Disequilibrium

Falling long-term interest rate assumptions have significant implications for long-term expected returns – impacting a wide range of investors and investment strategies in the process.

"Not everything that counts can be measured. Not everything that can be measured counts"
Albert Einstein.

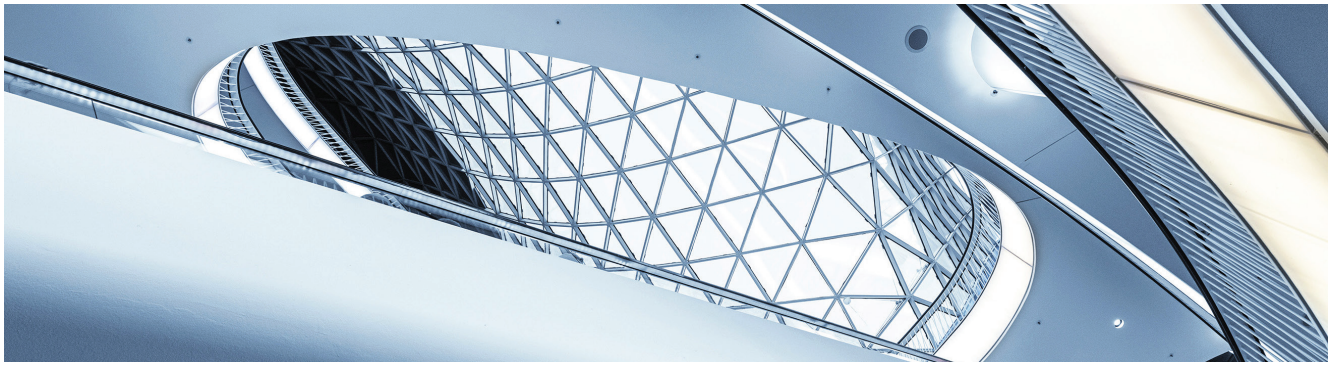
The concept of a long-term equilibrium interest rate – the nominal rate, adjusted for inflation, at which the capital supply in an economy precisely meets capital demand and which would therefore keep both growth and inflation stable – is the first brick in the building block approach to capital market expectations. Historic analysis of the equilibrium rate has put forward a number of differing arguments for its value. But what is the genuine relevance to investors of a theoretical concept, the value of which has, until recently, appeared to concern only academics?

1. **It helps determine central bank policy**
   A key component of the more widely known Taylor Rule, the underlying concept of an equilibrium interest rate is now accepted as a key determinant to the decision making of central banks.

   In particular, the long-term equilibrium rate helps central bankers to give secular context to the more cyclical fluctuations in economic activity and inflation that drive shorter-term monetary policy. In short, it is not the absolute level of policy rates that determines whether policy is 'loose' or 'restrictive' in its impact on economic activity - but the level relative to both the current and long-term equilibrium rate.

2. Estimates of both the current and long-term equilibrium rate are therefore a key variable in the US Federal Reserve's ("Fed's") (and other central banks') decision making. **Accurate analysis of the equilibrium rate is key to whether current government bond yields are attractive or not.**

3. In accepted economic theory, the long-term fair value of all risk assets derives from the equilibrium rate of interest adjusted for inflation, plus a compensatory risk premium. **Any shift in the long-term equilibrium rate of interest therefore has a potentially significant impact on the long-term returns assumptions of all asset classes.**



For any investor with a required rate of long-term return, or any sort of strategic asset allocation based on customary capital market assumptions, changes to the equilibrium rate of interest have obvious implications.

A higher equilibrium interest rate leads to higher expectations for all asset classes and a lower equilibrium interest rate leads to lower returns expectations for all asset classes – a crucial topic for investors with required rates of returns such as pension plans and endowments.

Why does it matter now?

So why do expectations for long-term equilibrium rates suddenly matter now? The answer lies in the passing of time and the promulgation of data. While long-term interest rate assumptions have been falling for years, it had previously been assumed this shift was cyclical.

In particular, the actions of the monetary authorities were expected to spur a self-sustaining recovery in capital investment and demand, even if recovery from the financial crisis took longer than had been the case in previous cycles. It was also believed that inflation would rise and that 'normal' interest rate policy would resume.

As a consequence, we believe few asset managers have adjusted the long-term equilibrium rate within their capital market models or adjusted their long-term returns assumptions.

Structural or cyclical changes to assumptions?

More recently, the data on productivity and on capital investment in particular point clearly to more structural issues within developed economies. We assert that the shift downward in long-term interest rate expectations is not a cyclical phenomenon but a secular shift that means expected long-term returns may be lower than some asset managers may be discounting.

Importantly, this concept has already moved outside of the world of the theoretical. The volatility of August and September 2015 suggests that markets are, at least in part, re-evaluating what low interest rates and Quantitative Easing really mean for risk assets if they persist for the long-term. Are these measures a painless cure to economic ills or do they cause overinvestment as some academic research has suggested[1]? If so, why is capital investment growth still falling when interest rates are so low? Perhaps it makes more sense to reverse the causality and say that long-term interest rate expectations are low precisely because capital investment growth is still falling.

About this paper

With a multi-asset investing history stretching back to 1982, UBS Asset Management has been at the forefront of the debate on capital market assumptions for over three decades.

This paper explores the basis to our thesis that the shift downwards in the equilibrium interest rate is a structural development. It also explores what investors can do within portfolios to address this change in long-term returns assumptions.

