013	1969–2013
Malta	n.a.	n.a.	1970–2013	1971–2013
Mauritania	n.a.	n.a.	1960–2013	n.a.
Mauritius	n.a.	n.a.	1963–2013	1967–2013
Mexico	1978–2013	2002–13	1960–2013	1967–2013
Mongolia	n.a.	n.a.	1969–2013	1969–2013
Morocco	n.a.	n.a.	1963–2013	1968–2013
Mozambique	n.a.	n.a.	1963–2013	1968–2013
Myanmar	n.a.	n.a.	1960–2013	n.a.
Namibia	n.a.	n.a.	1980–2013	n.a.
Nepal	n.a.	n.a.	1963–2013	1968–2013
Netherlands	1967–2013	1967–2013	1960–2013	1970–2013
New Zealand	1974–2013	1967–2013	1960–2013	1969–2013
Nicaragua	n.a.	n.a.	1960–2013	1969–2013
Niger	n.a.	n.a.	1963–2013	1963–2013
Nigeria	n.a.	n.a.	1963–2013	n.a.
Norway	1970–2013	1967–2013	1960–2013	1969–2013
Oman	n.a.	n.a.	1967–2013	1969–2013
Pakistan	1991–2013	2002–12	1960–2013	1967–2013
Panama	n.a.	n.a.	1963–2013	1967–2013
Papua New Guinea	n.a.	n.a.	1960–2013	1968–2013
Paraguay	n.a.	n.a.	1963–2013	1967–2013
Peru	n.a.	2007–12	1960–2013	1968–2013
Philippines	1976–2013	1998–2013	1960–2013	1968–2013
Poland	n.a.	n.a.	n.a.	1963–2013
Portugal	1967–2013	1967–2013	1960–2013	1969–2013
Puerto Rico	n.a.	n.a.	1960–2011	n.a.
Qatar	n.a.	n.a.	1963–2013	1968–2013
Romania	1997–2013	2011–12	1963–2013	1979–2013
Rwanda	n.a.	n.a.	1963–2013	n.a.
St. Kitts and Nevis	n.a.	n.a.	1963–2013	n.a.
St. Lucia	n.a.	n.a.	1963–2013	1968–2013
St. Vincent and the Grenadines	n.a.	n.a.	1963–2013	1968–2013
Saudi Arabia	n.a.	n.a.	1963–2013	1967–2013
Senegal	n.a.	n.a.	1963–2013	1968–2013

Table 3.4. Data Coverage for Global Interest Rates, Investment, and Saving *(continued)*

	Period			
Country	Short-Term Interest Rate	Long-Term Interest Rate	Investment	Saving
Seychelles	n.a.	n.a.	1976–2013	1969–2013
Sierra Leone	n.a.	n.a.	1963–2013	1967–2013
Singapore	1981–2013	1986–2013	1965–2013	1965–2013
Solomon Islands	n.a.	n.a.	1963–2013	1968–2013
South Africa	1967–2013	1980–2013	1960–2013	1960–2013
Spain	1967–2013	1967–2013	1960–2013	1969–2013
Sri Lanka	n.a.	n.a.	1963–2013	1967–2013
Sudan	n.a.	n.a.	1976–2013	n.a.
Suriname	n.a.	n.a.	1977–2005	n.a.
Swaziland	n.a.	n.a.	1963–2013	1968–2013
Sweden	1967–2013	1967–2013	1960–2013	1960–2013
Switzerland	1974–2013	1967–2013	1965–2013	1980–2011
Syria	n.a.	n.a.	1965–2010	1969–2010
Taiwan Province of China	1983–2013	1992–2013	1963–2013	1963–2013
Tanzania	n.a.	n.a.	1963–2013	1967–2013
Thailand	1977–2013	1996–2012	1960–2013	1968–2013
Togo	n.a.	n.a.	1963–2013	1968–2013
Tonga	n.a.	n.a.	1975–2013	n.a.
Trinidad and Tobago	n.a.	n.a.	1960–2013	1967–2013
Tunisia	n.a.	n.a.	1963–2013	1968–2013
Turkey	n.a.	n.a.	1960–2013	1963–2013
Uganda	n.a.	n.a.	1963–2013	1963–2013
Ukraine	2007–13	2007–13	n.a.	n.a.
United Arab Emirates	n.a.	n.a.	1964–2013	1968–2013
United Kingdom	1967–2013	1967–2013	1960–2013	1960–2013
United States	1967–2013	1967–2013	1960–2013	1960–2013
Uruguay	n.a.	n.a.	1960–2013	1967–2013
Venezuela	n.a.	n.a.	1963–2013	1966–2013
Vietnam	n.a.	n.a.	1963–2013	1967–2013
Zambia	n.a.	n.a.	1963–2013	1967–2013
Zimbabwe	n.a.	n.a.	1960–2013	n.a.

