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A World with Higher Interest Rates

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1. EXECUTIVE SUMMARY

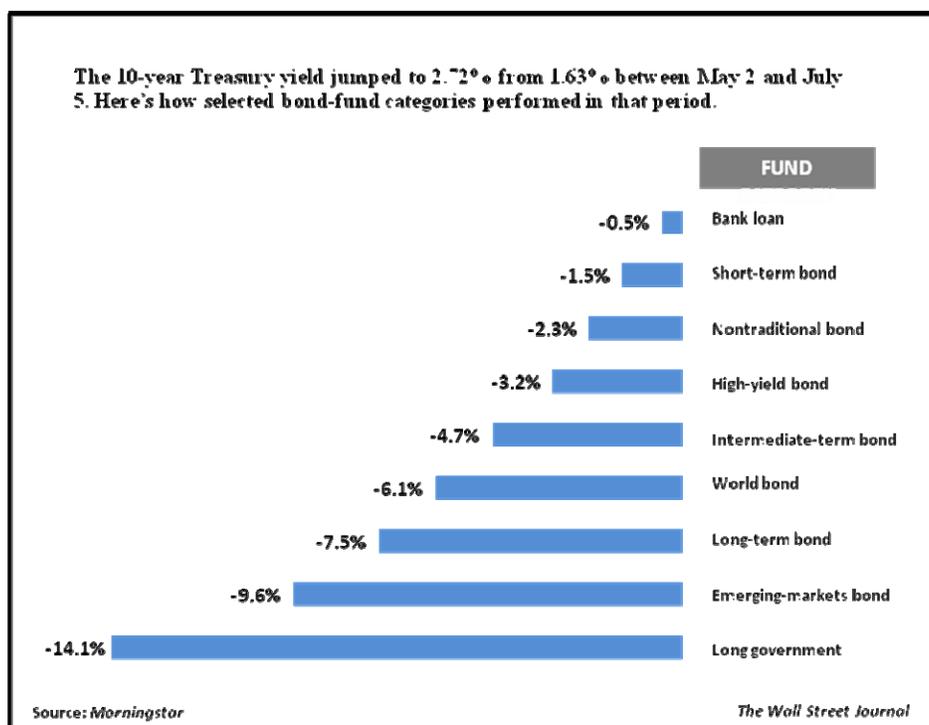
The past ten years have been characterized by extraordinarily low interest rates around the industrialized world. These rates have persisted in the wake of the recent economic crisis, as central banks have loosened monetary policy significantly. While a dramatic increase in interest rates over the near-term is unlikely, speculation is rife that such an increase is not only plausible, but could unfold rather quickly, impacting virtually every major sector of the economy.

This study attempts to take a more cautious and global approach in examining one possible future path of interest rates and their impact on selected sectors. Based on an analysis of global savings supply and investment demand, we suggest that a return to higher real rates could happen through the savings supply channel. In addition, higher inflation could result in a contractionary monetary policy and higher nominal rates.

This report analyzes some of the consequences of a rise in interest rates. One heavily impacted area would be debt service for industrialized governments. Here, we identify rollover risk as a key factor for determining the size and timing of the debt service problem in the near future. Our findings suggest that countries with low debt maturity would be more prone to debt service problems than countries with long maturity debt.

A high interest rate environment would create sets of winners and losers across the global economy. The U.S. Social Security system trust funds, for example, could avoid projected bankruptcy through higher interest income, while consumers with variable rate debt, such as students with private loans, would be hurt significantly. In addition, corporate pension plans would benefit from rising interest rates, while equity markets would suffer.

To understand how tightly the financial markets are tethered to interest rates, it's helpful to look at May 2 to July 5 of this year.



A 109 basis point rate increase caused a 14% capital loss. Consider how the markets would fare in the event interest rates were to rise by five percent!

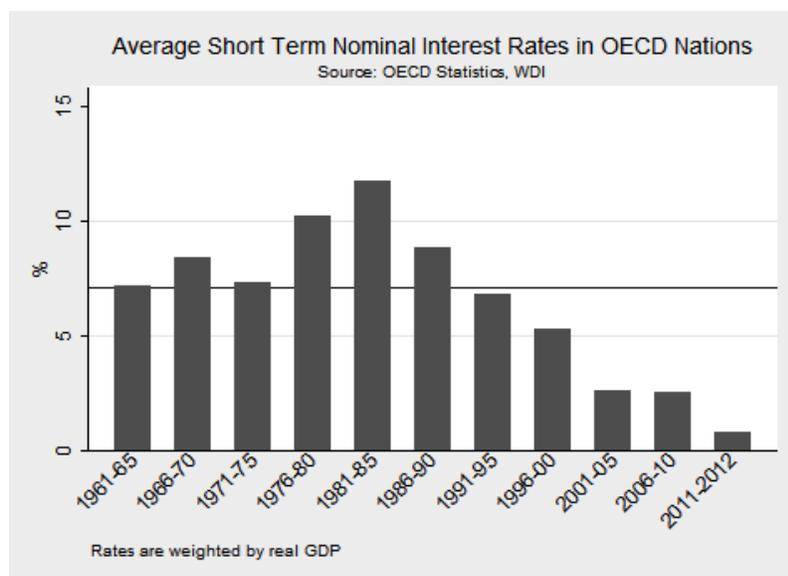
Among the vast cohorts of losers – and a few winners – would be nations whose governments have taken on enormous debt, like the U.S., where outstanding public debt soared from \$5.7 trillion in 2001 to \$16.3 trillion in 2012. The reason is clear: rising interest rates would kick up borrowing costs, with the problem most severe in the U.S. where the average maturity for debt – lower than in any other industrialized country in the world – would trigger the need for quick refinancing. A five percent cent spike in interest (to the 7% average of the last 30 years) would force the U.S. government to commit as much as 25 percent of its revenues to debt service, prompting the need for draconian spending cuts. Foreign holders of U.S. debt such as the Chinese Central Bank would also suffer since the bonds they own would lose significant value.

2. WORLD INTEREST RATES

SHORT TERM NOMINAL RATES

Figure 1 shows the post-war weighted averages of short-term nominal interest rates across OECD nations, where real GDP is used as the weight. As we can see, short-term nominal interest rates in 2006-10 remained at an average of 2.54%, which is much lower than the 7.1% overall average. The 1981-85 period was characterized by the largest short-term interest rates. The 1976-80 and 1986-90 periods were characterized by high rates (10.24% and 8.87%, respectively). The 2011-12 period has had even lower short term nominal rates as central banks have supported the economy through massive liquidity measures.

FIGURE 1

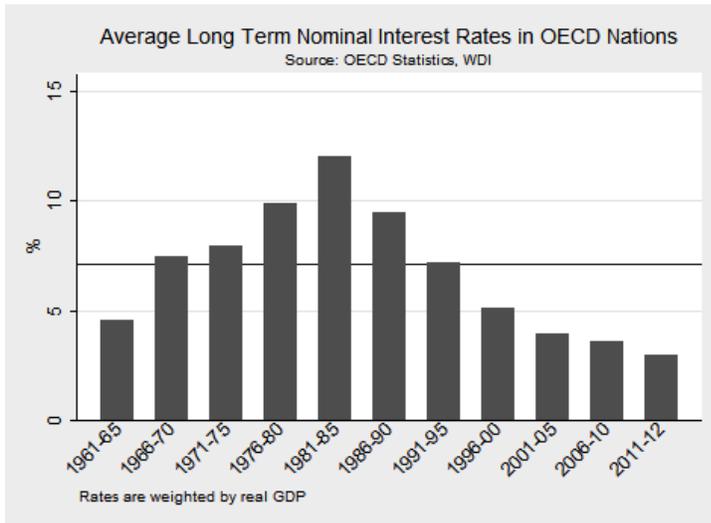


Technical Note: Using the concept of global interest rates in our analysis is warranted because of the globalized nature of capital flows. In recent years, such capital flows have helped lower cross-country variation in interest rates significantly.

Current Interest Rate Environment is Unique in History

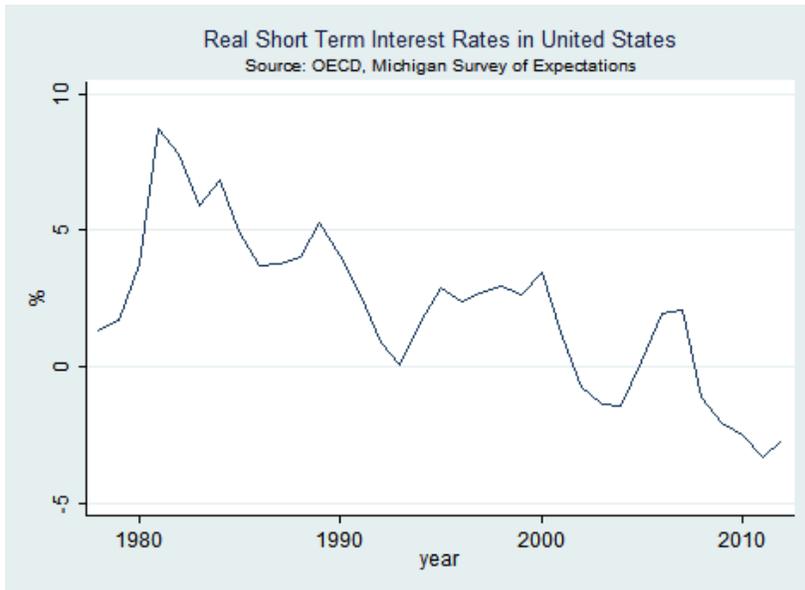
The low levels of nominal interest rates are a phenomenon that extends to long-term rates, as well. Long-term rates were highest in 1981-85 (12.05%), and lowest in 2001-05 (3.91%) and 2006-10 (3.54%). The 2000s decade was characterized by long-term rates that were around 60% of the average rate (7.12%) for 1961-2010.

FIGURE 2



This analysis holds for real rates as well. We confirmed our analysis by using the Michigan survey to create a series of ex-ante real interest rates for the United States. We found that short-term real interest rates peaked in 1981 (8.71%), remained high until 1985, and have declined since then, reaching their lows in the late 2000s. Between 2009 and 2011, short-term real rates have been around -2%. Figure 3 shows this trend in detail.

FIGURE 3



Both real and nominal interest rates (long- and short-term) in the 2000s have been lower than any other post-war period.

3. INTEREST RATE RISES IN NEAR FUTURE

HOW COULD IT HAPPEN?

Both real and nominal interest rates in the past decade have been unusually low compared to all other post-war periods. If this low interest rate environment were to reverse, it would likely occur through either a rise in inflation expectations or an increase in real interest rates themselves. We first look into potential causes of a rise in inflation expectations.

Loose Monetary Policy

When the central bank feels aggregate demand is too low and the output of the economy is below its potential, it can use monetary policy to introduce larger amounts of liquidity into the economy. In addition, it can promise to increase the growth of money in the future, thus raising inflation expectations.

Negative Supply Shocks

A second major cause of inflation and inflationary expectations comes from a substantial rise in the cost of important goods and services. For example, during the oil crisis of the 1970s, oil-importing countries like the United States were at the mercy of the OPEC nations. Given the ubiquity of oil in consumption portfolios, this led to a higher inflation rate.

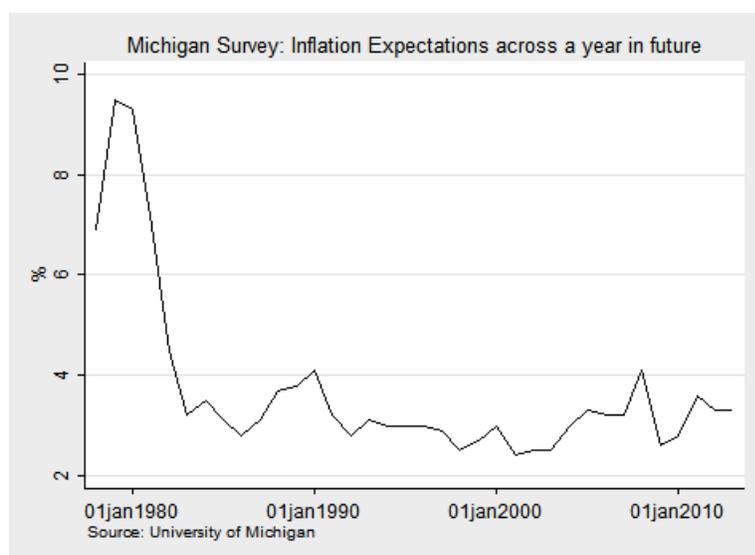
What does inflation expectation data tell us?