The paper builds on the significant body of research produced by UBS Asset Management on this topic. These include *Limbo Lower* (McNaughton, 2015), *The Wicksellian Natural Rate of Interest* (Orphanides, 2014), and on the unpublished work of the UBS Global Investment Solutions quantitative macroeconomics team in Chicago.

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[1] Knut Wicksell, 1898

What is the equilibrium rate **now**?

Given its importance to monetary policy, economic growth projections and capital market expectations, the equilibrium rate has been subject to a steady stream of academic research. But measuring the equilibrium rate of interest is difficult.

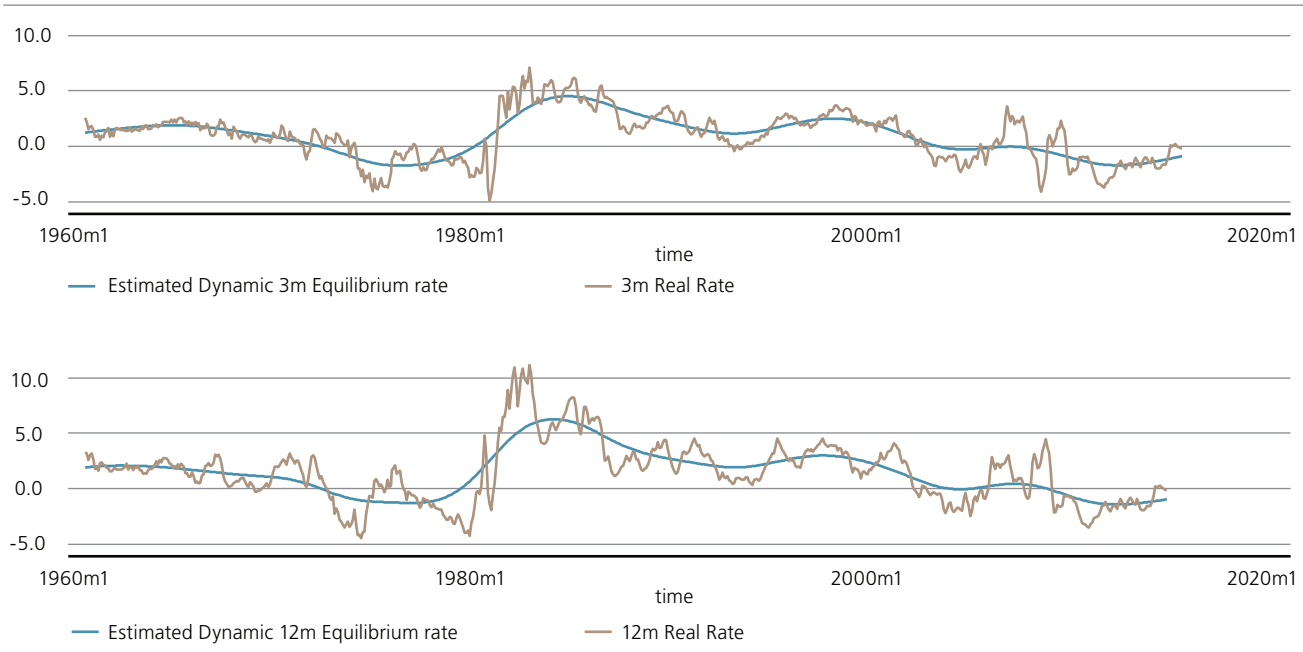
If it were merely a constant, computing a sample mean or median over a very long time period would be straightforward and could provide a reasonably accurate estimate. But by definition the equilibrium rate relies on the abstract construction of equilibrium in economies that are constantly subject to economic shocks and that are almost always, as many economies are now, in a state of disequilibrium.

Moreover, both inflation and nominal interest rates vary tremendously over time, reflecting the evolution of the real economy as well as the monetary regime and monetary policy pursued by authorities. The presumption that the equilibrium rate varies over time therefore seems reasonable.

Despite varied quantitative approaches, all of these academic studies show analogous results and the equilibrium rate in the US decreasing significantly since 1980. So what is the equilibrium rate of interest now? Below we present two different models for the equilibrium rate and the values they create. To give the reader a broader idea of how the choice of data affects results, we used both the 3-month and the 1-year Treasury bill yield, from which we subtracted the next 12 month inflation to obtain the real rate.