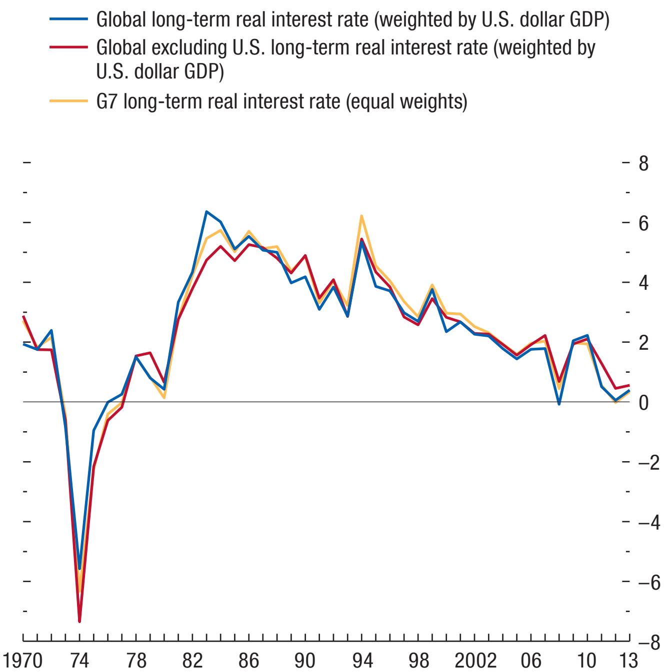
Source: IMF staff calculations.

United Kingdom, and the United States. Figure 3.3, panel 3, includes countries with data available starting in 1991. The global real interest rate includes data for Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, India, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The global cost of capital includes data for Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong SAR, the Netherlands, Spain, Switzerland, the United Kingdom, and the United States.

The principal component analysis in Figure 3.4, panel 1, includes data for Australia, Austria, Belgium, Canada, Finland, France, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The standard deviation of the real interest rate in Figure 3.4, panel 2, employs data for the same sample as the short-term global real rate in Figure 3.3, panel 1. The financial integration in Figure 3.4, panel 2, is constructed using data for Australia, Austria, Belgium, Canada, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

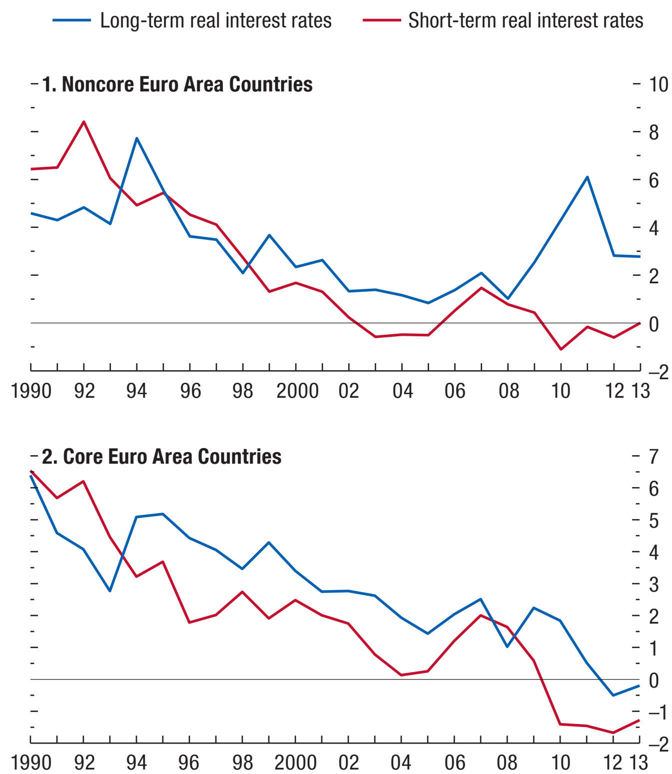
The global long-term real interest rate in Figure 3.17 is estimated using data for the same sample as in Figure 3.3, panel 1.