Inflation expectations literature uses three types of surveys. The first looks at consumers themselves. The Michigan Survey of inflation expectations is the largest and most comprehensive survey of this type. The second are surveys of academic economists who judge inflation risks for the future. The Livingston Survey conducted by the Philadelphia Fed is the

largest survey of this type. Finally, market participants including market economists and traders, are surveyed by the Philadelphia Fed in its Survey of Professional Forecasters (SPF).

Figure 4 shows inflation expectations data from the Michigan Survey. Inflation expectations peaked around 8-10% in 1979-80, but came down as a result of former Federal Reserve Chairman Paul Volcker's deflationary policies. Expectations have remained low (below 4%) since 1981. The Livingston Survey of academic and professional economists finds that no segment of the population is expecting large inflationary movements in the next few years.

FIGURE 4



There are two possible reasons for this. One is the slow growth environment that the world economy (and the American economy) face today. Many academics and professional forecasters believe that increasing money supply in a recessionary environment might lead to higher real output. Secondly, given the reputation of central banks, market participants believe the central banks have a strong lever if inflation starts spiking again.

In sum, inflation expectations are anchored at low levels, even after continued expansion of monetary base and loose monetary policy. More plausible scenarios of rising inflation involve external supply shocks as immediate triggers. The impact of loose monetary policy, although not

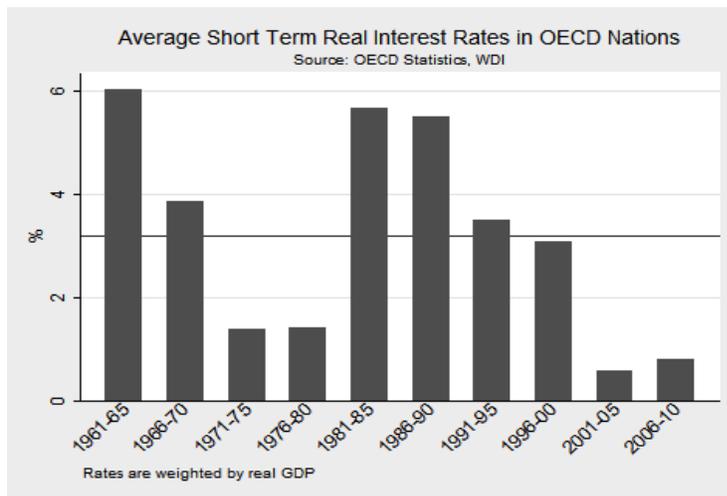
inflationary in the early stages, may become a factor after external cost shocks produce inflationary pressure.

WHAT ABOUT REAL RATES?

HOW COULD THEY RISE?

Real interest rates are determined through the interaction between demand for investment funds and supply of investment funds (savings). Figure 5 shows real interest rates for OECD nations in the post-war period.

FIGURE 5

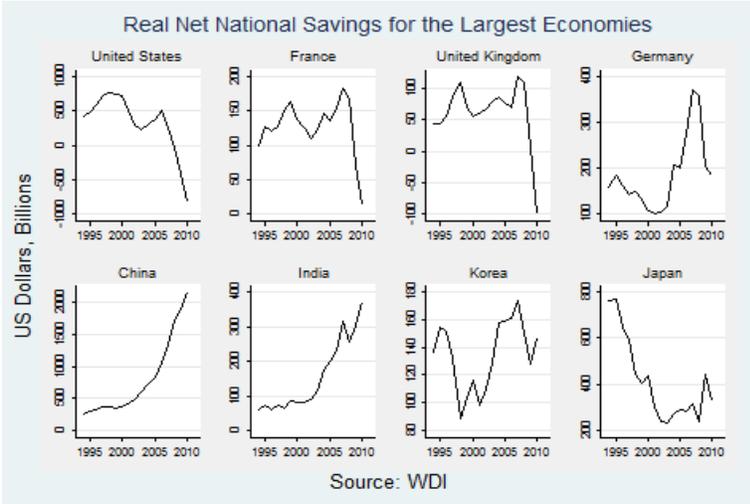


When supply of savings goes down in a closed economy, real rate rises. Supply of savings comes from both the private and public sectors. Although the debate today focuses a lot more on public sector savings, a proper analysis of savings supply and its effect on real rates must look at both public and private savings.

Figure 6 shows an obvious distinction between the trends for industrial nations and emerging nations. The United States, France, the United Kingdom and Japan have significantly lowered their net national savings in the past decade. Net national savings in the U.S. fell to negative levels by 2010, when its savings deficit was as large as 28% of the world's net savings. On the other hand, China, India and Korea

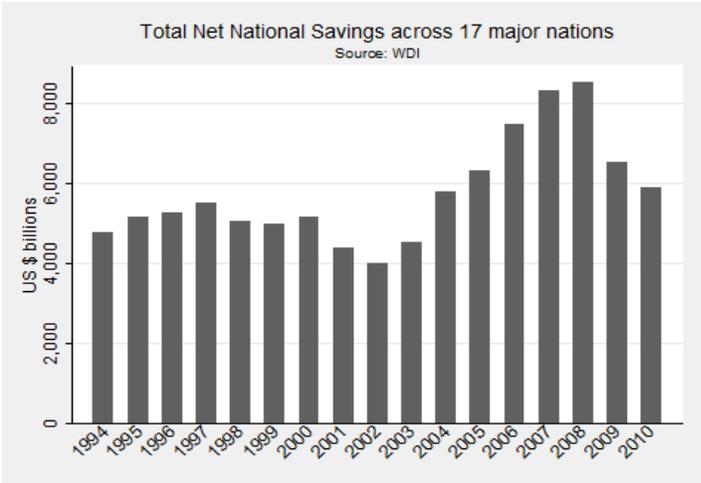
increased their savings, and became net capital exporters. As of 2002, China accounted for 24% of total net national savings.

FIGURE 6



Due to data limitations, we do not have a measure of world net savings. So, we added the total net savings of the 17 largest nations with complete data. Figure 7 shows this measure since 1994.

FIGURE 7



We see that total savings in these countries rose significantly in the 2002-2008 period and fell after that. This chart suggests why real rates may have remained low in the 2000-2008 period, and provides some warning signs of possible real rate increases in the near future, as savings have fallen since 2008. The big question is this: is the latest decline in net national savings across major nations cyclical, or evidence of a more permanent trend?

These graphs give credence to theories that the low real rate environment of the 2000s was caused by savings increases in emerging nations. Federal Reserve Chairman Ben Bernanke in 2005 suggested that a global savings glut, which involved a growth in savings over investment in Asian nations, put downward pressure on real interest rates. According to this idea, Asian nations were looking for safe places to invest, given their losses in the 1997-98 financial crisis. Hence, they increased their investment in U.S. securities, including government and corporate debt.

Huge imbalances in savings and balance of payments accounts suggest another important factor. Savings in China, India and Korea now affect world interest rates. Hence, for the savings supply to raise world real interest rates lower savings by OECD nations is not enough; it must be combined with lower savings among emerging nations to raise real world rates.

COMPONENTS OF WORLD SAVINGS

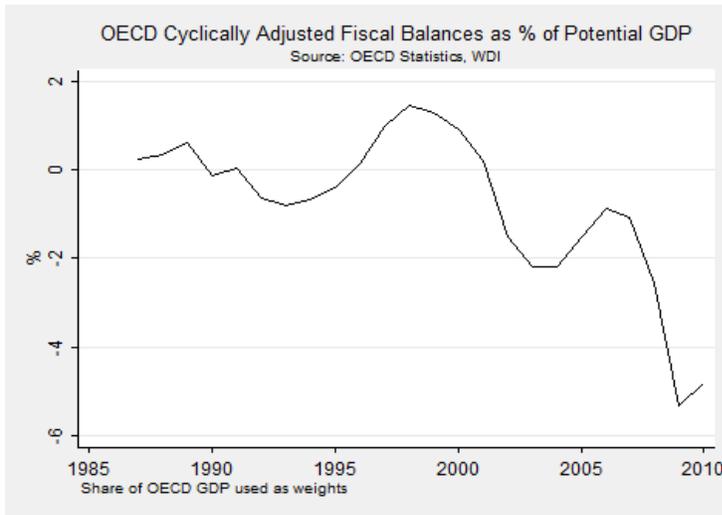
PRIVATE VERSUS PUBLIC SAVINGS

The supply of savings comes both from the private and public sectors. Although the debate today focuses on public sector savings, a proper analysis of savings supply and its effect on interest rates must look at both public and private savings.

Public Savings

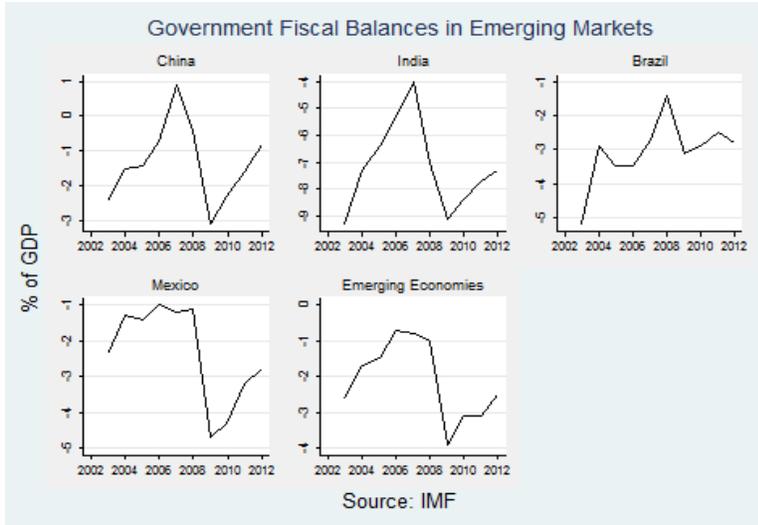
We separate OECD and emerging market fiscal balances. As Figure 8 shows, OECD fiscal balances dropped after 2007 to 5% deficit to potential GDP in 2010.

FIGURE 8



Emerging economies do not fare much better. Figure 9 shows the fiscal balance in China, India, Brazil and Mexico alongside a total fiscal balance for all emerging economies.

FIGURE 9

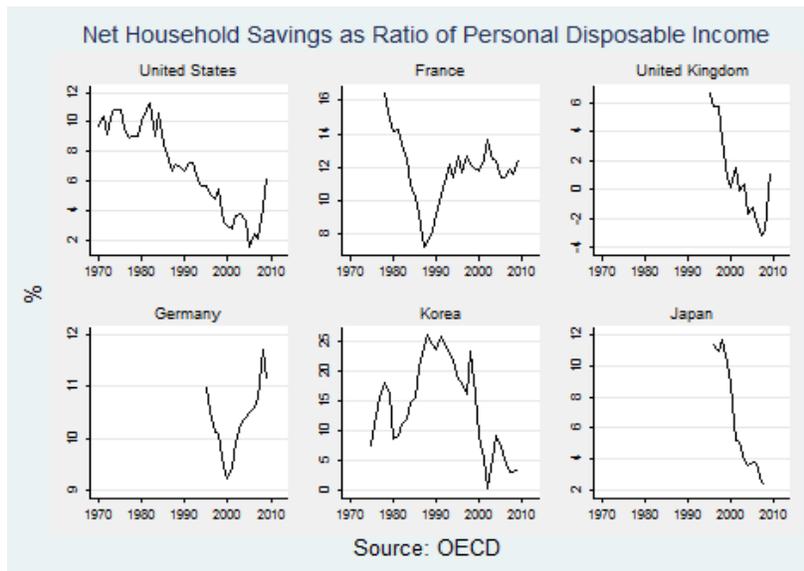


Clearly, this is not an encouraging picture for global savings. It suggests private savings will have to rise to keep world real interest rates at today's levels.

Private Savings

Data on private savings is harder to collect since much of it is not publicly available. Hence, we look at net household savings rates. As private savings includes both household and corporate savings, we are assuming that corporate savings trends are stable. Figure 10 shows net household savings rates for six of the largest OECD economies.