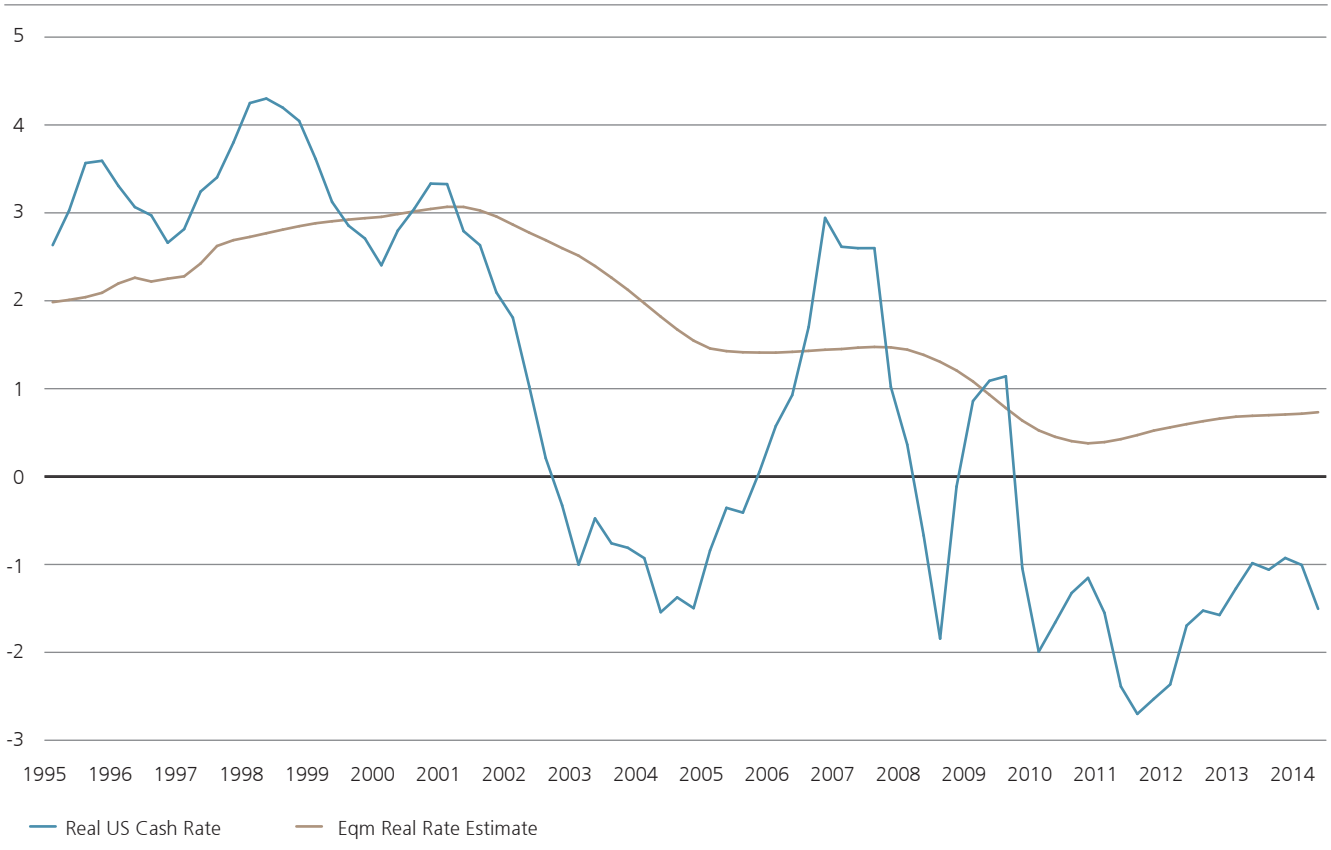
Study 1: Dynamic Model

Using a filter[1] to smooth certain cyclical elements from the data of the long-term time series, a dynamic model of the equilibrium rate leads us to think that the current 3 month equilibrium rate is currently at or just below zero, but that the line is at the early stages of an upward trend.



Source: UBS Asset Management
1 Hodrick-Prescott

A more sophisticated study carried out by Professor Athanasios Orphanides shows that results are rather sensitive to the choice of models, but in any case the equilibrium rate has been on a downward trend since Paul Volcker's anti-inflationary policies of the early 1980s.