Figure 3.17. Global Long-Term Real Interest Rates
(Percent a year)



Sources: Bloomberg, L.P.; Haver Analytics; IMF, International Financial Statistics database; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.
Note: G7 comprises Canada, France, Germany, Italy, Japan, United Kingdom, and United States.

Figure 3.18. Convergence of Real Interest Rates in the Euro Area
(Percent)



Sources: Bloomberg, L.P.; Organization for Economic Cooperation and Development; and IMF staff calculations.
Note: Noncore euro area countries comprise Greece, Ireland, Italy, Portugal, and Spain.

Finally, the construction of global long-term real rates excludes those countries that have experienced a significant increase in default risk in the aftermath of the global financial crisis (that is, some noncore euro area countries), because analyzing the determinants of default risks goes beyond the scope of the chapter. It is possible to observe, in regard to the euro area, that whereas global long-term real rates have steadily declined for core euro area countries, they have recently increased for noncore euro area countries. In contrast, short-term real rates have decreased for both core and noncore countries (Figure 3.18).

Box 3.1. Saving and Economic Growth

The study of private saving behavior has long been central to economics because private national saving is the main source for the financing of investment. Within this research, the causal nexus between the saving rate and economic growth has been the subject of long-standing debate. This box argues that this issue is critical to the understanding of recent saving developments in the global economy. It presents evidence that the increased growth acceleration in emerging market economies during the early years of the 2000s contributed to the increase in their saving rates.

In principle the causality between saving and growth may run in both directions. For example, it may be reasonable to consider high saving a precondition for high growth, especially if domestic investment cannot be easily financed with foreign capital (Solow, 1956; Romer, 1986; Rebelo, 1992). In contrast, Modigliani and Brumberg (1954, 1980) predict that higher income growth causes the household saving rate to rise. The crucial assumption behind their argument is that over the life cycle, young, working generations save, whereas the old spend what they accumulated when they were young. In the presence of productivity growth, the young generation is richer than its parents were at the same age. If incomes are growing, the young will be saving on a larger scale than the old are dissaving, so that higher economic growth causes higher saving rates.

This prediction has been challenged on both theoretical and empirical grounds. Kotlikoff and Summers (1980, 1988) argue that life cycle saving (that is, saving for retirement) is only a small fraction of national saving.[1] Others argue that with more realistic demographic structures, the effects of productivity growth on aggregate saving could go either way.[2]

Recent studies of consumption behavior have revived the idea that higher growth may lead to higher medium-term saving. In the presence of consumption habits, households whose incomes rise (fall) will adjust their consumption only slowly to the new higher (lower) level—that is, the saving rate will temporarily rise (fall) (Carroll and Weil, 1994).[3]

This box revisits the saving-growth nexus from an empirical point of view, paying particular attention to the ability of growth to predict saving in the short to medium term.

First, the analysis addresses the direction of causality between saving rates and output growth in the short to medium term by looking at whether past real GDP growth and private-saving-to-GDP ratios help predict one another.[4] The results of this analysis suggest that increases in saving rates seem to predict lower (not higher) GDP growth in the short to medium term.[5] In contrast, increases in GDP growth seem to predict higher saving rates (Table 3.1.1).[6] Overall, the results imply that even though the causality between saving and growth runs in both directions, the observed positive correlation between growth and saving must be driven by the effects of changes in growth on saving rates, not the other way around.[7]

Next, the growth-saving nexus in light of recent experience in advanced economies and emerging market economies, and in Japan and China, is reviewed (Figure 3.1.1). The experiences of Japan and China are relevant because they have contributed significantly to the recent changes in saving behavior in

The authors of this box are Davide Furceri, Andrea Pescatori, and Boqun Wang.

[1]It is also possible that uncertainty about life span, health, and health costs makes older people cautious about spending their assets (Deaton, 1992).