FIGURE 10



As we can see, net household savings rates in the largest OECD nations have fallen significantly since 2000. We do not have data on private savings in emerging nations. All of the above trends, however, suggest that emerging nation private savings have increased over the past decade, accounting for a much larger portion of world savings. Given the downward trend in total worldwide savings since 2008, the pressure is on private savings in emerging nations to offset the greater “dis-savings” in OECD nations.

Emerging Market Private Savings

As countries like China develop, it is inevitable that consumption becomes a larger part of their economies. Currently, China's domestic consumption is only 40% of its GDP, which is among

the lowest ratios for the largest economies. Since 2004, the government has professed to better balance its economy so that it grows not only on the back of exports and investment, but domestic consumption, as well (Lardy, 2006). This has been manifested in slow but sure changes in exchange rate policy, as the dollar to Yuan exchange rate fell from 8.25 in 2000 to 6.75 in 2010.

In the future, private savings in countries like China will decrease relative to the size of their economies. Although the actual level of savings may still go up if economic growth is robust, the chance of significant growth in actual savings levels is low. When a slowdown in private savings in emerging markets occurs, total savings around the world could sustain a negative shock, exacerbating problems in fiscal balances. It is within this scenario that a rise in real interest rates seems more likely.

One Possible Scenario: Budget deficits in advanced nations remain high. Consumption in China and other emerging economies rises and savings decrease. At a certain point, these two trends put strong downward pressure on worldwide savings. This puts upward pressure on real interest rates.

Summary

Interest rates could rise in the near future due to a jump in inflation expectations or a rise in real rates.

Inflation may rise due to supply shocks and inflation expectations could rise further due to loose monetary policy.

The more likely scenario includes the effect of savings on real rates. As public savings fall further and private savings growth slows in emerging markets, real rates may rise.

For real rates to rise, the decrease in savings must offset the decrease in demand.

4. IMPACT OF RISE IN INTEREST RATES

In the following sections of this report, we assume that nominal interest rates rise by 500 bps in 2013, and stay that way in the near term. We use this assumption to simulate how various sectors in the world economy, and the U.S. economy in particular, would be affected by an increase in rates. We also assume that interest rates rise by the same amount across countries. Finally, we assume a parallel shift in yield curves.

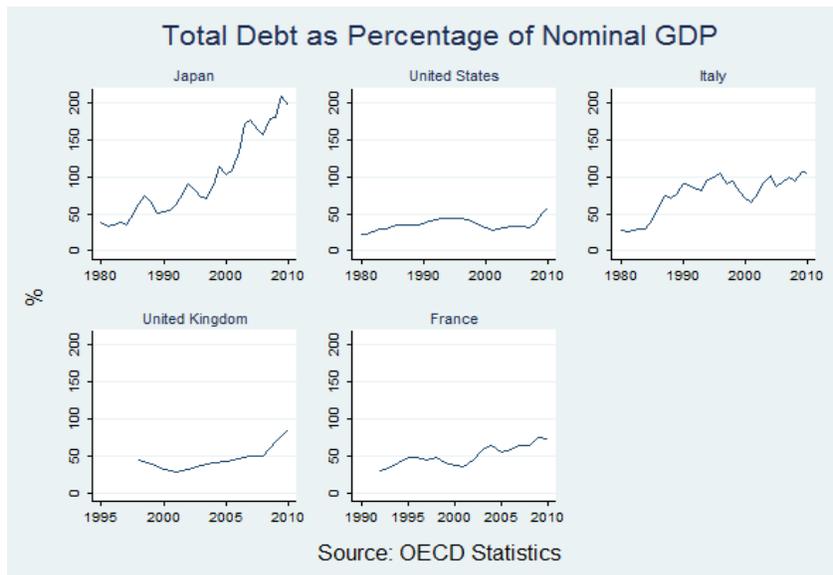
IMPACT ON DEBT SERVICE

RELATIVE RISKS

This section deals with the impact of an increase in interest rates on government debt (including government financing such debt) on current holders, and on sales of debt instruments. Figure 11 shows that debt has increased as a percentage of nominal GDP for each of the world's five largest debtor nations: Japan, the United States, Italy, the United Kingdom and France.

Japan provides a particularly scary example. Currently, debt service amounts to 24% of the national budget. If rates were to rise by 5 percentage points, debt service would consume 30% of the Japanese budget.

FIGURE 11

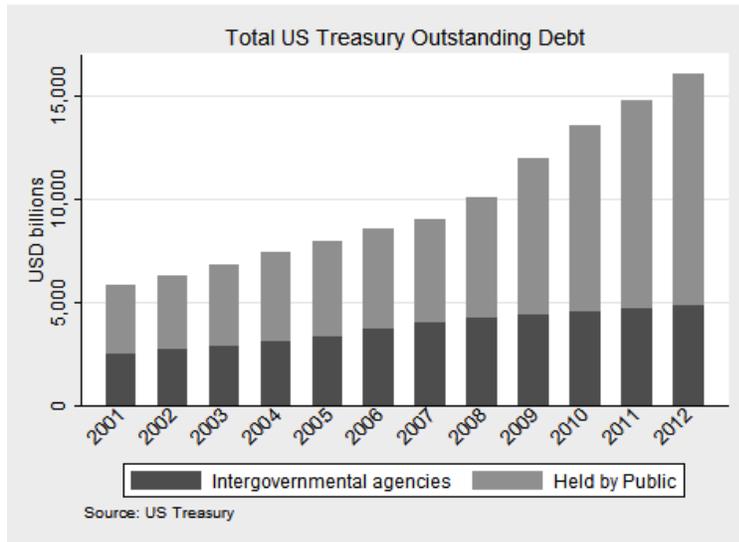


This trend is true for the whole of the OECD, as well. Total OECD central government debt to GDP ratio reached an all-time high of around 70% in 2010. In this section, we focus initially on government debt, and prospects for debt service after interest rate increases in the U.S., Italy and the United Kingdom.

UNITED STATES

The total debt outstanding for the United States (including debt owned by intra-governmental agencies) soared from \$5.7 trillion in 2000 to over \$16 trillion in 2012. Figure 12 shows this development.

FIGURE 12



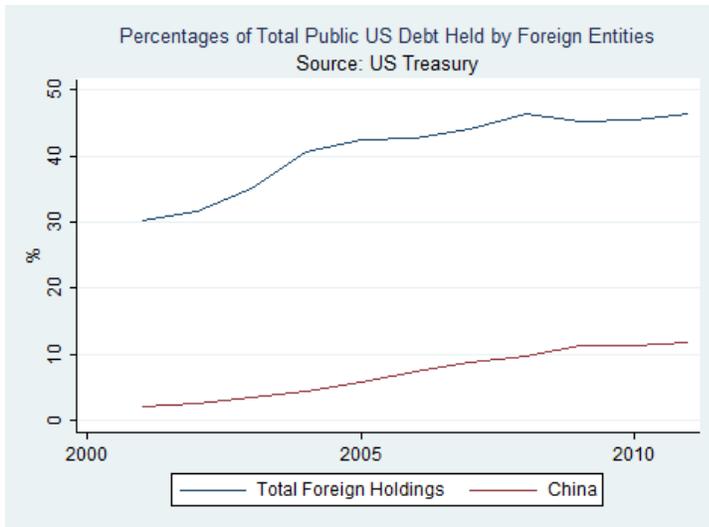
Almost all of this increase occurred through public debt, which rose from \$3.34 trillion in 2001 to \$11.01 trillion in 2012. Debt held by intergovernmental agencies rose from around \$2.5 trillion in 2001 to \$4.9 trillion in 2012.

The U.S. faces two fundamental issues surrounding its outstanding debt: ownership and term structure.

Composition of Debt Ownership

Between 2000 and today, the composition of debt holdings has changed significantly. The ratio of debt held by foreign owners to total publicly held debt rose from 30.1% in 2000 to 46.2% in 2010. Amidst all the controversy over foreign debt instrument purchases, it is worth remembering that around 55% of U.S. debt is still held by American interests. One drastic change has been the massive expansion of China's stake in U.S. debt.

FIGURE 13



While a majority of the debt is still held by domestic investors, the recent growth in debt holdings has come from China primarily, alongside Russia, Brazil and oil exporting nations. Finally, Caribbean tax shelter nations account for a significant portion of treasury debt holders today, although these holdings may actually be owned by third-parties.

Schedule of Debt

The schedule of debt payments is crucial to assessing the severity of debt concerns. As of January 2011, 59% of the United States' marketable debt matures before 2016. Table 1 shows the size of Treasury securities outstanding as of January 2011. A majority of U.S. outstanding debt is in the form of notes, which have a maturity of between one and ten years.

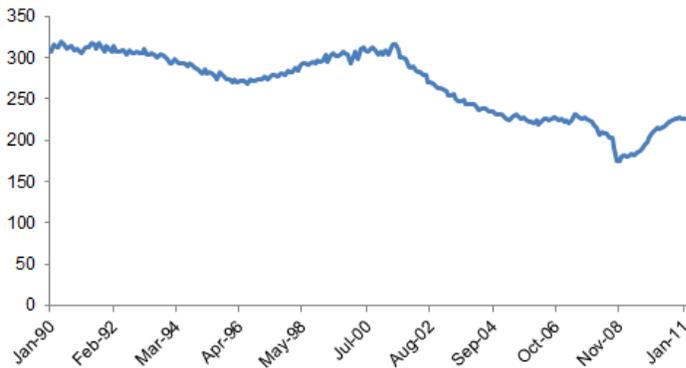
TABLE 1

Type	Debt Held by Public
Bills	1,692,740
Notes	7,261,197
Bonds	1,223,858
TIPS	835,413

Next, we look at how the average maturity of debt has changed since 1990. As Figure 14 shows, there was a dramatic decline from a high of 312 weeks in September 2000 to 174 weeks in October 2008. In addition, the average maturity for the United States is lower than any other industrial country in the world.

FIGURE 14

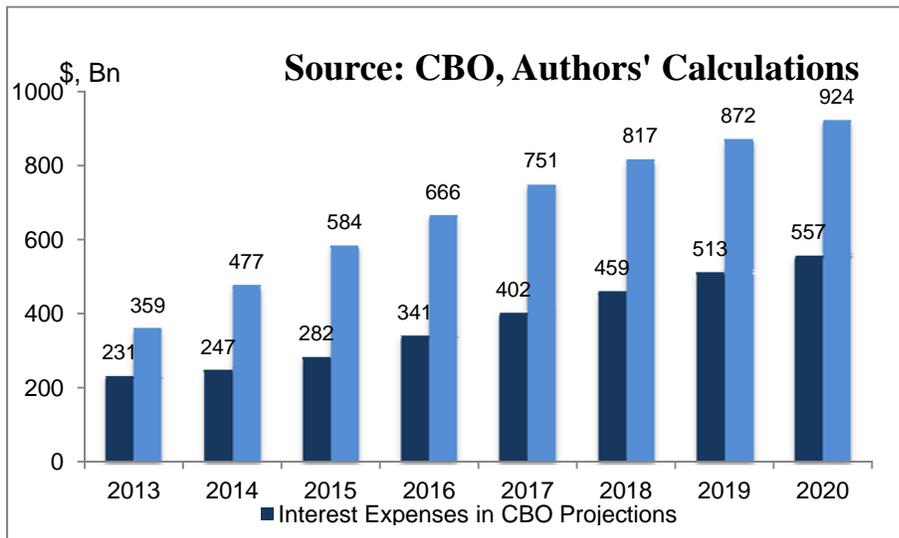
Source: Hamilton and Wu (2012)



Simulation Results

We simulate how debt service would change if interest rates on new U.S. debt rose by 500 basis points. We use predictions of interest expenses from the CBO, and compare them to predictions and our own simulation, shown in Figure 15.