Source: UBS Asset Management, Orphanides

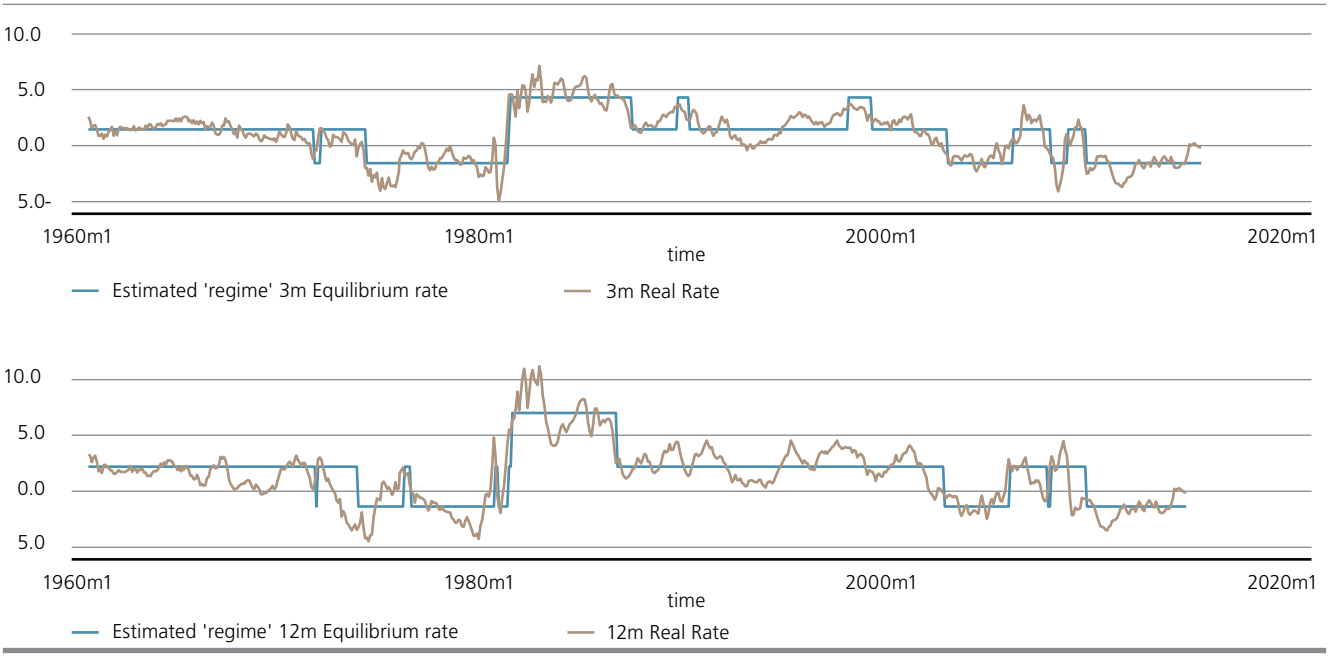
Study 2 Regime-Switching Model

Other studies of the equilibrium rate have suggested that there is a limited number of economic 'states' or 'regimes' each of which has an associated equilibrium rate. A switching regime, largely driven by changing monetary policy objectives (eg full employment in the US in the 1970s, the taming of inflation in the US in the 1980s) leads to a jump in the equilibrium rate. The analysis suggests that there are just three distinct policy regimes:

1. Extreme expansion (early 1970s, post 2008 to now)
2. Extreme restriction (early 1980s – the anti-inflationary policies of Paul Volcker)
3. Normal – a steady state

Using a 55 year data sample, the 3 month equilibrium rates in the three regimes are as follows:

1. Extreme expansion: -1.57
2. Extreme restriction: 4.30
3. Normal: 1.48



Source: UBS Asset Management, Haver

What these studies mean

While the studies do not provide the same results, they all suggest that the equilibrium rate is lower than a simple historical analysis would produce. However, the studies above are purely statistical and do not give us any reasoning on why this should be the case. Intuitively, central banks are more sensitive to inflation, thus reducing inflation premia. Moreover, the forces of globalization have brought with them greater international competition, another source of lower inflation premia. Whether other factors such as demography and technology matter to the long-term equilibrium rate will be the focus of the next section.

Drivers of lower long-term interest rates

Few would argue with the notion that long-term rate expectations in developed markets have dropped significantly over recent years. A quick glance at the yield on 30yr US Treasuries tells its own story. Even as short-term rate expectations rose in the early 2000s, long-term interest rate assumptions continued to fall. More recently, improving US macroeconomic data throughout 2014 and 2015 have pointed to a solid recovery; shorter-term rate expectations have risen. Once again, long-term interest rate forecasts have fallen.

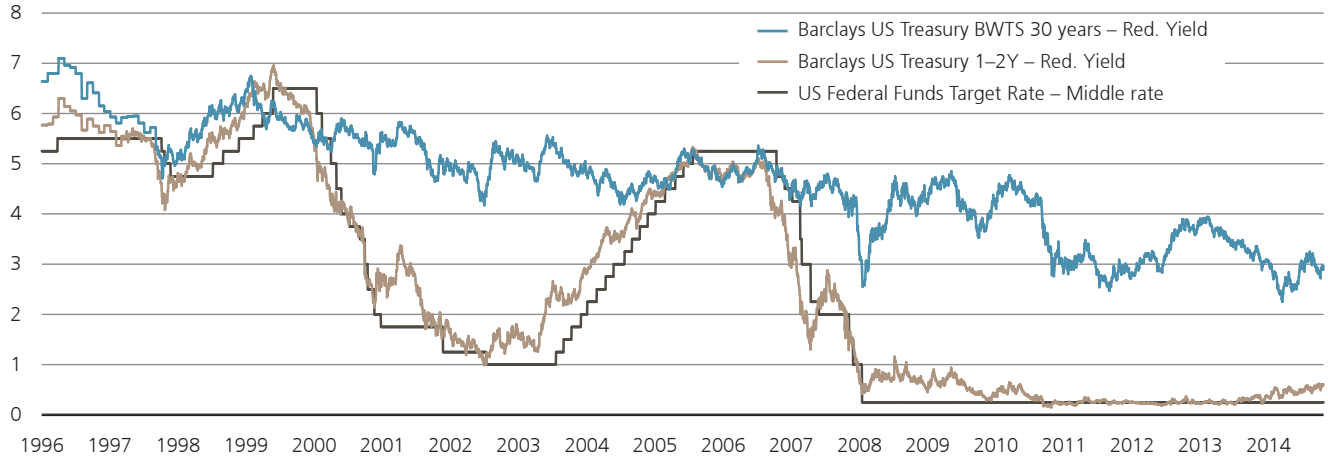
Explanations for the macroeconomic conundrum of declining long-term bond yields include a developing market 'savings glut', recycled into overseas government bonds in general and US Treasuries in particular. This theory was put forward by then Federal Reserve governor Ben Bernanke in a speech in 2005. But with the current account balances of emerging nations now materially poorer, interest rate expectations have continued to fall. If the savings glut was ever a material driver of lower Treasury yields, it does not appear to be the case now. Other forces are clearly at work. For investors, the critical question for long-term returns assumptions is whether those forces are cyclical or structural.

We contend that many of the drivers are structural.

Population Growth

Adam Smith wrote in his seminal work The Wealth of Nations that: "The most decisive mark of the prosperity of any country is the increase of the number of its inhabitants." Growth theory models based on Smith's work stipulate that an important determinant to identifying the equilibrium interest rate is the growth in potential output. In steady state, according to Robert Solow's (1956) macroeconomic growth model, this is equal to the sum of the rate of growth of labour productivity plus the rate of growth in population.