[2]The presence of liquidity constraints or prudential saving in a life cycle model can, however, induce young generations to save even in the presence of income growth (see Kimball, 1990; Jappelli and Pagano, 1994) and may be another explanation for the positive correlation between growth and the saving rate.

[3]Technically, the introduction of consumption habits means that households want to smooth not only the level of their consumption but also its change.

[4]Technically, a Granger causality test, which is a test of predictive causality, is being performed. The specification used is the following:

$$s_{it} = \alpha_{i1} + \rho_1 s_{it-1} + \beta_1 g_{it-1} + \varepsilon_{it1},$$

$$g_{it} = \alpha_{i2} + \rho_2 g_{it-1} + \beta_2 s_{it-1} + \varepsilon_{it2},$$

in which s_t and g_t denote the five-year (nonoverlapping) averages of the private-saving-to-GDP ratio and real GDP growth, respectively. The inclusion of country fixed effects makes it possible to analyze deviations from countries' averages. The analysis is performed for an unbalanced sample of 45 advanced and emerging market economies from 1970 to 2013.

[5]The sign of the effect, however, turns positive when country fixed effects are excluded, corroborating the growth theories' prediction that higher saving rates lead to higher output (growth) in the long term.

[6]These results are in line with those obtained by Carroll and Weil (1994).

[7]Similar results are also obtained using a two-step generalized-method-of-moments system estimator.

Box 3.1 *(continued)*

Table 3.1.1. Saving and Growth: Granger Causality Tests

	Saving		Growth	
Variable	(1)	(2)	(3)	(4)
Lagged Five-Year Saving	0.534***	0.556***	–0.0748***	–0.0846***
	(0.034)	(0.033)	(0.020)	(0.020)
Lagged Five-Year Growth	0.269***	0.187**	0.0965**	0.128***
	(0.080)	(0.073)	(0.046)	(0.045)
Constant	0.0970***	0.101***	0.0317***	0.0263***
	(0.016)	(0.015)	(0.009)	(0.009)
Number of Observations	502	502	502	502
R Squared	0.902	0.899	0.432	0.333
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	No	Yes	No

Source: IMF staff calculations.
Note: Standard errors are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

advanced economies and emerging market economies, respectively.

Beginning with emerging market economies, panel 1 of Figure 3.1.1 shows that increases (decreases) in saving rates followed increases (decreases) in growth. In China, the increase in growth early in the first decade of the 2000s was followed by an increase in the saving rate of about 12 percentage points during 2000–07 (panel 2 of the figure). Conversely, the recent growth slowdown was followed by a decline in the saving rate.

In advanced economies, the decline in the saving rate was preceded by declines in growth rates (panel 3 of the figure). This trend is particularly evident for Japan (panel 4 of the figure), where lower growth after 1990 was followed by a reduction in the saving rate of about 10 percentage points. These experiences also suggest that the effect of growth on saving has been broadly symmetric (that is, it has been present both when growth increases and when growth decreases).

The results suggest that current saving rates are well explained by lagged saving rates and real GDP growth (Table 3.1.1, columns 1 and 2). This holds not only for a panel of countries at medium-term frequencies, but also at the country level at annual frequencies (the estimated equations typically explain about 90 percent of the variation in saving rates).[8]

This model is used to assess the extent to which perfect foresight about GDP growth would help predict saving rates. To this end, the evolution of saving rates since 2001 is predicted, conditional on observed GDP growth for the same period and the initial saving-to-GDP ratio in 2000. The results, presented in Figure 3.1.2, show that the predicted values closely follow the actual evolution of the saving rate.[9] For example, in the case of China, the saving rate between 2001 and 2007 increased by about 13 percentage points. The results suggest that about 11 percentage points (that is, 85 percent) of the actual increase can be attributed to the increase in GDP growth.