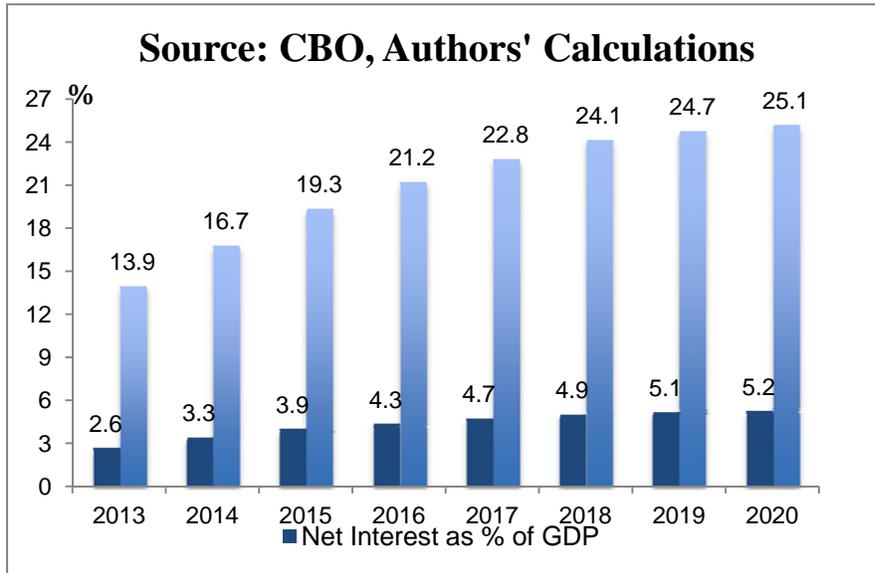
FIGURE 15



Interest expenses rise much earlier than CBO projections, to an alarming \$924 billion by 2020. This would lead to a more than a \$1.1 trillion rise in net present value expenses between 2013

and 2020 compared to current CBO projections. We also determine how large these expenses are relative to GDP by using CBO’s GDP projections. Only projections to 2018 are provided. We extend these projections to 2020 by extrapolating the CAGR between 2012 and 2018.

FIGURE 16



The U.S. government will have to devote up to 5.2% of GDP towards interest expenses. Even more problematic is that it may have to devote a colossal 25% of its revenues to meet interest expenses.

This will result in deeper problems. The extra interest expenses will have to be paid for in some way, unless we assume they will be added to debt again. For this to happen, there should be a large increase in net revenue through either tax increases or spending cuts. Mandatory spending – including Social Security, Medicare, Medicaid and interest – would be harder to change in the medium term. This category is predicted to hover between 13% and 15% of GDP between 2012 and 2022. The burden thus falls on discretionary spending.

As of 2011, total non-discretionary spending was 9% of GDP, of which defense contributed 4.7% and non-defense spending 4.3%. The CBO predicts defense spending will fall to 3% of

GDP by 2022 and non-defense spending to 2.6%, as increased debt service creates pressures to pursue austerity programs that cut spending.

In our simulation, we create two scenarios: one where both defense and non-defense discretionary spending are reduced equally, and the other where defense spending is not cut beyond CBO estimates. Hence, discretionary non-defense spending takes the full burden of meeting the extra interest expenses in the second scenario.

Figure 17 below shows that under the second scenario, by 2020, discretionary spending ought to be cut to \$119 billion from the CBO estimate of \$486 billion. If one looks at the current composition of non-defense discretionary spending, it is difficult to see how such a cut could be feasible.

FIGURE 17

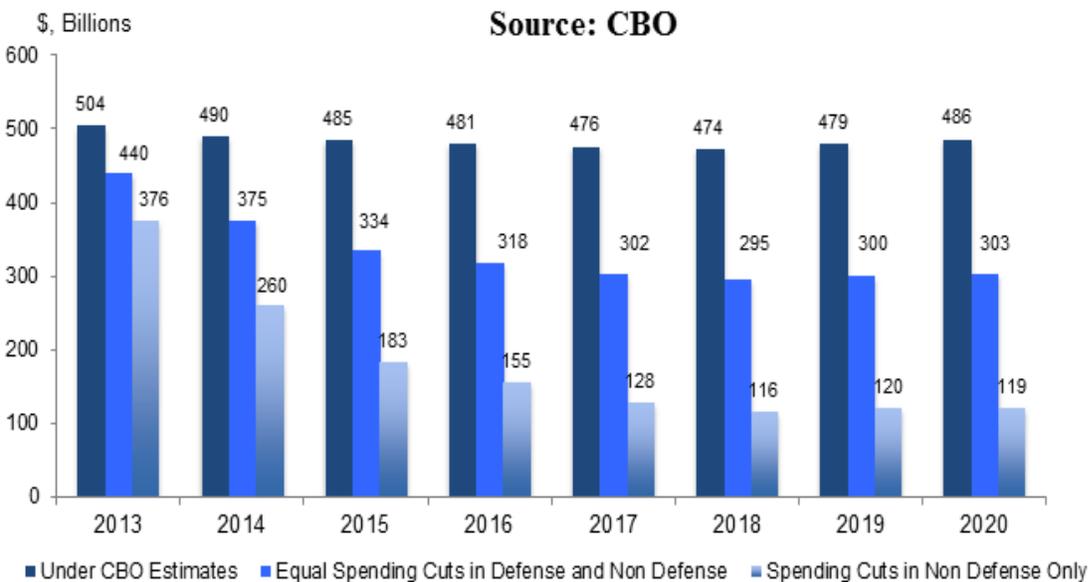
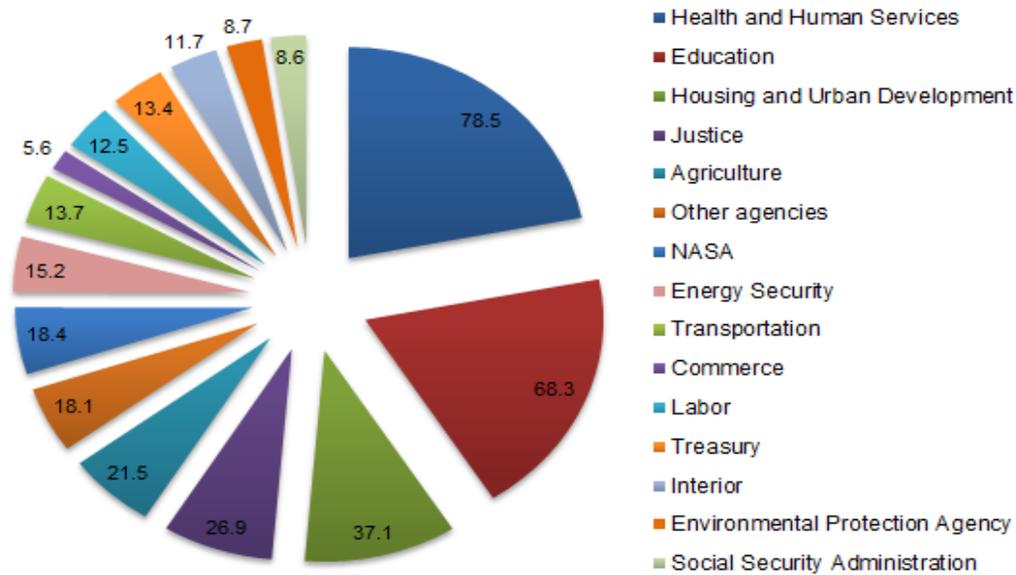


Figure 18 shows the variety of programs and their FY 2013 budgets. As we can see, health and education require more than \$119 billion. Non-defense spending cuts alone cannot meet extra interest expenses, suggesting that spending cuts may have to be split between defense, non-defense, mandatory spending, along with revenue increases.

FIGURE 18

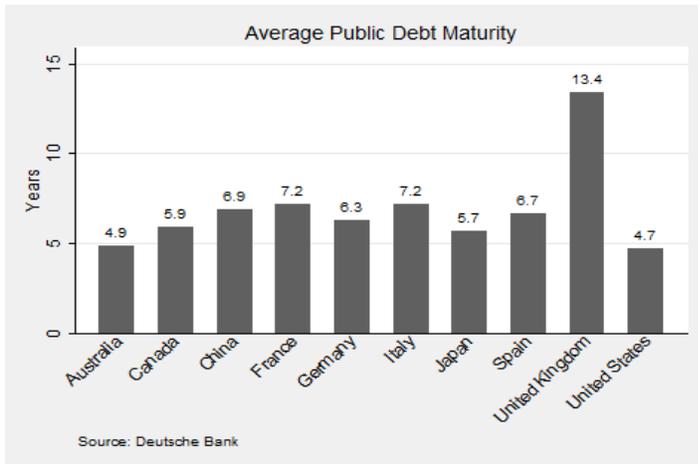


Even in such a case, the problems created by the increased debt service would be very painful. There is a real likelihood that such a level of debt service with its draconian cuts in spending would severely strain the social fabric.

UNITED KINGDOM

The United Kingdom's debt has been rising similarly, though Figure 19 shows its debt has a uniquely large maturity structure compared to those of other advanced nations. One reason is that British pension funds are large customers of the long maturity U.K. debt. Figure 19 also suggests that rollover risk may be less serious for the United Kingdom than for most other advanced nations.

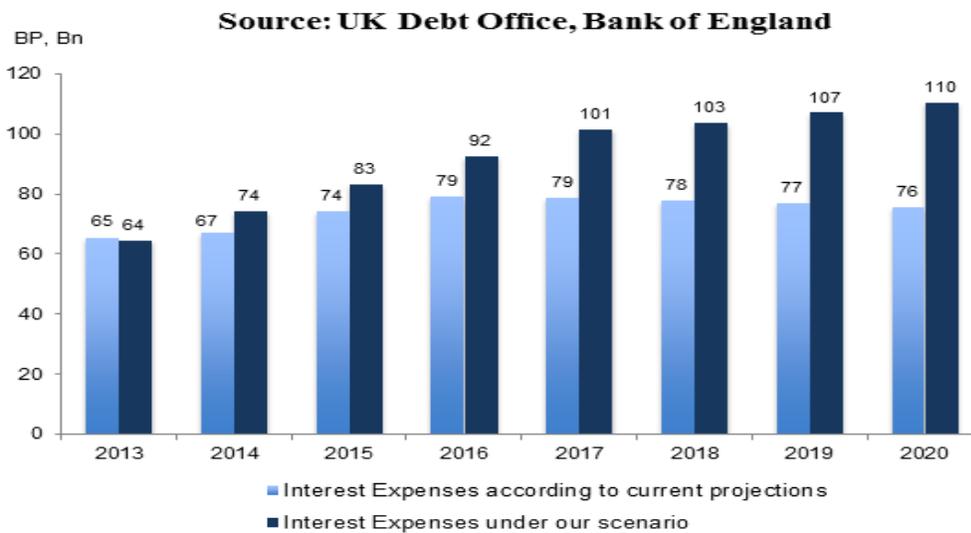
FIGURE 19



Simulation Analysis

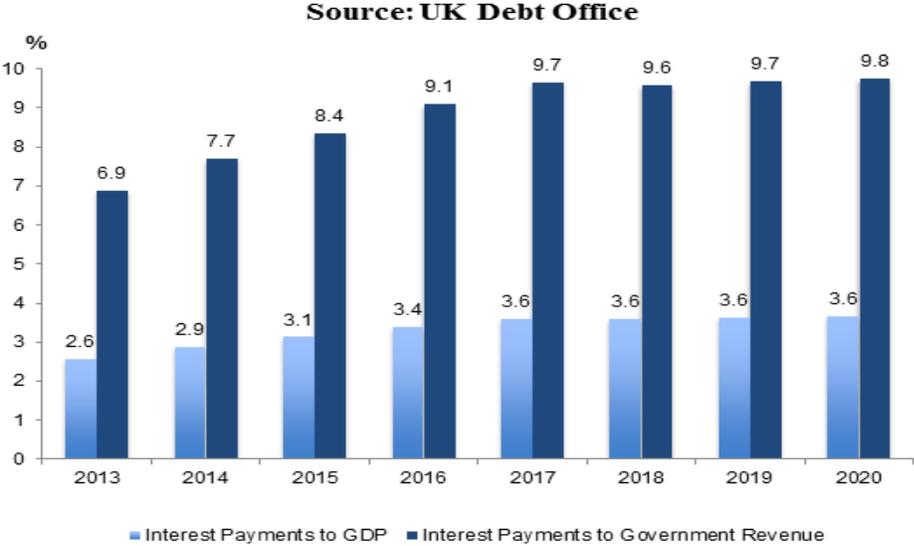
We do a similar simulation analysis for the United Kingdom, assuming the yield curve moves up 500 bps. Then we calculate actual interest expenses between 2013 and 2020, using predictions from the U.K. government to make comparisons with our simulation.