Exhibit 4:



Source: UBS Asset Management

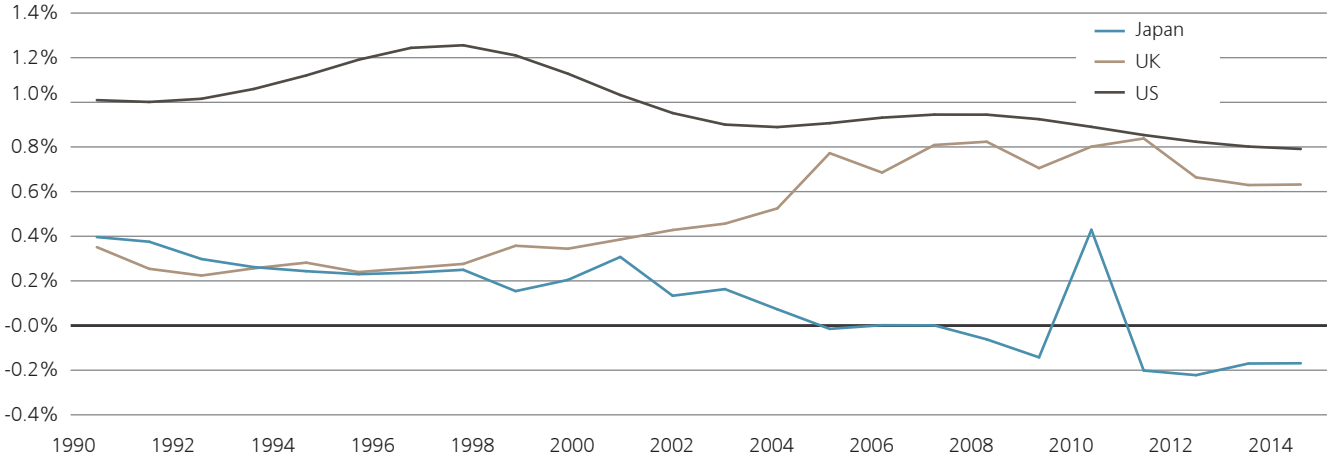
According to the United Nations (UN), population growth in the United States is projected to decline in coming decades by about a tenth of a percent per decade. In of itself, this would be expected to put downward pressure on the natural rate of interest.

However, the influence of the population growth of other countries may become increasingly important for the US going forward. In Japan, a dramatic demographic transition has been taking place. The population now is lower than it was in 2000. This decline is projected to persist and the dynamic is one of the principal reasons why estimates for the equilibrium rate of interest for Japan has been significantly and consistently lower than for the United States. According to the UN, the Japanese population will fall by 34% over the remainder of the 21st century.

The Japanese experience is also of interest in highlighting what may happen in China, the largest country in the world by population, and an economy that has become increasingly important for the global economy.

Chinese population dynamics appear to track those of Japan with a lag of about one generation. Therefore by 2030, the population of China is projected to reach its peak and subsequently decline. The UN expects the Chinese population to fall 27% between now and 2100. In light of its size, and judging from the experience of Japan, this suggests that population dynamics in China may also exert a downward pressure on global interest rates over coming decades.

Exhibit 5: Annual population growth 1990–2014



Source: UBS Asset Management

Ageing Populations

The rapid increase in life expectancy and the accompanying slowdown in the birth rate in many countries are affecting the long-term equilibrium rate in other ways too.

In the 1950s, around 9% of the G8 population was age 65 and older. In 2010, the percentage increased to 16%, and over the next 20 years, the United Nations projects that age group will grow to 26%. Of the G8 and the BRIC countries, only India has a birth rate that remains above the replacement rate.

These developments impact both the broader economy and long-term interest rates in a number of ways. When the ratio of the working-age population to the total population declines, the number of productive earners (ie workers) to non-productive consumers (ie retirees) also declines.

In theory, the permanent income hypothesis suggests that this situation encourages households to consume less and to save more in order to smooth out the level of per-capita consumption in the future. In practice, an ageing population simply results in increasing demand for safer, income generating assets in general and further downward pressure on long-term interest rates. Given the structural nature of these demographic patterns, age-driven investment preferences are extremely unlikely to reverse any time soon.

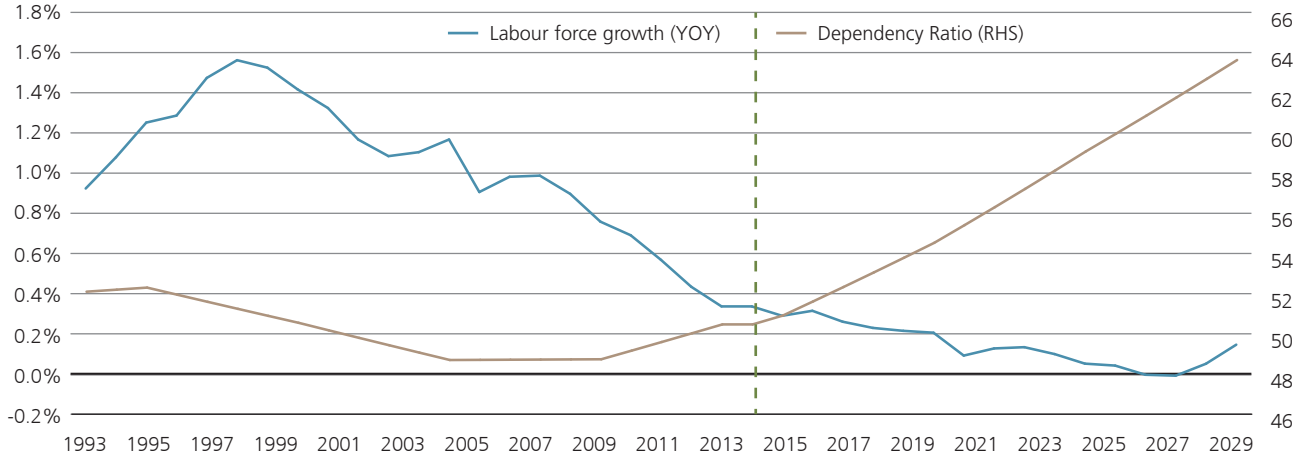
Another channel through which demographics is putting downward pressure on real interest rates is by increasing the liability duration for defined benefit pension plans.