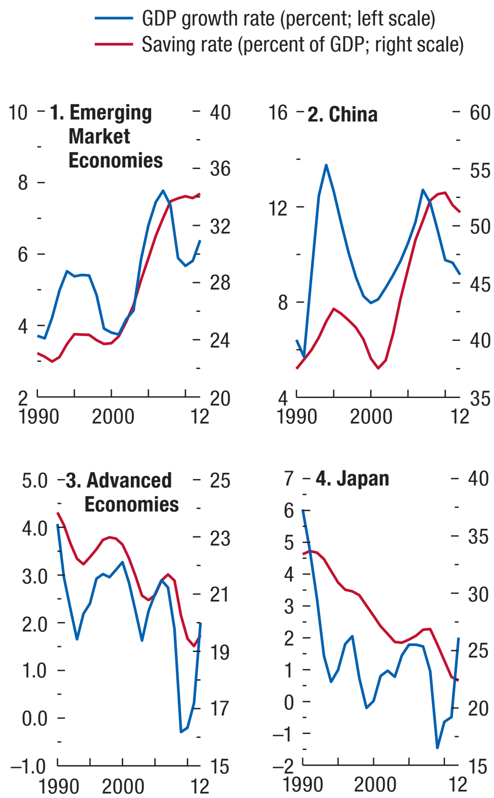
Finally, the analysis turns to some other possible determinants of saving in the short to medium term. In addition to growth, other factors may affect saving rates, including safety nets, financial constraints, and demographic structures. For example, these factors have been found to contribute to an explanation of *long-term* trends and cross-country differences in saving rates (IMF, 2013). Here, the exercise tests whether they also explain short- and medium-term movements in saving rates. For this purpose, the saving rate is regressed against its lagged value, GDP growth, and a vector of controls, including (1) the private-credit-to-GDP ratio (as a proxy for financial deepening), (2) the age-dependency ratio (defined as the ratio of the population ages 0–14 and 65 and older to the population

[8]It can be shown that this specification is equivalent to a reduced-form life cycle model with habit in which $s_t = \alpha_0 + \alpha_1 h_t^* + u_t$, and $h_t^* = \beta g_t + (1 - \beta) h_{t-1}^*$. In this equation, s_t is the saving-to-GDP ratio at time t, g_t is the growth rate of income at time t, and h_t^* is the unobservable stock of habit at time t. The reduced-form equation is then estimated using instrumental variables. See Furceri, Pescatori, and Wang (forthcoming).

[9]In particular, the average absolute ten-year-ahead forecast error of saving rates is only about 1.1 percentage points of GDP (that is, about 4½ percent of the saving-to-GDP ratio). Figure 3.1.2 presents the results only for selected countries. Similar results (available on request) are obtained for most of the countries in the sample.

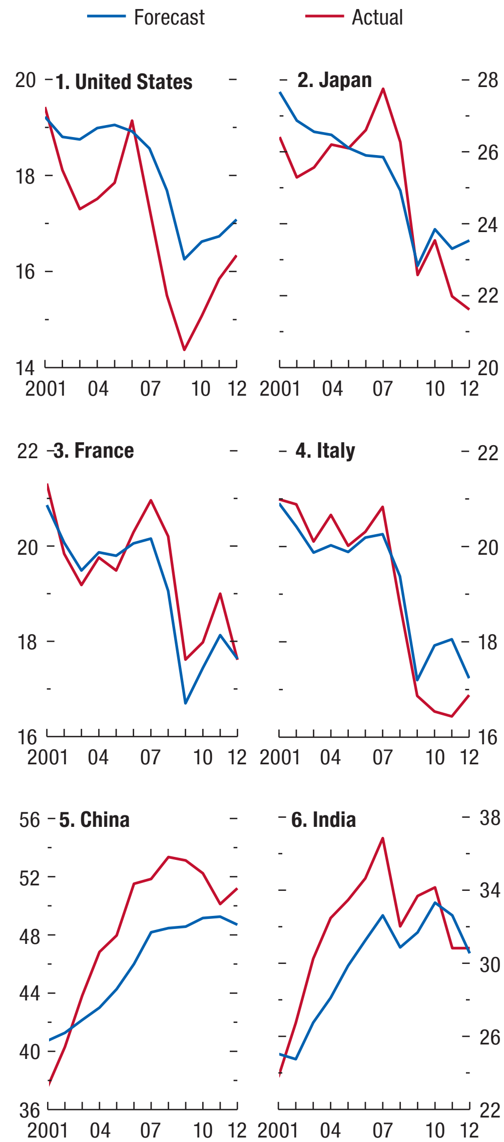
Box 3.1 *(continued)*

Figure 3.1.1. Saving Rate and Accelerations (Decelerations) in GDP



Sources: Haver Analytics; Organization for Economic Cooperation and Development; World Bank, World Development Indicators database; and IMF staff calculations.