FIGURE 20



As Figure 20 shows, interest expenses rise from around 65 billion pounds today to around 110 billion pounds in 2020. This is somewhat larger than the 76 billion pounds projected in the outlook, but very small compared to the U.S.

FIGURE 21



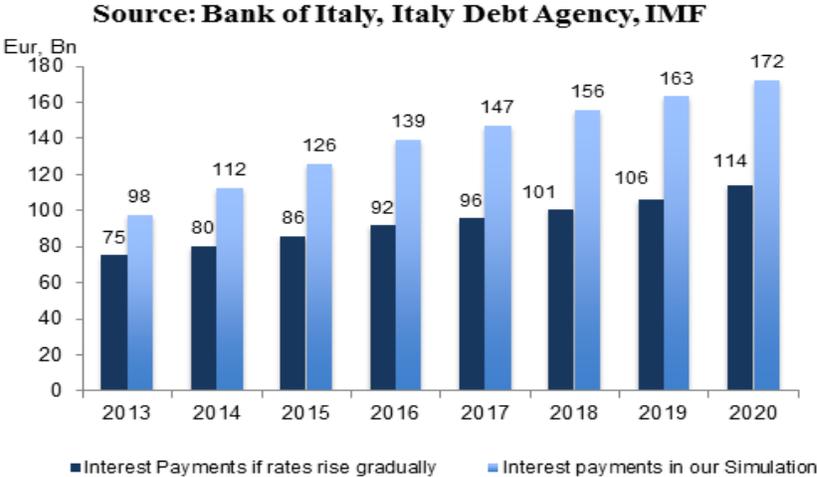
Overall, the United Kingdom is least exposed to rollover risk among advanced nations because its debt is locked in at low fixed rates and the maturity is large (average weighted maturity of around 13 years). Hence, even if interest rates on new issuances rise, they will have a smaller effect on actual debt service.

ITALY

We perform the same simulation analysis for Italy, which has the third largest debt market in the world. Because we could not find any formal predictions for interest rates, we assume they rise to the level in our simulation (500 bps), then increase gradually between 2013 and 2020. We then compare our simulation to this baseline.

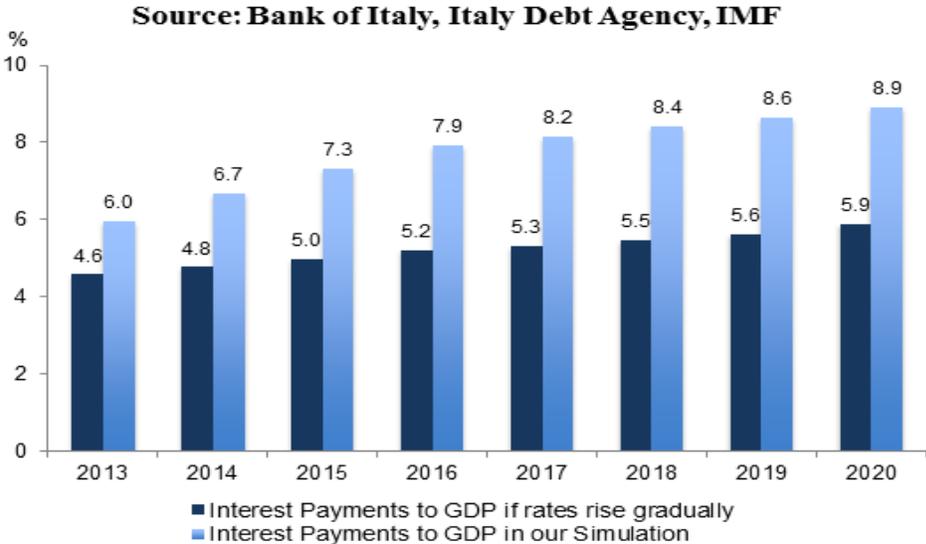
Figure 22 shows the interest expenses projection between 2013 and 2020. We see clearly how expenses almost double to around 172 billion euros by 2020, instead of the 114 billion in the baseline case.

FIGURE 22



Interest expenses would jump to around 8.9% of GDP, compared to 5.9% of the baseline, as shown in Figure 23.

FIGURE 23



Our analysis suggests that the Italian government would be under severe duress if such a rise occurred. Contributing around 9% of GDP to debt service in a nation burdened with an aging population appears to be a recipe for even larger social problems.

Impact on Debt Service: Summary

Rising rates would hurt the United States significantly because of the need to roll over debt relatively soon, thus creating higher interest expenses.

Italy would face a similar problem, and would be further hurt by already high interest payment levels.

The United Kingdom would have a smaller debt service problem due to its longer maturity debt profile.

4.B. IMPACT ON GOVERNMENT DEBT HOLDERS

Bond-holders would experience an immediate loss under higher interest rates since their instruments would become less valuable. If interest rates on government bonds rose by 500 bps, the bonds would become cheaper as they would have to compete with bonds offering much higher interest rates. Here, we focus on owners of United States government debt.

An increase in interest rates would make any bond-holder a loser, especially if they need to sell the bonds before maturity. On the other hand, investors who plan to keep their bonds until maturity would only lose out on the opportunity cost of the higher interest rate paid out on new bonds in the market. Hence, the risk profile of the debt holder would affect their decision to stick it out, or dump their U.S. government debt.

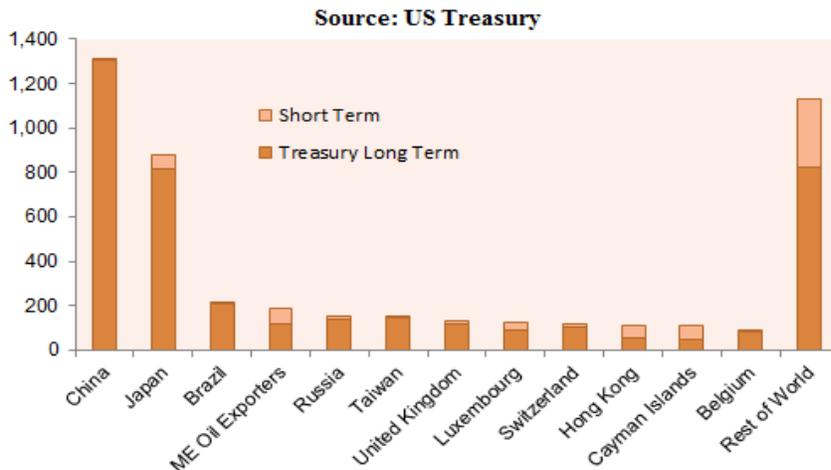
The greatest loss in bond valuation would occur for holders with long maturity debt, as the prices of these instruments would diminish more than short-term maturity debt. This occurs because the risk of missing out on the higher interest rates declines, as a bond gets closer to its maturity date. Simple analysis shows that such losses range from very low (5% for Treasury bills) to very high (up to 52% for 30-year bonds).

Effect on Foreign Holders

The impact on foreign holders is an important issue for two reasons. First, foreign holders owned close to \$5 trillion of U.S. Treasury securities as of June 2011. Secondly, a majority of their holdings were in the form of longer term securities (\$4.05 trillion) which, as discussed earlier, are more susceptible to valuation losses under a rise in interest rates. In our scenario of rising interest rates, foreign investors whose portfolio is biased towards longer term bonds would lose a larger portion of their holdings.

This begs the question: who are the major foreign holders of long-term debt? Figure 24 shows that China has concentrated its portfolio almost exclusively on long-term debt, while Japan's proportion is close to 93%.

FIGURE 24



Given a 500 bps increase, the value of China's holdings in U.S. bonds would have declined from \$1.15 trillion to around \$920 billion in April 2011, assuming China's holdings of U.S. debt are at the same maturity (weighted) as total debt outstanding.

The United States Treasury also publishes data on the proportion of long-term Treasury debt held by foreign institutions, such as central banks and government agencies. Of the \$4.05 trillion (not including Treasury bills) of foreign-held debt, \$3.1 trillion is held by official foreign institutions.

And of this \$3.1 trillion, official Asian institutions hold \$2.66 trillion. Hence, under rising rates, official institutions would lose at least 20% of the value of their debt holdings.

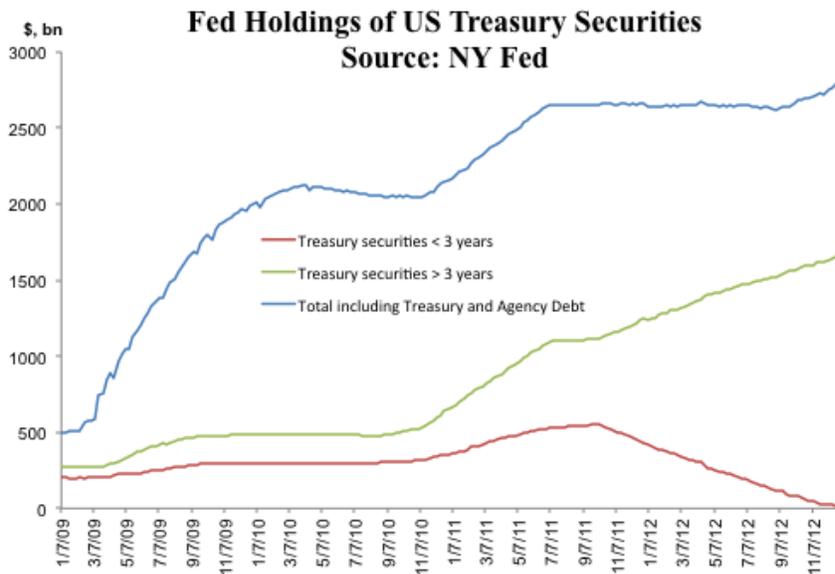
Effect on Domestic Holders

Reports by the CBO show that as of 2010, major domestic holders of U.S. Treasury securities included pension and retirement funds (8.6%), mutual funds (6.7%) and individuals (9.0%).

These holders would also suffer due to losses in bonds valuation.

Another important buyer of government debt is the U.S. Federal Reserve. As we can see from Figure 25, the Fed, through its open market operations, has raised its portfolio of long-term U.S. notes/bonds to around \$1.57 trillion. At the same time, it has reduced its holdings of Treasury bills from around \$277 billion in late-2006 to just \$18.4 billion today. This strategy of swapping debt maturity has been implemented to stimulate a sagging economy.

FIGURE 25



Impact on US Government Debt Holders: Summary

U.S. government debt holders would see an immediate valuation loss, and would be forced to either sell the bonds at a loss or stick with them.

Foreign entities such as China, which has focused on longer maturity U.S. bonds, would see the largest valuation loss.

The U.S. Federal Reserve would also incur valuation losses, though it is hard to imagine the Fed dumping U.S. bonds after losses.

TABLE 2: Impact on other Domestic entities

Domestic Entity	Size of the US Government Debt as Disclosed	Possible Impact, Notes
Life Insurance Companies (e.g., AIG, MetLife, Hartford)	Ownership of 161 billion in debt (29.85, 40 and 9.36 billion)	Ownership of a larger percentage of US debt, should create large valuation loss if interest rates rise. In the case of AIG, government debt is 34% of total equity. However, we are not aware of hedging strategies so ultimate impact is hard to analyze.
P&C Insurance Companies (State Farm in particular)	Ownership of 93 billion in debt (6.53 billion in particular)	Possible large valuation loss, although hedging strategies are hard to analyze.
Private Pension Funds	Ownership of 448 billion in debt	Possible large valuation loss, although hedging strategies are hard to analyze
Investors in Mutual Funds	Ownership of 919 billion in debt	Possible large valuation loss, although hedging strategies are hard to analyze
Banks (Citi, BOFA, GS, MS in particular)	Ownership of 188 billion in US government debt	Possible large valuation loss, although hedging strategies are hard to analyze
Broker Dealers	Ownership of 204 billion in US government debt	Possible large valuation loss, although hedging strategies are hard to analyze
Household Investors	Ownership of 1.1 trillion in US Government debt	This includes households plus leveraged traders, hedge funds and private equity funds whose ownership of US government debt rose from 256 billion in 2008 to 1.1 trillion in 2011.