Bank of America Merrill Lynch estimates that a one year increase in life expectancy equates to a 7%-9% increase in additional liabilities for a typical defined benefit pension plan . Simply put, this increases the demand for longer-dated bonds.

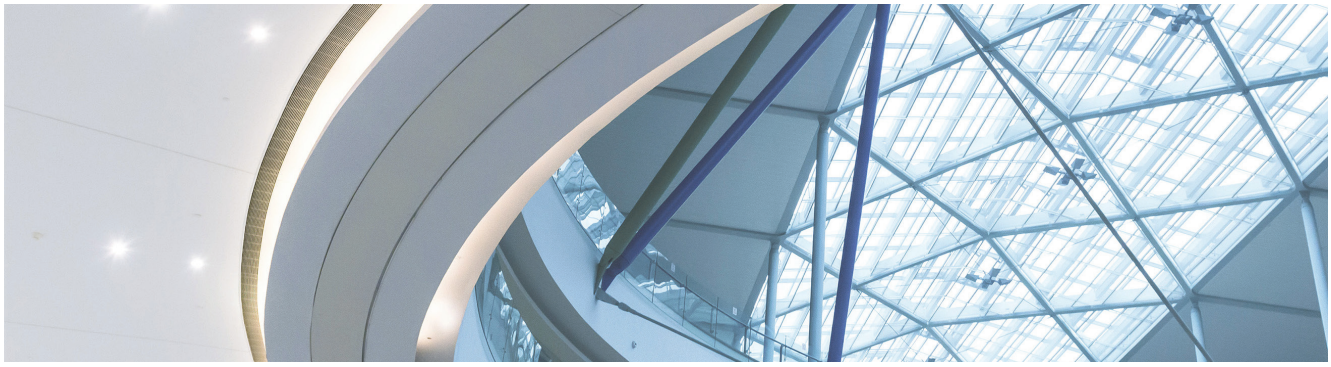
The mis-match between demand and supply is made even worse as more companies move to a liability-driven investment (LDI) framework.

As ever, the regulatory backdrop is having unintended consequences. In the US, new pension regulations and new reporting rules have made pensions much more sensitive to their funded status, that is, the

Exhibit 6: Labour force and dependency ratio



Source: UBS, Haver Analytics, United Nations
Dependency ratio is ratio of population age 0-14 and 65+ per hundred population age 15-64



ratio of pension assets to liabilities. US pensions must now be fully funded or committed to amortising any underfunding over a seven year period. Assets and liabilities must be valued on a mark to market basis and there is pressure to reduce the asset-liability gap risk. This is important because many pension plans, both public and private, are dangerously underfunded.

However, this also means that as the funding status gap closes, pensions are incentivised to hold safer, liability hedging assets: ie to buy bonds and dampen long-term interest rates.

The mystery of falling investment and productivity

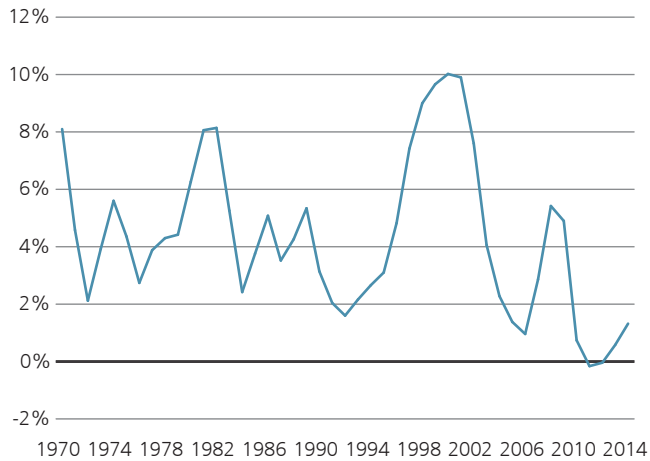
In the current context of very high profitability by historic standards in the US, generally strong profitability elsewhere in the developed world and with an apparently powerful incentive in low interest rates to invest rather than hoard cash, many commentators are struggling to explain definitively why capital investment in developed economies remains low.

There are a number of unproven theories: in part, falling capital investment may simply reflect the changing nature of our economies as consumption picks up the slack from slowing investment spending. It may reflect too the changing patterns of consumption and the growth in less capital intensive services such as internet shopping, leisure and tourism. Government austerity measures and the lack of major infrastructure investment may also have played a role in reducing investment more recently, most notably in the US (Exhibit 7) and UK. Finally, lower capital spending in developed markets may also reflect the fact that the focus of capital investment, even for companies domiciled in developed markets, has been in emerging markets.