Figure 3.1.2. Total Saving: Actual versus Conditional Forecasts
(Percent of GDP)



Sources: World Bank, World Development Indicators database; and IMF staff calculations.
Note: Forecast is conditional on observed GDP growth and the initial saving-to-GDP ratio observed in 2000.

in the 15- to 64-year-old age bracket), and (3) public health expenditure as a share of GDP (as a proxy for safety nets).[10]

The results show that even though the signs of the coefficients are as expected—increases in safety nets, financial deepening, and aging reduce saving—none of the control variables is statistically significant (Table

[10]In particular, the following specification is estimated:

$$S_{it} = \alpha_i + \rho_1 S_{it-1} + \beta_1 g_{it} + \delta' Z_{it} + \varepsilon_{it}.$$

Country fixed effects are included so that the effect of the explanatory variables on deviations of the saving rates from countries' averages can be analyzed.

Box 3.1 *(continued)*

Table 3.1.2. Determinants of the Evolution in Saving-to-GDP Ratios

	(1)	(2)	(3)	(4)
Lagged Saving Ratio	0.756***	0.763***	0.756***	0.756***
	(0.029)	(0.028)	(0.028)	(0.028)
GDP Growth	0.282***	0.302***	0.202*	0.203*
	(0.045)	(0.074)	(1.78)	(0.115)
Financial Deepening	–0.003	–0.005		–0.001
	(0.006)	(0.004)		(0.006)
Safety Nets	–0.161		–0.245*	–0.223
	(0.145)		(0.125)	(0.165)
Age-Dependency Ratio	–0.748			
	(2.772)			
GDP Growth × Financial Deepening		–0.001		–0.001
		(0.001)		(0.001)
GDP Growth × Safety Nets			0.003	0.002
			(0.002)	(0.002)
Average Short-Term Impact of Growth on Saving	0.282***	0.290***	0.350***	0.289***
Number of Observations	878	878	878	878
Adjusted *R* Squared	0.890	0.890	0.890	0.890

Source: IMF staff calculations.
Note: Country fixed effects are included but not reported. Clustered robust standard errors are in parentheses. The average (short-term) impact of growth on saving is computed as $\beta_1 + \vartheta\bar{Z}$, in which $\bar{Z}$ is the simple average of the control variable interacted with GDP growth. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

3.1.2, column 1).[11] A possible explanation for this result is that these variables differ significantly across countries and they move only gradually. Therefore, whereas they are important in explaining cross-country differences in saving rates, as shown in IMF (2013), they do not seem significant in explaining short- to medium-term movements within countries.

Another way through which some of these factors (namely, financial constraints and safety nets) may affect saving rates is by strengthening the response of saving to changes in income (for example, Jappelli and Pagano, 1994; Sandri, 2010; Furceri, Pescatori, and Wang, forthcoming). To test this hypothesis, interaction terms between growth and the set of control variables are included in the previous specification.[12] The results suggest that interaction effects are not statistically significant (Table 3.1.2, columns 2–4). Moreover, the inclusion of these variables (both as controls and as interaction terms) does not improve the fit of the regression and does not significantly affect the overall impact of growth on saving.[13]

In summary, the analysis performed confirms a strong relationship between the saving rate and growth at the country level in the short to medium term. Overall, life cycle motives coupled with consumption habits (and possibly prudential saving behavior) are plausible explanations for the observed saving patterns.

[11]These results are robust to the inclusion of time fixed effects, using a two-step generalized-method-of-moments system estimator and alternative specifications of the variables, such as (1) using both old and youth age-dependency ratios; (2) using a low-order polynomial to represent 15 population brackets: 0–4, 5–9, . . . , 65–69, 70+ (Higgins, 1998); and (3) using de jure measures of financial constraints (Abiad, Detragiache, and Tressel, 2010).

[12]In particular, the following specification is estimated:

$$S_{it} = \alpha_i + \rho_1 S_{it-1} + \beta_1 g_{it} + \delta' Z_{it} + \vartheta' g_{it} Z_{it} + \varepsilon_{it}.$$

[13]When the interaction terms are included, the average impact of growth on saving is given by $\beta_1 + \vartheta\bar{Z}$.

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