Mitigating Factors

When interest rates rise on U.S. government debt, individual investors would be hurt by the initial valuation loss. However, there are some mitigating factors. A rise in yields may change the risk weightings of investors and, hence, the spreads between risk-free U.S. government bonds and riskier assets. When yields rise, these spreads may tighten, in which case investors who have a portfolio balanced between risk-free bonds and other sectors would not lose as much on potential return as they would if the spreads did not tighten.

The question of how strongly the spread tightening would cushion the losses of investors really depends on the weightings of the various sectors in the initial portfolio, and the behavioral response to the rise in yields. If the risk weightings shift to higher risk sectors at a strong rate, then the spreads will tighten more, leading to a larger cushion against original valuation losses.

4.C. IMPACT ON U.S. MORTGAGES AND MBS

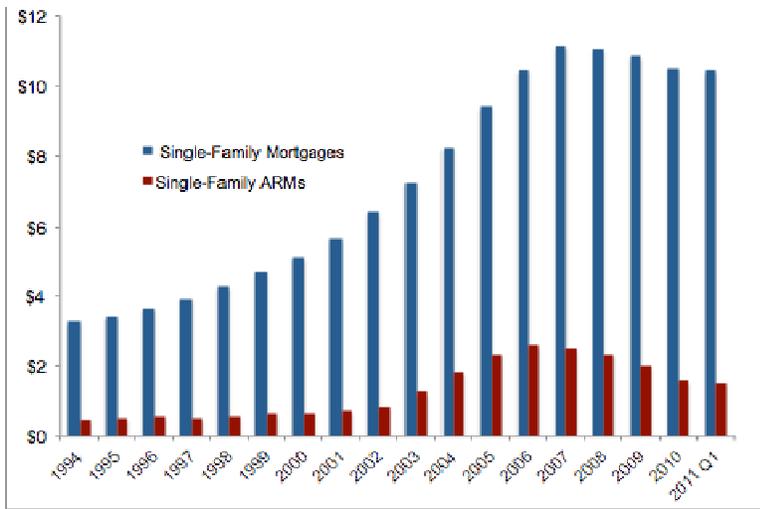
In addition to federal government debt, a rise in interest rates would also impact mortgages and mortgage-backed securities. Because large amounts of mortgage debt have variable rates, they could spell problems for homeowners.

IMPACT ON MORTGAGE OWNERS

Fixed Rate Mortgages

Homeowners who own fixed rate mortgages would not be seriously affected, since they have locked in at low rates for the remainder of their payment terms. The impact would be acute, however, for homeowners with adjustable rate mortgages. In order to quantify this, we estimate the total of adjustable mortgages currently outstanding in the U.S. We focus on single-family mortgages, for which the Federal Housing Finance Agency provides statistics.

FIGURE 26: Single Family Total and ARM Mortgages Outstanding

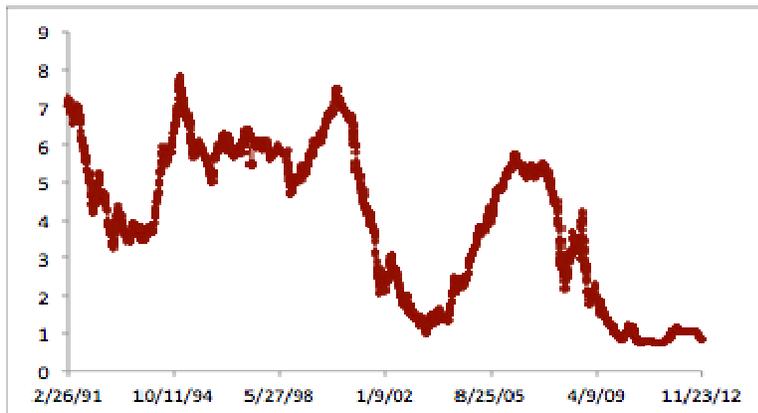


As Figure 27 shows, the total of single-family adjustable rate mortgages soared during the mortgage boom, but tumbled in recent years. As of Q2 2012, single-family ARMs constituted \$1.48 trillion, around 14% of total single-family mortgages outstanding in the U.S.

Impact due to rising rates

Currently, the National Average Contract Mortgage Rate provided by FHFA is 3.44%. Another useful rate is the 12-month LIBOR rate. As Figure 27 shows, the 12-month LIBOR rate has decreased to around 1% amidst stimulative policies of central banks in United States and Europe.

FIGURE 27: 12-Month London Interbank Lending Rate



It is worth noting that both of these rates are not the exact rates which market lenders always offer homeowners. There are also the index rates on top of which the margin rates are placed. If we assume that margin rates will not change when market interest rates go up, then a rise in the market interest rates should translate into a one-for-one rise in the total ARM interest rates. A 500 bps rise in market rates would then raise interest payments for borrowers by 5 percentage points.

Even assuming that the average ARM rates today are around 5% (which is conservative), we would see a near doubling of interest payments for the regular mortgage borrower if rates rise by 500 basis points. This could push many homeowners into delinquency and defaults. Given the large size of the ARM mortgage market, even a small rise in percentage defaults is bound to cause a large ripple in the economy.

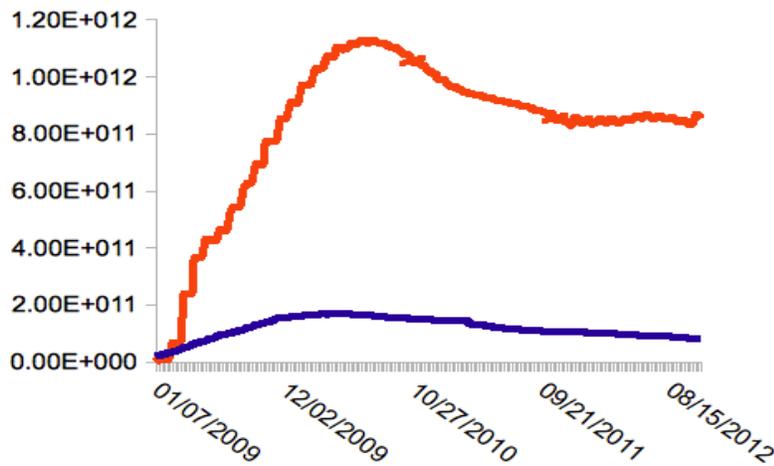
OWNERS OF MORTGAGE BACKED SECURITIES

Institutions that own mortgage backed securities would be affected by the rise in rates, as well, since higher rates would impact their assets and liabilities. Here, we cannot separate mortgage backed securities based on ARMs and those based on fixed rate securities due to the lack of data.

Federal Reserve and MBS

The largest buyer of mortgage debt in the last five years has been the Federal Reserve. As the following figure shows, the Fed went from a position of no ownership before 2009 to around \$1.1 trillion at its peak in 2010. It currently holds around \$800 billion of MBS as of October 2012.

FIGURE 28: Federal Reserve MBS and Agency Debt Holdings



Other Institutions' Ownership of Mortgage Debt

The next table shows different sectors and their ownership levels in billions of dollars.

TABLE 3: Ownership of MBS Debt

Entity	Ownership Size
Foreign Sector	1061.2
Federal Reserve	946.5
Deposit taking banks	1668.3
Life Insurance Companies	353.0
Mutual Funds	1027.9
Money Market Mutual Funds	334.6
REITs	342.6
Brokers and Dealers	169.8

As the above table shows, the largest owners of mortgage debt are the foreign sector, Federal Reserve and deposit taking banks. This data suggests the effects of a rise in rates would not be concentrated in one sector.

Effect of Rise in Rates for Mortgage Security Owners

The impact of rising rates would be different for owners of fixed rate mortgage backed securities and securities based on ARMs. Since ARM rates change and the underlying default rates would increase, the value of the MBS would fall. This would lower the assets of the institutions that

own MBS backed by ARM mortgages. In the case of MBS backed by fixed interest rate mortgages, the effect is similar to that of government debt. These securities would deliver lower returns than new investments, and therefore undergo a valuation loss.

5. IMPACT ON DEFINED BENEFIT PENSION PLANS

A rise in interest rates would impact defined benefit pension plan funding. We discuss present trends in the pension plan industry and the likely impact of a rate increase.

Defined Benefit Plans

The “benefit” in DB plans is defined as some proportion of average or final salary, with the proportion increasing with tenure. Since DB plans have both liabilities and assets, the impact of interest rates are worth investigating. We do not analyze the alternative – defined contribution plans –since they are less directly linked to interest rates.

A serious problem for corporate DB plans today is their underfunding in a world of low interest rates. Many of the interest rates in DB plans were locked in when interest rates were considerably higher. Now, these funds cannot accumulate returns at the rates needed to meet their obligations to their members. According to a 2005 estimate, total underfunding of all United States insured plans was \$650 billion: \$450 billion for single employer plans and \$150 billion for multi-employer plans.

Types of DB Plans

There are two types of DB plans that may be affected by a rise in interest rates.

I. Corporate DB plans

The problem of underfunding in corporate DB plans is well documented. According to the Milliman Annual Report on the 100 U.S. public companies with the largest defined benefit pension plan, assets totaled \$1.246 trillion at the end of 2011, while the funding deficit was \$326.8 billion, the highest ever and \$94.7 billion over the previous year.

The major reason for this underfunding appears to be projected liabilities for DB pension plans, which have been rising rapidly since 2007. The median discount rate used has also negatively affected liability size, as a higher discount rate means lower net present value of liabilities. It is clear that this is ultimately driven by low long-term interest rates.

Impact of a Rise in Rates

The most direct impact of a rise in rates would be on future pension obligations (liabilities) and, hence, on the underfunding problem. Any spike in interest rates in advanced nations would almost certainly serve to raise the discount rates used for calculating liabilities under corporate direct benefit plans. This would lower liabilities for pension accounts and solve any underfunding problems.

In order to calculate the quantitative effects, we set up a simple actuarial model using present day liabilities and a current discount rate of 4%. We assumed liabilities remain constant over an average duration of 14 years, then calculated the net present value of liabilities if we assumed interest rates go up by a) 500 basis points, and by b) 300 basis points. Table 4 shows the dramatic results of this simulation. A 500 bps increase in 10-year Treasury rates would help liabilities to fall to \$1.11 trillion from \$1.58 trillion, while the funded ratio would rise from 79% to 111%. Even with a more modest rise in rates (300 bps), underfunding would be much smaller.

Table 4: Impact on Corporate Pension Liabilities

Condition	Liabilities	Assets	Funded Ratio
Present Day	1583.6 bn	1251.9 bn	79%
500 bps increase in rates	1267.3 bn	1251.9 bn	111.1%
300 bps increase in rates	1380.8 bn	1251.9 bn	102.1%

II. Public Pension Plans

Public pension plans are divided into federal, state and local. Since federal plans are relatively small compared to state and corporate plans, they are not analyzed here.

State and local pensions suffer from serious underfunding. The causes are twofold: a) as benefits for public employees crept up above those of private employees, liabilities for pension plans rose, and b) assets in these plans lost tremendous value in the 2008 financial crisis and are still recovering.

One of the greatest challenges to measuring underfunding is the fact the present value of state pension liabilities varies according to the method of calculation. When discount rates are low, liabilities become larger than the assets, creating underfunding. As Table 4 shows, using different assumptions about the discount rate can give us a level of liabilities that range from \$2.97 trillion to \$5.17 trillion.

Table 5: Impact on Public Pension Liabilities

Company	Assumptions	Liability Size
Novy-Marx and Rauh	Treasury Rate Used	5.17 trillion
Novy-Marx and Rauh	Government Assumptions used	2.97 trillion
Wilshire Consulting	Government Assumptions used	3.11 trillion

Valuation Methods

The government method to value pension funds is to discount future liabilities at a rate of anticipated return on pension fund assets, currently at 8%. Advocates of this method argue that since governments can meet their obligations, discount rates based on projected returns are appropriate. This also means that asset values are smoothed over in some years.

Another method of valuation is fair value, where the asset is valued at the amount an investor would be willing to pay for it at that point in time. Given the low risk profile of pension assets, use of fair value may result in discount rates being half of the government assumption (around 4%). This leads to a higher liabilities and much greater underfunding of the pension plans.

As we saw in the table 5, merely changing the assumptions on the rate being used can change liability size by trillions of dollars.

Impact of a Rise in Rates

The most direct impact a of rise in rates would be on the projection of future obligations (liabilities) and, hence, on underfunding problems. If we use Treasury rates to discount liabilities (a method that appears to make more economic sense), then the size of underfunding ranges from \$3 to \$4 trillion. If interest rates rise by 500 bps, these underfunding problems become smaller.