The theme of lower capital investment is echoed in another worrying developed world economic trend: falling productivity. In the UK (Exhibit 8) productivity reached a peak in the early 1970s only to fall steadily since. The fall has accelerated sharply since the turn of the millennium.

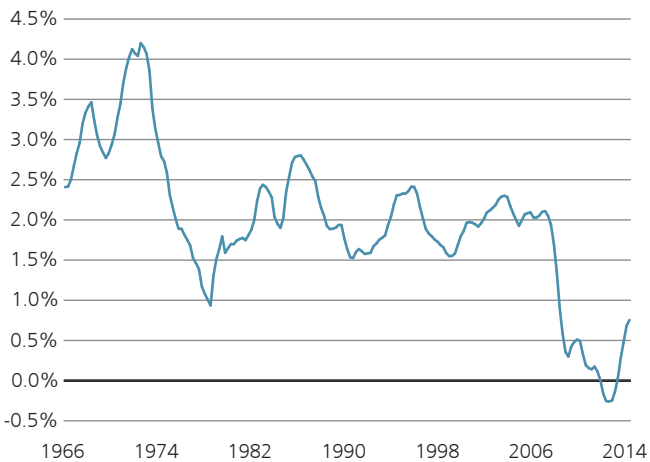
Clearly, a lack of investment is, of itself, generally a precursor to falling productivity. It may in part reflect the type of investment that companies have been making, focusing on labour intensive sectors such as services.

Exhibit 7: US Real Non-Residential Fixed Investment Growth (Annualised 5yr MA)



Source: UBS Asset Management, Datastream

Exhibit 8: UK Productivity Growth 1966-2015 (Annualised, 5yr MA)



Source: UBS Asset Management, Datastream

Deleveraging

But there are other clear drivers behind the reduction in capital investment. In a bid to reduce the potential for future financial crises, new capital adequacy regulations have forced banks to deleverage. These structural changes have had a significant impact on western economies. On the one hand, bank deleveraging has driven interest rates lower by effectively forcing banks to buy a high proportion of government bonds as part of their increasing capital buffer against loan books.

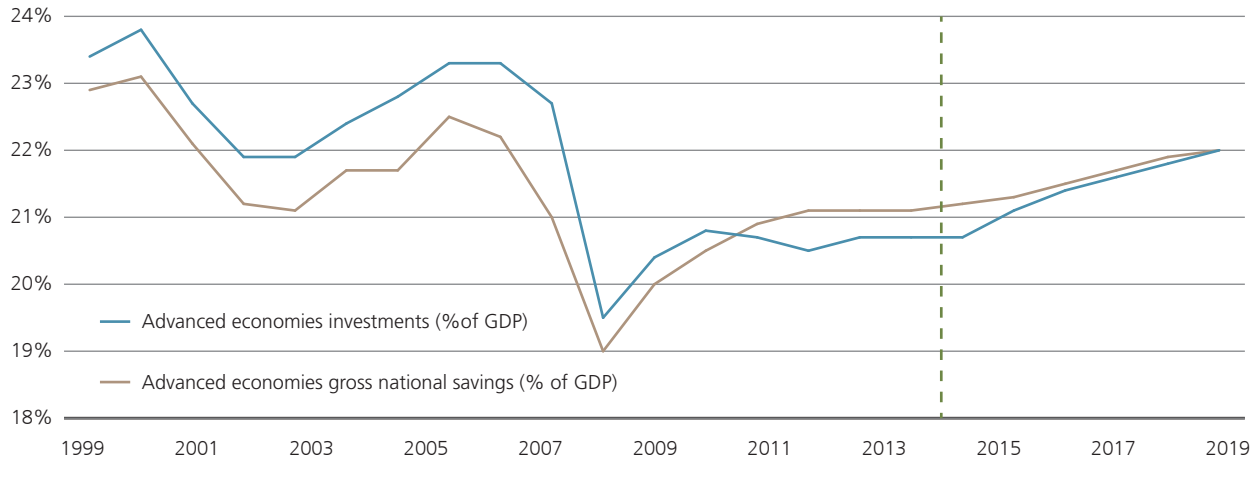
On the other hand, as the major medium for the transmission of capital to the wider economy, it should be no surprise that the scale of balance sheet compression undertaken by the banking sector should result in lower lending growth, lower capital investment, lower economic growth forecasts and therefore lower long-term interest rates.

Since there is no suggestion that the regulatory regime will ease sufficiently to allow banks to return to higher levels of leverage, it appears self-evident that the sustainable rate of loan growth and capital investment will be lower for a much longer period than has been the case historically.

But the theme of deleveraging does not just hold true for the banking sector. Corporate debt levels have shrunk too as equity investors have penalised heavily stretched balance sheets and rewarded the operational flexibility of cashflow strength and low debt. We will have to wait and see whether these changes in investor preference prove to be cyclical or structural, but we believe at least part of the change reflects a structural shift in investor preferences due to ageing populations.

And at the individual level, rising savings ratios despite low interest rates across the developed world appear more than a cyclical rise in risk aversion following the financial crisis.