Even so, there remains an underfunding problem that is not going to disappear just by changing the method of picking discount rates. That's because this underfunding is not only a factor of discount rate calculations, but real problems we identified earlier, namely a decline in pension fund assets and a tremendous increase in their liabilities.

Summary

A world with higher interest rates would have this impact on the DB pension industry: The underfunding problems of the DB corporate pension plans would become much smaller due to lower liabilities. Funded ratio would rise to 98% from 79% if interest rates rose by 500 bps. Public pension funds that are underfunded would still remain underfunded because much of the deficit comes not from discount rate calculations but from a large drop in assets and benefits increases. Underfunding would only fall by 4%.

6. IMPACT ON SOCIAL SECURITY

We analyze the impact of a rise in interest rates on Social Security through an analysis of the role interest rates play on the Social Security structure today.

Structure of United States Social Security

U.S. Social Security operates through two large trust funds managed by the Department of the Treasury. Benefits to retired workers and their families, and to families of deceased workers, are paid from the OASI Trust Fund. Benefits to disabled workers and their families are paid from the DI Trust Fund. More than 98 percent of disbursements in 2011 were for benefit payments. It is also worth noting that 67% of benefits go to retired workers, 15% to survivors and 18% to the disabled and their families.

The income to the trust funds is invested in special securities that provide principal and interest, both of which are guaranteed by the federal government. The rate of interest accrued by these funds is determined by a formula that takes into account the general interest rate level in the U.S. For example, the interest rate for new securities dropped to 2.41% in 2011, and to 1.6% in 2012. However, given that the funds have bonds that were acquired in the past, the effective interest rate (average return on all investments in 2011) was actually 4.401%.

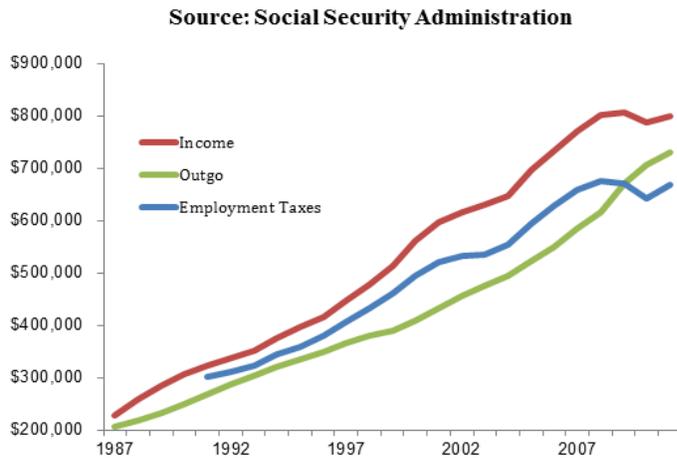
Non-Interest Income and Outlays

As a pay-as-you-go system, Social Security depends on payroll taxes on today's labor force to pay benefits to retirees. Under this regime, having a larger cohort such as baby boomers retire and get benefits from a smaller cohort increases outlays and puts pressure on fund profits. The CBO estimates that 97 million people will collect benefits in 2035, compared to 56 million today. Adding to the pressure are some of the measures taken over the past two years to stimulate the economy, such as lowering Social Security payroll taxes.

For the first time since 1983, total expenditures for Social Security exceeded non-interest income in 2010 and 2011. In 2011, a temporary reduction in payroll tax was a large reason. Total benefit payments for OASI were \$603.8 billion in 2011 and \$132.3 billion for DI. The largest source of income, payroll taxes, only totaled \$482.4 billion for OASI and \$81.9 billion for DI. This trend will only get worse as benefit payments rise and the economy grows no better than moderately after the recovery. Under this scenario, outlays would start outstripping total income by 2023, including interest income. This would erode the funds' principal and exhaust the funds by 2033. When that happens, the only solution is to pay expenditures out of current taxes which, under currently estimates, would only cover two-thirds of benefits.

Figure 28 shows income and expenses, including employment tax income, which is the major income source, apart from interest income. As we can see, tax income has slowed down since 2008 and that has impacted total income negatively, leading to annual deficits.

FIGURE 28: Income and Expenses of SSA



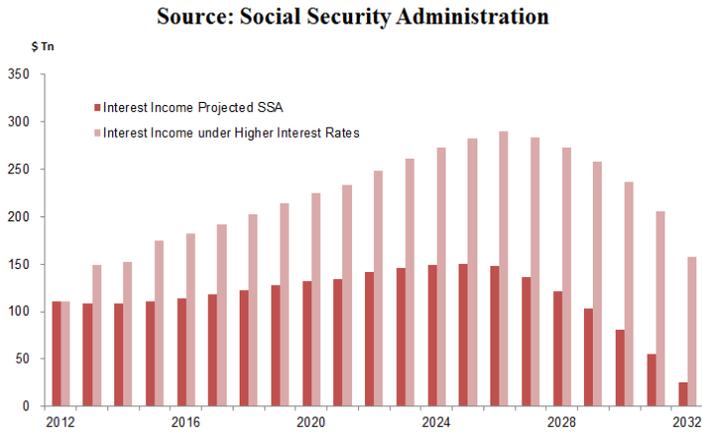
This picture suggests that a change in interest income could change the future of the Social Security Trust funds. We consider this issue next.

IMPACT OF INTEREST RATE RISE

When interest rates rise, total assets of the trust funds also increase. Thus, when interest earnings are higher, pressure on total taxes to meet outlays is smaller. We created a simulation model (based on the projected data for 2012-2032, provided by the SSA), by raising the effective interest rates on the fund investments. Since these are expected to rise anyway, we measured the expected change and increased it to match our scenario of a 500 bps rise in rates.

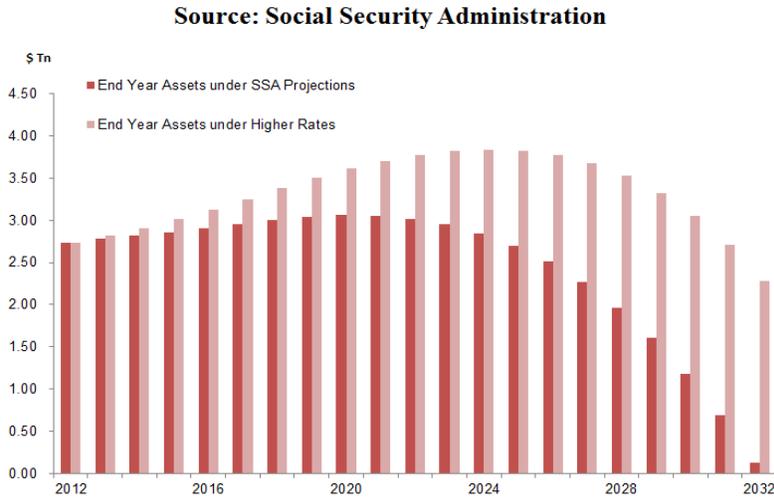
We see in the following figure that interest income, instead of vanishing by 2032 (as in the baseline case), remains quite high. When we compare the net present value of interest income between 2012 and 2032, we find that our case would provide interest income with NPV of \$2.14 trillion, instead of the \$1.43 trillion in the baseline case.

FIGURE 29: Interest Income Simulation



We next compare asset sizes under current projections and our projections with higher interest rates. As we can see, instead of vanishing by 2032, the fund assets would remain considerably high (around \$2.3 trillion). This would provide a huge boost to the Social Security funds’ sustainability and solvency.

FIGURE 30: Fund Asset Simulation



WINNERS AND LOSERS

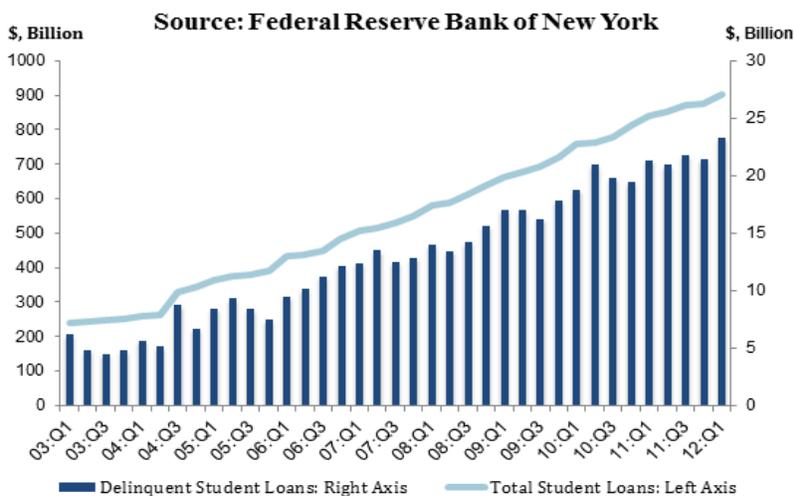
One group of winners includes the American public, whose Social Security payments would be protected if the Social Security trust funds remain solvent for a longer period. This would benefit the cohort receiving benefits after 2032. One reason is that current law requires all Social Security benefit payments be cut by around 25% when the trust fund is exhausted. Higher interest rates would stave off this exhaustion.

The clear loser in this scenario is the U.S. government, which owns this debt. When interest rates rise, the government should pay the funds more every year through interest payments. These payments, however, translate into greater liabilities for the federal government. In fact, a rise in rates could add about \$700 billion in present value interest expenses for the government.

7. IMPACT ON STUDENT DEBT

We look into the impact of a rise in interest rates on student debt in the United States. Student debt in the United States has ballooned since 2000. As of the first quarter 2012, the Federal Reserve estimated total student debt at about \$900 billion. Figure 31 shows this trend.

Figure 31: Student Debt Stock and Delinquent Loans Stock



Student debt has now overtaken credit card debt as the second largest type of private debt after mortgages. It is also the fastest growing category of debt in a time when the private sector is generally de-leveraging and shedding other kinds of debt. During the first quarter of 2012, student loan balances rose by \$64 billion while all other household debt fell by \$383 billion.

A part of the problem is delinquency rates in the United States. The size of the delinquent student loan portfolio rose from around \$5 billion in 2003 to around \$23 billion in 2012, a growth of around 500%. This spells trouble down the road, especially if interest rates rise.

Types of Student Loans

To understand the risks posed by student debt, it is important to distinguish between federal loans and private loans. Federal student loans are subsidized by the U.S. government and constitute the largest sector of the student debt market, around \$750 billion in 2012. The private student market is around \$140 billion.

1. Federal Student Loans

Federal student loans include Stafford Loans, PLUS Loans and Perkins Loans. There is a distinction between federal subsidized loans – which are provided to undergraduates with demonstrated need, and are therefore subsidized by the U.S. government – and unsubsidized federal loans.

Interest rates on all student loans are set by the U.S. Congress. For loans disbursed between 2012 and 2013, the interest rate on subsidized loans was 3.4%, while the rate on unsubsidized loans was 6.8%. The rates are slightly higher for PLUS loans, which are for parents or graduate students, at 7.9%. For Perkins loans, the rate is currently fixed at 5%.

An important characteristic of these loans is that the rates are fixed once the loan is disbursed. This means there is a large degree of arbitrariness in net present value of interest payments based on when the loans were made. A student taking the same amount of loans in August 2011 would

be paying 3.4% interest for the remainder of the loan's lifetime, while someone who took the loan in 2009 would be paying 5.6% for the loan's remainder life.

Effect of rise in interest rates

As we can see from Table 6, the prime rate for private loans and the student loan rate fixed by Congress at any point in time are not strongly correlated. As a result, it is hard to see how Congress would set student loan interest rates if market interest rates rose.

Table 6: Prime rate and Student Loan Rate

Disbursement Date	Student Loan Rate	Prime Rate
7/1/06	6.8	8.5
7/1/08	6	5
7/1/09	5.6	3.25
7/1/10	4.5	3.25
7/1/11	3.4	3.25

It is possible, however, to deduce that rising market interest rates would create pressure on Congress to raise interest rates for the new loan disbursements in 2013 and beyond. Assuming that the interest rates the government pays on debt is going to rise by 500 bps, keeping interest rates for federal student loans at the same rate would actually cost the U.S. Treasury around \$37.5 billion in interest income for the first year the cohort with higher rates would begin repayment. This would increase in following years as the costs that the government subsidizes become part of the total government debt, leading to larger annual interest payments.