Exhibit 9: Net savings in G10



Source: UBS, Haver Analytics, United Nations

Disincentives to invest

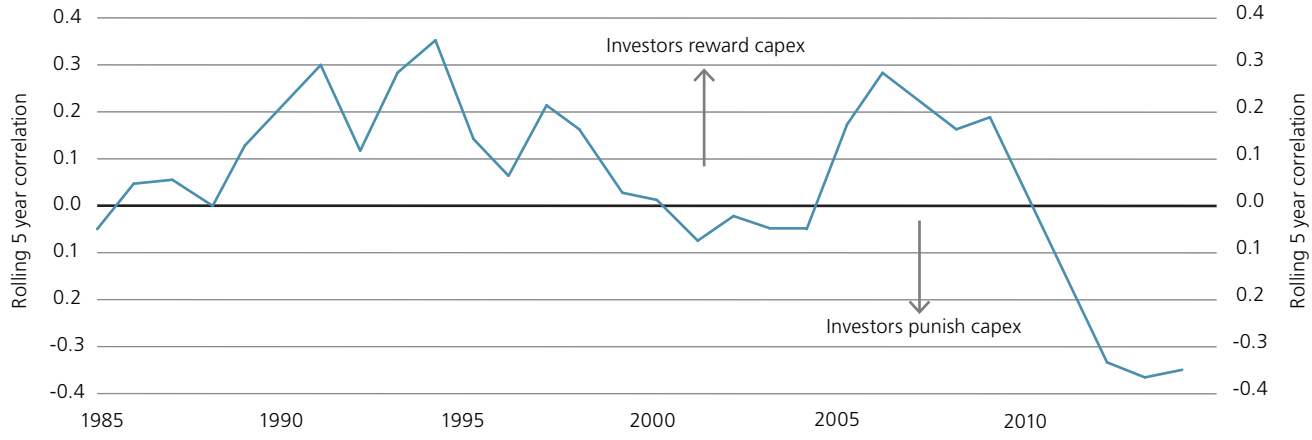
Indeed, in recent years corporates have been powerfully disincentivised by markets to reinvest capital for long-term growth (Exhibit 10). Instead, listed companies have been rewarded for returning capital to shareholders in the form of dividends and share buy-backs.

We can see this though the correlation between capex and relative returns and in rising dividend payout ratios in the US and Europe. In the rising value of buybacks we can see the way corporates have responded directly to investors who would rather have capital returned than reinvested.

And while it is tempting to heap all of the blame at the feet of the financial crisis there is evidence that the change in corporate behaviour started earlier. In particular, we believe that the dot.com crash structurally changed investor preferences from capital investment growth 'hope' to the perception of capital return as a degree of outcome 'certainty'. The financial crisis then accentuated an established trend by further penalising indebted companies.

Without meaningful change to the incentives for both public and private capital investment, we see these developments as structural dampeners on long-term economic growth in developed economies and on long-term equilibrium interest rates. We would reiterate that rather than seek to understand why investment has fallen while interest rates are so low, it makes more sense to argue that interest rates are low because investment has fallen.

Exhibit 10: Corelation between capex share and relative returns in US equities



Source: HSBC, Thomson Reuters DataStream

Conclusions

Consequences for investors

In the first instance, lower long-term equilibrium rates have significant implications for future monetary policy. In particular, the development blunts the effectiveness of interest rates as a tool for policy stimulus. This raises the prospect of further 'unconventional' policy measures in the future. As we have argued, lower long-term equilibrium interest rates means that expected returns fall for all assets along the risk spectrum while expected risk stays the same.

To achieve the same target return, investors must therefore take on more risk. But with higher risk trades becoming more crowded the expected return will fall too.

We believe that many investors are unaware of the implications of lower long-term interest rates. By relying on inaccurate analysis of the equilibrium long-term interest rate, the relationship between many investors' strategic asset allocations and their long-term investment objectives appears to be in an increasing state of disequilibrium.

We believe that:

- Investors with a required rate of return are potentially the hardest hit by lower return expectations that drop out from our equilibrium interest rate work: eg endowment plans that need to distribute a certain percentage of assets or underfunded pension plans. In light of these changing assumptions many may need to revise returns expectations and consider the suitability of their overall investment plans and strategic allocations.

- For Defined Benefit pension plans lower long-term rates have a potentially significant impact on overall funding status by increasing the Present Value of discounted liabilities at the same time as expected return assumptions of risk assets are falling.

- Households planning for retirement may need to increase their savings rates if they are to sustain a given level of income in retirement.

- In a world of lower returns, investors will need to keep an even closer eye on costs.

How should investors respond?

- Investors need to be more unconstrained in their approach in order to broaden their investment universe and increase potential sources of alpha.

- Switching to new benchmarks, more aggressive asset allocations may be necessary – (but doing so also increases the risk of falling short of the financial goal).

- Flexibility around Strategic Asset Allocations is likely to be an important driver of long-term returns. 'Set and forget' does not appear to be a viable strategy in this environment.

- Investors also need to be more focussed on downside risk management. Achieving sustainable positive absolute returns in a low expected return world is, in large part, the result of managing downside risk wisely. In practice, this means being nimble, flexible and liquid enough to take risk off the table when key events are approaching or when the risk is no longer being rewarded.

- In a world where correlations are no longer static, the benefits of diversification need to be actively monitored and sought out at a risk factor level. Risk management must become fully integrated taking a critical role in all aspects of the investment decision-making process - from the design of the trade, to the construction of the portfolio, to the monitoring of the fund.

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