In such a situation, the government may decide to raise interest rates for federal loans in lock-step with a rise in market rates. Prior to 2006, federal student loan rates were variable, and moved close to the rates at which the Treasury borrowed. If the government pursues such a strategy again, its financial position would be strengthened. However, the demand for such loans may decrease given that higher interest rates on these fixed rate loans would condemn students to large payments throughout their lives.

Simulation

We assume that the U.S. Congress passes laws that stipulate federal student loan rates rise by as much as the rise in market rates (500 bps). Given that the total stock of federal student loans in repayment today have fixed interest rates for their lifetime, interest rate rises would not affect the students who have taken those loans. The only ones impacted would be students who take out loans after 2013, when the simulation assumes rates would rise.

For the first batch of undergraduate loan recipients, the interest rate would be 8.4%, 500 bps above today's rate. These recipients would start paying their debt around 2018-19, when the high rates would put a huge burden on them financially. According to the project on Student Debt, the average amount of student debt at graduation is around \$25,000 today. If we assume this trend continues, new loan recipients would have to pay around \$2,100 per year in interest payments, instead of the \$850 they pay today.

2. Private Student Loans

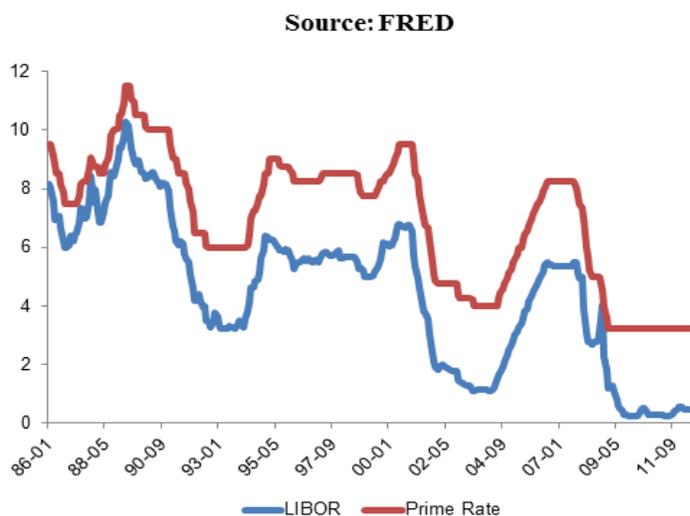
The private student loan market consists of loans made by entities other than the federal government, including schools, non-profit lenders and for-profit financial institutions. We focus primarily on the for-profit financial institutions market (PSL) which, though large, is hard to quantify.

According to a new report by the Consumer Financial Protection Bureau, the PSL market was around \$140 billion in 2012. Compared to the 2003-04 academic year, when 5% of

undergraduate students had private loans, 14% of undergraduates in 2007-08 had private student loans. Loan origination volumes rose from around \$6.6 billion in 2005 to \$10.1 billion in 2008. Over this period, lenders loosened their credit requirements. Once the 2008 crisis hit however, the industry changed dramatically. FICO scores rose significantly, suggesting that lenders were looking for high credit scores to justify loans. Loan origination volumes themselves dropped from \$10.1 billion in 2008 to \$5.7 billion in 2011. Similarly, the proportion of loans co-signed in a random sample of private loans went up from 55% in 2005 to 90.5% in 2011.

The biggest distinction between the federal and private student loan market is that the private student loan market operates through variable interest rates, which are tied to either LIBOR or the prime rate. Figure 32 shows that the correlation between prime and LIBOR rates is very high at 0.98. This suggests that interest rates on private student loans move closely with other variable interest rates, such as variable mortgages and credit card loans. As the overall interest rates in the economy rise, the interest rates on private student loans also rise.

FIGURE 32: Prime and Libor Rates



Effect of rise in rates

As we can see from Figure 35, these rates fell significantly in the 2000s, and especially since 2008. Hence, they closely track with interest rates in the general economy. In the case of a 500 bps rise in interest rates, both the LIBOR and Prime rates would rise by close to 500 bps. This

would hike the interest rates that students pay on their student loan, thus impacting their ability to pay, as well as default rates.

Most microeconomic models of loan defaults focus on the loan-to-income (LTI) ratio as an important factor in the default decision. A high LTI ratio means that loan payments squeeze the borrower, making it harder for him/her to satisfy their basic needs while repaying the loan. This often leads to a strategic default decision, where the borrower can default, then file for Section 7 bankruptcy and hope to either clear or at least lower the loan burdens.

Simulations

If interest rates rose by 500 bps, payments on a typical loan would nearly double, from 6.4% (the current rate) to 11.4%. For a loan with a principal of \$25,250 (which is the average size of student debt), this would generate an increase in interest rate payments from \$1,623 to \$2,886 annually. If we assume an average student loan is repaid within 10 years, then the size of new interest payments would on average be larger than the size of the principal payments, putting tremendous pressure on borrowers and running up defaults.

Loans at highest risk of default are those already in delinquency. As of 2011, there were at least \$6.55 billion of PSL loans at least 30 days delinquent. In the event of a doubling of interest payments, one can assume that most of these delinquencies would turn into defaults, adding \$6.5 billion to the default stock. If we assume just 2% of loans currently being repaid without delinquencies default, then a further \$2.2 billion would be in default, leading to an increase in default stock to \$8.7 billion.

Although we lack data on what banks have placed in reserve for loss coverage, it is hard to imagine they would be prepared for this magnitude of loss.

Effect on ABS Market

Issuance of asset-backed securities with private student loans as their asset was around \$16 billion in 2006, but declined to around \$3 billion by 2011. Similarly, default rates on ABS reached 18% on certain origination vintages, reflecting the fact that most ABS loans are provided through riskier channels.

If interest rates rose by 500 basis points, the default rates on the underlying loans would certainly follow suit, inflicting huge losses on securities and triggering more ratings downgrades. This could spark a furious sell-off of these securities. Although the size of such assets would probably not endanger the solvency of large financial firms, those that had bought such assets would have to deal with large losses during certain quarters.

WINNERS AND LOSERS

Public Loan Market

Federal Government: It is likely the U.S. government would have to bail out many federal student loan borrowers if market rates rose significantly. Such implicit bailouts would cost the federal government more than \$30 billion in interest income per year.

New Borrowers: Borrowers repaying loans in the public loan market would be safe because of the fixed interest rates on their loans. However, new borrowers might have to bear the brunt as they watch their loan opportunities recede.

Current Borrowers: Given that current borrowers have taken advantage of low fixed interest rates, they would be protected from interest rate volatility in the future.

Private Loan Market

Current Borrowers: Current borrowers would be adversely affected by a rise in interest rates as their payments would be nearly double and many borrowers would be pushed into default.

New Borrowers: New borrowers would not be as severely affected, since they have the choice of not borrowing or borrowing more frugally. However, they would face limited options for paying educational costs.

Private Lenders: Although this market pales in size to that of mortgages, lenders' profits would be reduced due to increased write-offs for much of this debt. The actual impact on lenders would depend on the credit risk of their portfolios.

Other Investors: Firms and others invested in private student loan ABS securities would see the value of their assets plummet, and might have to settle for selling them well below par. This would lead to large losses for investors. On the other hand, investors who had shorted these securities would profit.

8. IMPACT ON INDIVIDUAL INVESTORS

We analyze the impact of a rise in rates on individual investors through two channels: bond markets and the stock markets.

I. Impact through bond markets

When interest rates rise, individual investors who have a large part of their portfolios in sovereign debt or MBS will see these portfolios lose value. In this case, they could choose to either sell and pick up valuation losses, or hold the bonds and lose out on the higher returns provided by new bonds.

Individual investors who invest in new bonds, however, would realize higher returns from the bond markets. Retirees who channeled their portfolios into stocks because of the low returns from bonds could switch their portfolios to bonds and earn higher returns. In cases where investors are hurt by not meeting a certain minimum level of return (i.e., retirees), higher interest rates would help savers attain such minimum returns, enhancing their economic security.

II. Impact through Stock Market

The most probable cause of higher interest rates in the near future would be lower savings supply, together with tight monetary policy. Even though there will be a recovery, we do not see strong possibilities of a productivity or profitability jump above and beyond the cyclical recovery process. Hence, the effect of interest rates on stock prices should be negative in the near future.

Quantification of the effect of an interest rate rise on stock prices is always difficult. We average the lowest and highest values for elasticity across all the studies that look at United States stock markets. The average at the lower end is -4.58% and the average at the higher end is -5.76%. This suggests a 1 percentage point increase in the level of the nominal interest rate would be associated with around a 5% immediate loss in stock prices. When we do the same for the Euro area, we find an average range of -4.84% to -6.87%.

Below, we show the range of losses for Euro Area and the United States if interest rates rose by 500 bps. Clearly, such losses would erode the returns of average individual investors.

Table 7: Loss in Stock Market from a rise in Interest Rates

Nation	Loss Maximum	Loss Minimum
United States	28.8%	22.9%
Europe	34.4%	24.2%

Summary

Individual investors would have to take losses on their portfolios due to interest rate rises on fixed income allocations. On the other hand, investors could switch to new bonds with higher rates, which should help savers. Finally, a rise in rates could hurt stock market returns, nullifying gains made by higher returns from bonds.

9. CONCLUSIONS

We have discussed how today's ultra-low interest rate environment is unusual compared to the rest of the post-war period. That landscape could quickly shift to higher rates, however, and we suggest one possible scenario is where global supply of savings decreases, thereby raising real rates. In addition, nominal rates could easily rise due to an upswing in inflation.

As interest rates are really relative prices for savings, changes in interest rates create winners and losers in virtually every economic sector.

The first losers are OECD governments, which have become highly indebted in recent years. Their borrowing costs would go up with a rise in global interest rates. The force of this impact would depend on the size of debt servicing, along with ownership composition and maturity of debt portfolio. We identified debt maturity a pivotal issue. The U.S. government could face growing pressure to cut its deficit due to the short maturity of its debt, which would trigger the need for quicker refinancing. On the other hand, the United Kingdom would have smaller refinancing problems due to its longer maturity debt.

In terms of debt holders, central banks, including the Chinese Central Bank and the U.S. Federal Reserve, would suffer when the bonds they hold lose value. We believe investors, such as insurance companies which have large stakes in government debt, would be forced to take valuation losses, as well.

Among the winners are the Social Security trust funds, which would earn higher returns and thereby avoid bankruptcy. This would protect Social Security payments beyond 2032. On the other hand, the federal government would owe a larger debt to the Social Security trust funds, adding to its debt service burden.

The student loan market would also be severely impacted by a rise in interest rates. In the public loan market, the federal government might have to implicitly subsidize borrowers if market rates rose sharply. Since the private student debt market is dictated by variable rates, current

borrowers would be hurt and possibly pushed closer to bankruptcy. Private lenders might also be forced to take losses, along with investors in student debt backed securities.

Corporate defined benefit pension plans are beset with underfunding problems due to low discount rates in liability calculations. A rise in interest rates would lower the liabilities and, hence, the underfunding problems. State and local pensions, on the other hand, are underfunded even when using the lenient GASB discount rates, which would not jump even if market rates were to rise. This means that state pension plan underfunding cannot be solved by a rise in interest rates alone.

Clearly, the gallery of winners and losers is unlimited, underscoring the need for vigilance by all sectors as the economy inevitably moves beyond the very low interest rates of the past decade. A rise of five percent is admittedly large, but it has ample historical precedent, and those borrowers, debt holders and investors who make strategically smart decisions now will have the luxury of maximizing their gains, or minimizing their losses, down the road.

Appendix

Table 8: Loss in Stock Market from a rise in Interest Rates

Issue	Winners	Losers
Government Debt	Speculators who wait to move into government debt after valuation loss	OECD Governments; especially United States, Italy, Greece; holders such as US Fed, China and Japan central banks
Government Debt		Insurance Companies and Banks with big government debt holdings
Social Security	Social Security Trust Funds; Social Security recipients after 2032	Federal Government
Corporate Pensions	Companies and Recipients	
State and Local Pensions		State Finances
Public Student Debt Market		Federal Government
Private Student Debt Market	Current Borrowers	New borrowers; Variable Rate current borrowers

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